



**Grant Agreement no. 287613**

**HYDROBIONETS**

**Autonomous Control of Large-scale Water Treatment Plants  
based on Self-Organized Wireless BioMEM Sensor and Actuator  
Networks**

**INSTRUMENT: Collaborative Project (Small or Medium Scale  
Focused Research Project)**

**OBJECTIVE: ICT-2011.3.3**

***D9.1: Initial Dissemination Plan***

Due Date of Deliverable: 31<sup>st</sup> March 2012  
 Completion Date of Deliverable: 28<sup>th</sup> March 2012

Start date of project: 1<sup>st</sup> October 2011      Duration: 36 months

Lead partner for deliverable: UVEG, iXscient

Revision: v1.0

<b>Project co-funded by the European Commission within the 7<sup>th</sup> Framework Programme (2007-2013)</b>		
<b>Dissemination Level</b>		
<b>PU</b>	Public	✓
<b>PP</b>	Restricted to other programme participants (including the Commission Services)	
<b>RE</b>	Restricted to a group specified by the consortium (including Commission Services)	
<b>CO</b>	Confidential, only for members of the consortium (including Commission Services)	

## Document History

Issue Date	Version	Changes Made / Reason for this Issue
22 <sup>nd</sup> February 2012	v0.1	First draft
9 <sup>th</sup> March 2012	v0.2	Further details added by partners
20 <sup>th</sup> March 2012	v0.3	Details added by Acciona
28 <sup>th</sup> March 2012	v1.0	Final version

**Document Main Author(s): David Wenn**

**Document signed off by: Baltasar Beferull-Lozano**

## Copyright

© Copyright 2012 UVEG, iXscient.

This document has been produced within the scope of the HYDROBIONETS Project and is confidential to the Project's participants.

The utilisation and release of this document is subject to the conditions of the contract within the 7<sup>th</sup> Framework Programme, grant agreement no. 287613.

## Table of Contents

<b>1. Introduction .....</b>	<b>4</b>
<b>2. Dissemination Strategy .....</b>	<b>5</b>
2.1. Exploitation and Impact Sub-committee .....	7
<b>3. Dissemination Methodologies.....</b>	<b>8</b>
3.1. Journals / Conferences .....	8
3.2. Participation in program committees and editorial boards .....	9
3.3. Dissemination of open source software prototypes .....	10
3.4. Industrial demonstrations/workshops .....	10
3.5. Project logo.....	10
3.6. Project Fact Sheet .....	10
3.7. Project flyer .....	11
3.8. Project website.....	12
3.9. Templates.....	14
3.10. Press releases .....	15
3.11. Dissemination through Masters courses .....	15
<b>4. Networking.....</b>	<b>15</b>
<b>5. Conclusions .....</b>	<b>15</b>

# 1. Introduction

The HYDROBIONETS dissemination strategy is based on the objectives of the project, the stakeholders within the consortium and the requirement to significantly impact the market. The technological advances throughout the project need to be disseminated to the scientific community while the benefits of the technology need to be promoted to the end users as well as potential collaborators for future product development of Wireless BioMEM Networks (WBNs) in all the different possible applications.

In deciding on a dissemination strategy for HYDROBIONETS, all these factors have been taken into account. As a result, the dissemination strategy comprises a matrix of four distinct groupings:

1. Dissemination methodologies targeted at the specific audiences (scientific, academic, general public).
2. Promotion through various water industry associations (e.g. Water UK, the Athens Water Supply and Sewerage Company (EYDAP SA), Spanish Association of Desalination and Water Reuse (Asociación Española de Desalación y Reutilización, AEDyR), International Water Association, and the European Water Supply and Sanitation Technology Platform (WSSTP)).
3. Providing information to public sector associations/agencies, focusing on desalination, water treatment and water purification.
4. Networking with user groups, conference and trade show organisers, etc.

To enact this strategy, HYDROBIONETS is engaging the stakeholders in a variety of ways including:

- Conferences and workshops targeted at specific stakeholder groups.
- Scientific publications.
- General publications targeted at specific stakeholder groups.
- Participation in relevant EU activities (e.g. Cost Actions, ICT Summits, interaction with other European Projects, etc...), international standardization groups/forums (e.g. the Internet Engineering Task Force – [www.ietf.org](http://www.ietf.org)).
- “Open house” activities/demos to present the testbed and the technologies to specific audiences (e.g., specialized industries, user groups, public sector agencies).
- Integration of its main results and methodologies (i.e., scientific and technology transfer) in the advanced graduate courses/seminars taught at the universities of the academic partners. For example, novel in-network processing algorithms, cross-layer protocols, distributed classification, matrix completion, and linked stream data processing from the project will be introduced in various graduate courses. In addition, there will be opportunities of research projects/graduate thesis for the students in these universities on topics related to the proposed research.
- Dissemination through other relevant Research Projects belonging to National Excellence Programs, where there are interesting synergies. As an example, UVEG participates in the Excellence Research Program CONSOLIDER, Project “Foundations and Methodologies for Future Communication and Sensor Networks (COMONSENS)” (<http://www.comonsens.org>), which is the most important Research Program in Spain.
- Project website.
- Flyers and other project literature.

From its dissemination activities, HYDROBIONETS seeks to develop a distinctive “corporate” image, including a logo and presentation templates, which are easily identifiable by all the interested stakeholders. The particular nature of the project and its natural evolution shall be reflected in this strategy and changes to some of the activities set out in this document may be necessary during the lifetime of the project. The project will endeavour to be both effective and efficient in its dissemination activities. This will involve an on-going review of the methods employed and changes and updates as necessary.

## 2. Dissemination Strategy

To set the scene for the HYDROBIONETS dissemination strategy, it is important to understand the project objectives and some of the issues facing the water industry and potential impact on the community. The problem of quality and quantity of water resources is a global challenge for the future years. Both an adequate amount of water and adequate water quality are essential for public health and hygiene.

According to the last Health Statistics of the World Health Organization (WHO), even though more people have access to safe water and improved sanitation globally compared with those in 2000, rapid population growth has hampered improvements in many countries. Close to a billion people are still without access to improved water supplies, half of whom live in the African and Western Pacific Regions.

According to several studies by the International Programme for Technology & Research in Irrigation & Drainage<sup>1</sup>, water resources are rapidly deteriorating in terms of volume and quality. The levels of ground - water are declining, while severe droughts cause more and more famines, further degrading the livelihood of already impoverished populations. As a result, according to some estimates, roughly 2 million people die every year due to diarrhoeal diseases. Even political stability itself is at stake, as experts predict that upcoming conflicts are likely to revolve more and more around access to water resources of good quality.

Both water treatment and desalination plants play a major role in terms of obtaining large quantities of water with good quality. However, desalination plants are very expensive to operate. Nevertheless, the application of the WBNs to RO desalination plants is expected to significantly decrease the costs of chemicals, membrane replacements and energy. Together, these contribute approximately 45% of the total operating costs of the plant. Installation of the HYDROBIONETS system is conservatively expected to yield a 10% decrease in energy consumption, 15% decrease in chemical use and 25% decrease in membrane replacement, thus resulting in a significant reduction of the total cost of desalinated water.

While it is very important to disseminate the results of the project as widely as possible, consideration must also be given to any confidential information, the public dissemination of which could impact any future patent applications. Therefore, all dissemination will follow the publication clearance procedure specified in the Consortium Agreement and in the Project Handbook.

Basic research will be disseminated through the normal scientific and academic route of peer reviewed publications. Within HYDROBIONETS, it is expected that the new results obtained on BioMEM and mote design, in-network processing algorithms, cross-layer networking protocols, as well as semantic knowledge management tools, will provide the greatest majority of these publications. It is also expected that the project will promote itself through journals, conferences, trade magazines, trade shows and networking events. Aspects of these are discussed later in the document.

---

<sup>1</sup> International Programme for Technology & Research in Irrigation & Drainage (IPTRD). Case studies on Water Conservation in the Mediterranean Region. Technical Report, Food and Agriculture Organization (FAO), 2002.

Dissemination to the general public is multifaceted. This comprises raising the general awareness of the worldwide water quality issues, the progress being made in the project and the vast potential of the technology for everyone. To achieve this, a number of dissemination routes have been identified:

- HYDROBIONETS website
- Project flyer
- Multilingual press releases
- Attendance at international conferences
- General press coverage – TV, radio, national and local press

Within the HYDROBIONETS consortium, there is one large industrial end user partner – Acciona Agua. This presents a great opportunity to leverage their global reach and networking contacts in terms of dissemination and exploitation. The company has links to various water associations, trade bodies and also various on-going projects related to water treatment, water quality and cost-effectiveness. Many dissemination activities targeted at industry will be co-ordinated through Acciona with input from the other partners as necessary.

The attainment of the dissemination strategy can be reached through the establishment of links with distinct but overlapping target groups and end users, such as trade associations, policy makers, industrial and research entities. The methods through which HYDROBIONETS can reach these target groups involves varying approaches that can be grouped as either clustering activities with other on-going actions/projects, or through conference activity, either at periodic venues or specific HYDROBIONETS organised and sponsored events.

During the first 24 months of HYDROBIONETS, a set of promising end-users will be identified and contacted in order to evaluate and understand their potential interest and capability for collaborating with the project. The process will be organized as shown in the following table:

<b>End-User Name</b>	<b>End-User Type</b>	<b>Country</b>	<b>Domain</b>	<b>Type of action performed by HYDROBIONETS/ outcome</b>
Athens Water Supply and Sewerage Company (EYDAP SA)	Private Company	Greece	Urban Quality of Life	To perform targeted project presentation
Spanish Water Technology Platform "Plataforma Tecnológica Española del Agua" (PTEA)	Public-Private Research Network	Spain	Research Platform	Dissemination
Spanish Association of Desalination and Water Reuse	Association	Spain	Desalination and Water Reuse	Dissemination in annual Conference
International Desalination Association - IDA	International Association	International	Technological association	Dissemination in Conference
European Desalination Association - EDS	European Association	European	Technological association	Dissemination in Conference

## **2.1. Exploitation and Impact Sub-committee**

An Exploitation and Impact sub-committee will be setup to monitor these aspects, comprised of a relevant subset of partners. Consideration will also be given to appointing an external expert to this sub-committee at a later stage of the project, if deemed relevant. The sub-committee will review key performance indicators and give feedback on the commercial and impact success of the project. It will provide reports to the Steering Committee at least annually. Its remit will cover:

- Commercialisation
- Standards
- Management and protection of Intellectual Property
- Dissemination
- Identification of exploitable project results
- Market analysis
- Identification of business opportunities
- Identification of risks

Further details of exploitation activities will be provided in an Exploitation Plan to be produced at a later stage during the project. For now, it is sufficient to note that, as part of exploitation, there may be some dissemination to other companies who may ultimately be interested in using or licensing the technology

## 3. Dissemination Methodologies

### 3.1. Journals / Conferences

Raising awareness of the HYDROBIONETS project and its results, to relevant stakeholders is an important feature of the project. The strong multidisciplinary character in HYDROBIONETS provides for a wealth of channels where information can be distributed.

Partners have been successful in the past in publishing in top conferences and journals in their areas of research, and we expect that the same will happen in the context of this work. In particular:

- Results related to information processing will be presented at relevant signal processing and communications conferences and workshops such as: Information Processing and Sensor Networks (IPSN); European Conference on Wireless Sensor Networks (EWSN); International Conference on Acoustics, Speech and Signal Processing (ICASSP); International Conference on Computer Communications (INFOCOM); International Symposium on Communications, Control and Signal Processing (ISCCSP), International Conference on Embedded Networked Sensor Systems (SENSYS), International Conference on Distributed Computing in Sensor Networks (DCOSS), International Conference on Communications (ICC), IEEE Sensor Array and Multi-channel Signal Processing Workshop (SAM), IEEE International Symposium on Information Theory (ISIT), European Signal Processing Conference (EUSIPCO). Similarly, this work will be published in top journals such as: IEEE Transactions on Signal Processing; ACM/IEEE Transactions on Networking; Eurasip; IEEE Transactions on Information Theory; IEEE Transactions on Communications, ACM Transactions on Sensor Networks, IEEE Transactions on Communications, etc.
- Results related to probabilistic inference and event detection will be presented at conferences such as: International Conference on Pattern Recognition (ICPR); International Conference on Robotics and Automation (ICRA); International Conference on Computer Vision (ICCV); Computer Vision and Pattern Recognition (CVPR), Information Processing and Sensor Networks (IPSN); European Conference on Wireless Sensor Networks (EWSN); International Conference on Acoustics, Speech and Signal Processing (ICASSP); International Symposium on Communications, Control and Signal Processing (ISCCSP), International Conference on Embedded Networked Sensor Systems (SENSYS), International Conference on Distributed Computing in Sensor Networks (DCOSS), European Signal Processing Conference (EUSIPCO). Similarly, this work will be published in top journals such as IEEE Transactions on Pattern Analysis and Machine Intelligence and IEEE Transactions on Signal Processing.
- Results related to data mining and knowledge extraction will be published in journals, conferences and workshops that are at the frontier of data management including spatial, temporal and sensor data management (e.g., ACM SIGMOD, VLDB, ICDE, EDBT, MDM, SSDBM, WWW), Artificial Intelligence (AAAI, IJCAI, ECAI), Semantic Web (WWW, ISWC, ESWC) and Sensor Networks (SensorKDDm, TOSN, Sensor). We will also investigate the possibility to organize special sessions on Linked Open Sensor Data Extraction and Integration in major Semantic Web conferences. Similarly, this work will be published in top journals such as IEEE Transactions on Knowledge and Data Engineering.

- Results related to sensor devices, sensor networks, and distributed middleware will be published in conferences such as: International Conference on Distributed Computing Systems (ICDCS); Embedded Network Sensor Systems (SenSys); International Symposium on Reliable Distributed Systems (SRDS); International Conference on Dependable Systems and Networks (DSN); European Dependable Computing Conference (EDCC); Pacific Rim Dependable Computing Conference (PRDC); USENIX, MobiSys, Percom, and MobiCom. Similarly, this work will be published in top journals such as: IEEE Transactions on Parallel and Distributed Systems; ACM Transactions on Sensor Networks; IEEE/ACM Transactions on Networking; IEEE Transactions on Mobile Computing; IEEE Transactions on Mobile Communications; IEEE Radio Communications; IEEE Sensors Journal; IEEE Comms Magazine, etc.
- Results related to BioMEMs will be published in conferences such as “Transducers Eurosensors IMCS-International Meeting on Chemical Sensors Biosensors” and the following relevant journals: Sensors & Actuators B; Biosensors & Bioelectronics; Bioelectrochemistry; Nanotechnology; Nanoletters; TRAC-Trends in Analytical Chemistry; Trends in Biotechnology; Journal Micromechanical Microengineering; Analytical Chemistry.
- Finally, results related to the application itself will be published at application-specific conferences for water monitoring & management, such as Water Research.

The majority of the above mentioned conferences are extremely competitive, with acceptance rates below 30% and in specific cases below 20%. Technical papers that are accepted for publication to conferences are accompanied by a technical presentation outlining the core of the proposed solution, the improvement over the state-of-the-art, and a solid evaluation, demonstrating the validity of the proposed ideas and technologies.

In addition, outreach activities will include the participation in EU cost action activities on biosensors and technologies on water purification/treatment by submitting abstracts, papers, posters and flyers related to the main results and testbed of the HYDROBIONETS project to their workshops and meetings.

### **3.2. Participation in program committees and editorial boards**

Through such a position, participants of HYDROBIONETS will be able to play a role in setting the agenda and organising special sessions or special issues. Some examples of relevant affiliations are given below:

- Baltasar Beferull (UVEG) participates in different Technical Program Committees that are relevant to the topics treated in HYDROBIONETS, such as International Conference on Distributed Computing in Sensor Networks (DCOSS) and Information Processing and Sensor Networks (IPSN).
- V. A Siris (FORTH-ICS) is Area Editor for the Computer Communications Journal and was the Workshop Co-Chair for the 11<sup>th</sup> IEEE International Symposium on World of Wireless, Mobile and Multimedia Networks, 2010.
- Maria Papadopouli (FORTH-ICS) was editor of a Special Issue of the International Journal of Network Management (Wiley) on Traffic Monitoring and Network Measurements: from Theory to Practice. She was also General Co-Chair for the 17<sup>th</sup> IEEE Workshop on Local and Metropolitan Area Networks 2010 and is on the Program Committee for the IEEE DySPAN 2012 conference.

### **3.3. Dissemination of open source software prototypes**

A selection of any developed software modules will be made available as open source software through the project website. Because software distribution plays an important integral role in disseminating the project results, active participation in the free software community (e.g. Usenix-Freenix, Linux, BSD-Con), is also important.

### **3.4. Industrial demonstrations/workshops**

Towards the end of the project, consideration will be given to holding a workshop where the whole range of project activities will be presented and in which organisations related to the water industry and potential commercial end users will be invited and given briefings on the technologies developed. This could also include a visit to the demonstration site.

### **3.5. Project logo**

Although not a dissemination mechanism in its own right, the logo of the HYDROBIONETS project (shown below) is very important as it gives the project an identity. The logo is used on all HYDROBIONETS documentation and at all dissemination events. The logo of the project was designed during the first months of the project. An animated version has also been produced for use on the project website and in Powerpoint presentations.



*Figure 1: HYDROBIONETS logo.*

### **3.6. Project Fact Sheet**

A Project Fact Sheet, below, was produced as required at the beginning of the project and submitted to the Project Officer. This is mainly to be used for the EC's own dissemination and for inclusion on their website.

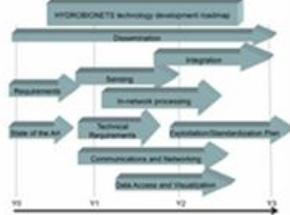
**AUTONOMOUS CONTROL OF LARGE-SCALE WATER TREATMENT PLANTS BASED ON SELF-ORGANIZED WIRELESS BIOMEM SENSOR AND ACTUATOR NETWORKS**

# HYDROBIONETS

HYDROBIONETS is developing the world's first real-time micro-biological wireless networked control system for water treatment and desalination plants, providing the fundamental design principles, signal processing and communication algorithms, and the implementation of a Wireless BioMEM Network (WBEM) with distributed multi-sensing and multi-actuation capabilities, demonstrating the detection and avoidance of bacteria biofilm formation in membranes, as well as increasing the productivity and energy efficiency of these industrial plants.

### Key innovation

The project focuses on the research and development of Self-Organized Wireless BioMEM Networks (WBEM) and their integration in a global system to manage the complete water cycle in large-scale water treatment and desalination plants. The key feature is the integration of WBEM networks and actuators in terms and the adaptability of the network structure to the specific requirements that the type of application impose. The WBEM will achieve a distributed management of control parameters, by designing a novel algorithm that can be successfully applied in a broad range of the great challenge that represents the design of wireless networked control systems for large-scale industrial plants in the different stages of processes in these plants. A wide class of interdisciplinary team formed by materials, sensors, microsystems, communications, signal processing, control and networking experts as well as engineers has been assembled to investigate, develop and validate the WBEM. This is a novel and ambitious approach in the field of micro-biological water sensing and control when several different disciplines converge.



### Measurable Goals

The measurable goals of the project include: (a) prediction and avoidance of membrane fouling thanks to a novel powerful multi-sensing and multi-actuation over the Red Water (recyclable) level in these plants, (b) increased productivity of the plant and reduction in costs due to both an increased lifetime of membranes and savings in power consumed by the high-pressure pumps, (c) improved management of the industrial plant in general, (d) an improved data access and visualization of the various processes in the plant.

### At A Glance

Contract number: 087645  
 Project coordinator: Universidad de Valencia  
 Contact person: Prof. Baltasar Bofrull-Lomas  
 Inst. de Robótica y de Tecnología de la Información de Comunicaciones  
 Universidad de Valencia  
 Coordinador: José Solerín, S  
 46100 Burjassot (Valencia)  
 Spain  
 Tel: + 34 96 3544464  
 Fax: + 34 96 3548330  
 Baltasar.Bofrull@uv.es  
 Project website: www.hydrobionets.eu  
 EC contribution: 2,350,000 Euro  
 Project start date: 1<sup>st</sup> October 2011  
 Duration: 36 months

### Technical approach

The main technical objectives of HYDROBIONETS are the following:

- Definition of overall electrical and algorithmic architecture capable of combining different disciplines such as Network, Communications, Smart-Wireless, Signal Processing and Control, leading to a fundamental understanding of the capabilities and limitations of WBEM.
- Design of novel distributed micro-biological multi-sensing and multi-actuation devices integrating simultaneously: (a) sensor data treatment (especially biofilm formation and biofouling level control), (b) actuation, data visualization and hierarchical control systems, as well as capability of communication and wireless communication.
- Definition of a network architecture and communication protocol that can support monitoring and control over the WBEM and provides interface or interoperability towards other ICT infrastructures in the controlled environment.
- Design of novel distributed processing algorithms to extract useful information: (a) optimizing the cooperative tasks (signal acquisition, detection, prediction, action) under multiple concurrent conditions, namely: (a) WBEM of the plant, (b) the variation of response between different types of biofouling, (c) changes in the conditions of the medium, (d) the variability of the network and (e) the variability of the network structure induced by the coding, processing, and networking protocols, and are able to satisfy the desired control requirements.
- Integration of sensor data with metadata and basic information from the plant to derive: (a) provide intelligent ways to identify and visualize critical information either from the raw data or from processed data, with the goal of improving the capability to ready warning and early response to certain events in the industrial plants, as well as (b) representing the data in a clear and concise manner.
- Demonstrate and validate a fully implemented multi-sensing and multi-actuation system and demonstrate a large-scale water treatment and desalination plant involving the water cycle.

Project partners	Country
Universitat de València	ES
CSIC	ES
FORTH	GR
RTH	BE
IFMKN	HU
Idiap	ES
University of London	UK

### Demonstration and Use

HYDROBIONETS will push on a practical deployment and demonstration of WBEM in water treatment and desalination plants, providing several interesting improvements in the functioning of these plants such as: an increase in membrane lifetime due to detection of fouling and a reduction of membrane cleaning and recovery time, an efficient data storage in the plants and an improvement in the assessment of the efficiency of the treatment stages both in the membrane and in the reverse osmosis membranes. In addition, the WBEM will be able to detect and avoid membrane fouling, and most importantly, both in the reverse osmosis membranes and in the biofouling, such as Chlorine, used in reverse osmosis, will be able to detect and avoid membrane fouling in the reverse osmosis membranes because they can be damaged by the oxidant. The developed multi-sensing and control system will be installed in one of ACCIONA's water plants.

### Scientific, Economic and Societal Impact

Knowledge developed during the HYDROBIONETS project will open new horizons. Although the focus is on a specific system (WBEM) for water quality monitoring in water treatment and desalination plants, the main project results and outcomes are NOT application specific. Rather they can potentially address a broad spectrum of critical needs including smart WBEM for monitoring water supply networks, the environment etc. The work will lead to the development of future services with expected benefits such as improving quality of life, safety and security of water supply. Implementation of HYDROBIONETS technology in other applications such as control of food or air quality, monitoring of mass health or disease mechanisms. Apart from this, it will be able to generate impact in industry and the general public. HYDROBIONETS is also expected to have an impact on the competitiveness of European water treatment and desalination, since the application of the WBEM in Reverse-Osmosis desalination will decrease the costs in the use of chemicals, membrane replacement and energy which constitute approximately 45% of the total cost of desalinated water. In addition, all costs related to other maintenance issues will be also significantly reduced. On the societal side, the implementation of water treatment provided by HYDROBIONETS can generate a number of benefits of the concerned European population, by increasing the production of drinking water supplies in a more efficient and energy cost. This project will also identify and analyze possible contributions to standardization in different directions to ensure a well-validated European water treatment standardization organization, as well as standardization of engineering interfaces and interoperability between the different types of sensors and plants that are present in industrial water plants.

Figure 2: HYDROBIONETS Project Fact Sheet.

## 3.7. Project flyer

A flyer is currently being designed, giving an overview of the project including the objectives and the consortium partners. This will be based on the Project Fact Sheet but modified to include the project logo and match the colour scheme. Printed copies of the flyer will be distributed among the partners to be used for dissemination activities. It will also be available for download from the project website.

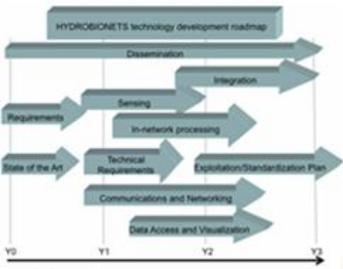
**Autonomous Control of Large-scale Water Treatment Plants based on Self-Organized Wireless BioMEM Sensor and Actuator Networks†**



**Hydrobionets**

**Key Innovation†**

The HYDROBIONETS project focuses on the research and development of Self-Organized Wireless BioMEM Networks (WBNs) and their integration in a global system to monitor the complete water cycle in large-scale water treatment and desalination plants. The key feature is the integration of BioMEM sensors and actuators in nodes and the adaptation of the network function to the specific requirements that this type of application imposes. The WBNs will achieve a distributed monitoring of critical parameters, representing a novel instrument that can be successfully applied in a short term to the great challenge that represents the dense wireless networked control of microbiological parameters of water in the different stages of process in these plants. A world-class interdisciplinary team formed by materials, sensor, microsystems, communications, signal processing, control and networking experts, as well as end-users, has been assembled to investigate, develop and validate the WBNs. This is a novel and ambitious approach in the field of microbiological water monitoring and control where several different disciplines converge.†



**Measurable Goals†**

The measurable goals of the project include: (a) prediction and avoidance of membrane fouling, thanks to a more powerful multi-sensing and multi-actuation over the feed water (not available before in these plants); (b) increased productivity of the plant and savings in cost due to both an increased lifetime of membranes and reduction in power consumed by the high-pressure pumps; (c) improved management of the industrial plant in general; (d) an improved data access and visualization of the various processes in the plant.†

**At a Glance†**

Contract number†  
287613†

Project coordinator†  
Universitat de València†

Contact person†  
Prof. Rafael Botella-Lomas†  
Inst. de Robòtica i de Tecnologies d'Informació i de Comunicacions†  
Universitat de València†

Carlos José Botella, CI†  
46100 Burjassot (Valencia), Spain†  
Tel: + 34 96 354446†  
Fax: + 34 96 354330†  
Rafael.Botella@uv.es†  
www.hydrobionets.eu†

EC contribution†  
2,250,000 Euro†

Project start date†  
1<sup>st</sup> October 2011†

Duration†  
36 months†

**Technical Approach**

The main technical objectives of HYDROBIONETS are the following:†

- 1- Deviation of novel theoretical and algorithmic tools capable of combining different disciplines such as Networking, Communications, Biotechnology, Signal Processing and Control, leading to a fundamental understanding of the capabilities and limitations of WBNs.†
- 2- Design of novel distributed microbiological multi-sensing and multi-actuation devices integrating simultaneously continuous data measurements (especially bio film formation and bioicide level control), acquisition, data validation and biosensor self-calibration processes, as well as capability of compensation and wireless communication.†
- 3- Definition of a network architecture and communication protocol that can support monitoring and control over the WBN and provide interface or interoperability towards other ICT infrastructures in the controlled environment.†
- 4- Design of novel distributed processing algorithms to extract useful information, optimizing the cooperative tasks (signal acquisition, detection, prediction, actuation) under challenging constraints, namely: a) low SNR of BioMEM signals; b) time variation of response between different types of BioMEMs; c) space-temporal correlation of the measurement data; d) control algorithms that are distributed and robust to the uncertainties introduced by the coding, processing, and networking protocols, and are able to satisfy the desired control requirements.†
- 5- Integration of sensor data with metadata and static information from the plant in order to provide intelligent ways to identify and visualize crucial information either from the raw data or from processed data, with the goal of improving the capability for early warning and early response to control events in the industrial plants, as well as formulating the behaviour of the various parameters.†
- 6- Demonstration and validation of a real system solution for space-temporal data monitoring, assessment and control in a large-scale water treatment or desalination plant showing the various gains.†

**Demonstration and Use†**

HYDROBIONETS will perform a practical deployment and demonstration of a WBN demonstrator working under real conditions in water treatment and desalination plants, providing several tangible improvements in the functioning of these plants such as: an increase in membrane lifetime due to detection of significant bio-fouling, improved optimization of bioicide and cleaning agent doses for membrane cleaning and recovery, more efficient disinfection stages in the process and an improvement in the assessment of the efficiency of pre-treatment stages before the membranes. This will lead to increased productivity and lower operating costs. In reverse osmosis desalination plants, the WBN will monitor the bio-fouling potential of the seawater, as well as at the different pre-treatment steps, and most importantly, before the reverse osmosis membranes. Moreover, the bioicide, such as chlorine, used for disinfection, will be also controlled so that it is not reduced just before the reverse osmosis membrane as because they can be damaged by the oxidants. The developed multi-sensing and control system will be installed in water of (desalinated) water plants.†

**Scientific, Economic and Societal Impact**

Knowledge developed during the HYDROBIONETS project will open new horizons. Although we focus on a specific system (WBNs for water quality monitoring in water treatment and desalination plants), the main project results and outcomes are NOT application specific. Rather, they are potentially over a broad spectrum of functional nodes including distributed WBNs for monitoring water supply networks, the environment, etc. The work will lead to the development of future innovations with expected benefits such as improving quality of life, safety and security of water supply. Implementation of HYDROBIONETS technology in other applications such as control of food or air quality, monitoring of human health, or defence mechanism against bioterrorism will be also possible in industry and the general public. HYDROBIONETS is also expected to have an impact on the competitiveness of European water treatment and desalination, since the application of the WBNs in Reverse Osmosis desalination will decrease the costs in use of chemicals, membrane replacements and energy, which constitute approximately 45% of the total cost of desalinated water. In addition, all the costs related to other maintenance issues will be also significantly reduced. On the societal side, the improvement of water treatment provided by HYDROBIONETS can better the livelihood of the concerned European populations, by increasing the production of drinking water supplies in a low financial and energy cost. This project will also identify and explore possible contributions to standardization in different dimensions: interaction with national and European water-related standardisation organisations, as well as standardisation of open APIs and interfaces and interoperability between the different types of networks and platforms that are present in industrial water plants.†

**Project Partners†**

Universitat de València (Spain)†  
CSIC-CNM (Spain)†  
FORTH-ICS (Greece)†  
KTH (Sweden)†  
MFKK (Hungary)†  
Acciona Agua (Spain)†  
Xcient (UK)†



Figure 3: HYDROBIONETS Project Flyer.

### 3.8. Project website

The HYDROBIONETS website was produced and placed on line during the first 6 months of the project ([www.hydrobionets.eu](http://www.hydrobionets.eu)). It has a public area where public information on the project, its achievements, the partners, as well as important news on events and meetings are posted. In addition, it has a private section for the partners, controlled by a user name and password, where confidential information can be deposited and which allows the partners to update their profile and add further information to the public area.

The project website provides an excellent place to disseminate information. Currently there are the following dissemination routes on the website.

- Outline and objectives of the project
- Project news
- Project partners
- Project flyer – downloadable
- List of dissemination events past and future
- List of journal publications and conference presentations
- Links to similar technology developments
- Press releases

Initial efforts have focused on getting some basic information on the website. However, in future, the website will adopt the Web Content Accessibility Guidelines (WCAG)©. WCAG offers documentation and guidelines to make web content accessible to people with disabilities. This includes, for example, icons to enlarge the text.



Hydrobionets



HOME

PRESENTATIONS

DELIVERABLES

EVENTS

PUBLICATIONS

PARTNERS

USEFUL LINKS

AAA

Login Form

User Name

Password

Remember Me

Log in

[Forgot your password?](#)  
[Forgot your username?](#)  
[Create an account](#)

## HYDROBIONETS Project Description and Objectives



Recent advances in ICT and MicroElectroMechanical Systems (MEMS) have led to devices incorporating wireless communication, processing and storage capabilities, as well as diverse sensing and actuation functionalities in a single unit that is compact, economical, autonomous and destined to become ubiquitous. This revolution appears in the form of dense and distributed Wireless Sensor Networks, the potential of which is enormous for various applications that are of great interest to society, including water monitoring and management in large-scale industrial plants, where microbiologic control of water quality is crucial. A basic understanding of system performance limits and the optimal design of large-scale, robust in-network practical algorithms associated with such biological signals remains far from mature. This proposal is motivated by the grand challenge of providing: a) a fundamental understanding of the performance bounds of large-scale Self-Organized Wireless BioMEM Networks (WBNs); b) concrete design guidelines, algorithms, software and hardware architectures to assure the required robustness, fault-tolerance, power efficiency, autonomy and adaptation; c) implementation and deployment of a large-scale and reactive WBN for microbiological autonomous monitoring and decentralized control of water quality in industrial environments.

HYDROBIONETS will address: a) the distributed acquisition of spatio-temporal biological signals, including the specific design of BioMEMs and their stable integration to motes; b) in-network cooperative processing and distributed intelligence to achieve essential tasks such as inference, detection, and decision-making; c) networked dense control to ensure adequate water quality, productivity and energy efficiency of water treatment plants. The results of this project will be demonstrated in real large-scale industrial water treatment and desalination plants, provided directly by partner ACCIONA, a worldwide leader in the water industry.

The Hydrobionets project has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 287613

Figure 4: Screenshot of HYDROBIONETS website.

### 3.9. Templates

The project has designed a number of templates following a particular style. Shown below are some screenshots of the official Powerpoint presentation template that is to be used in all dissemination events. This will provide a uniform project image.

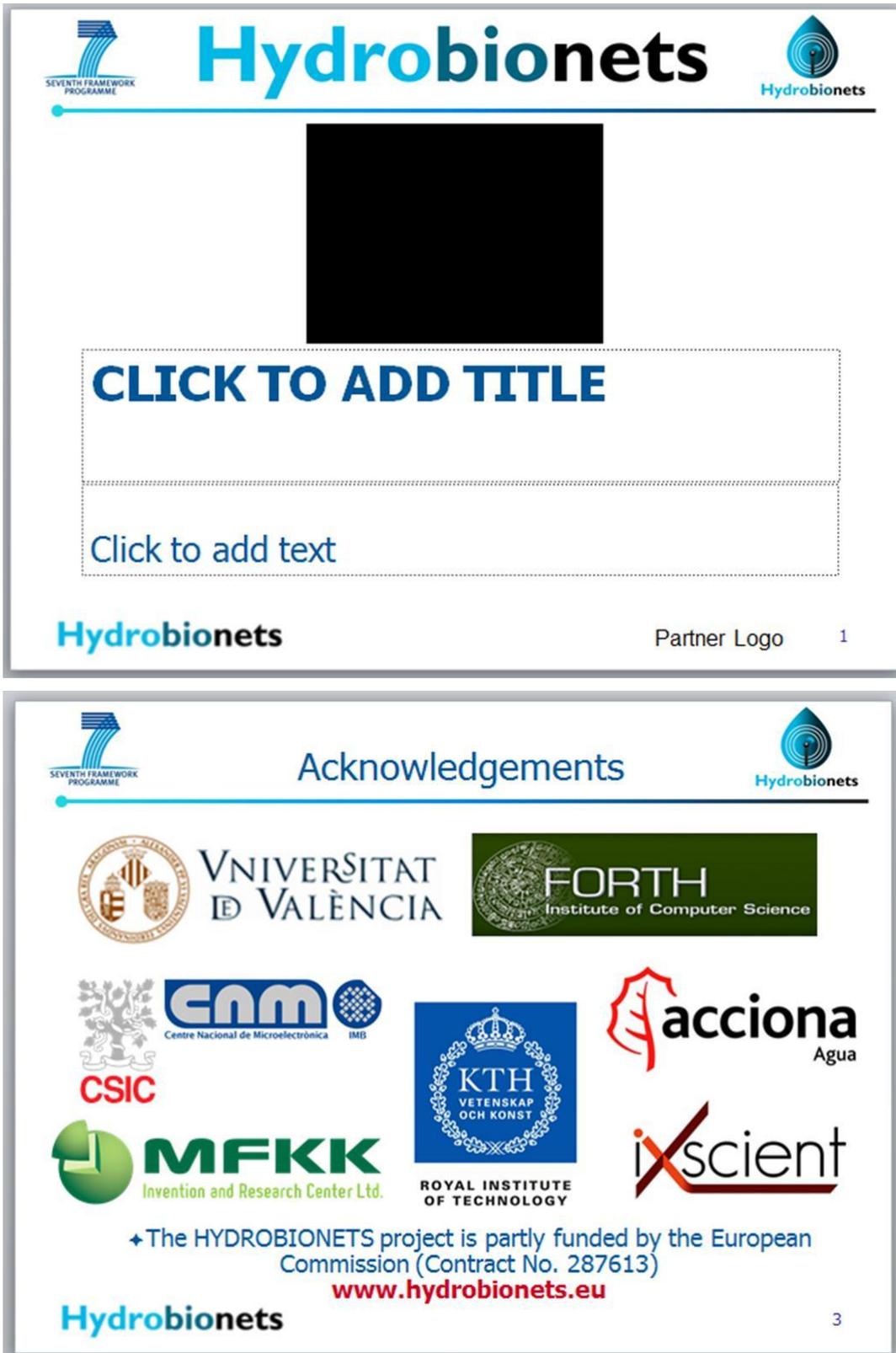


Figure 5: Screenshots of HYDROBIONETS Powerpoint presentation template.

### **3.10. Press releases**

The Coordinator, UVEG, held a press conference to highlight the aims of the project. A formal press release has been distributed to all the partners and can be used on their institute websites.

### **3.11. Dissemination through Masters courses**

Partners such as UVEG and KTH run Masters courses as part of their syllabus (e.g. (Master course EL2745 Principles of Wireless Sensor Networks at KTH, or Master<sup>2</sup> course Design and Implementation of Wireless Sensor Networks at UVEG). Project dissemination in such courses will occur by illustrating the course content with the application scenario of HYDROBIONETS, and by assigning to Master thesis students projects which are substantially inspired by the project.

## **4. Networking**

We will use commercial contacts through Acciona, and this will be linked to future exploitation activities. Commercial contacts can also be established through:

- Demonstrations, booths or specialized symposia / workshops at selected conferences, as previously mentioned
- Organizing industrial workshops about the project, inviting selected EU parties and companies (as part of exploitation efforts)
- Direct approach to experts and companies active in the field (to be based on work to be performed in the exploitation part of HYDROBIONETS) such as:
  - Technology providers (e.g. Scarab, a Swedish private development company that develops proprietary technology for water purification and creates projects for increasing supply of high quality water; Temak, a Greek company which provides expert solutions in the field of water treatment and fluid control equipment) Dropsens, etc.)
  - End-users, such as other water companies and companies in other relevant fields (e.g. Veolia Water Systems; Cetaqua-Agbar, etc.)

Contact will also be made with other relevant projects and European Technology Platforms (ETPs), such as the European Water Supply and Sanitation Technology Platform (WSSTP), during the course of HYDROBIONETS.

## **5. Conclusions**

This document outlines the initial dissemination plans and opportunities for HYDROBIONETS. It is not intended that all details should be fixed at this early stage in the project, rather a framework has been laid and the partners will respond to dissemination opportunities which emerge. The area of WBNs is very exciting with a lot of interest worldwide at the moment and it is clear that there will be extensive further opportunities for dissemination throughout the course of the project.

---

<sup>2</sup> Master Advanced Sciences of Modern Telecommunications (ASMT), <http://www.uv.es/mscasmt>