

# Technological innovations

Identified and analyzed by  
PIANO project WP 2



## Domain:

- Agricultural Water Management,
- Municipal Water Management,
- River Basin Management,
- Industrial Water Management,
- Water For Energy

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## Introduction

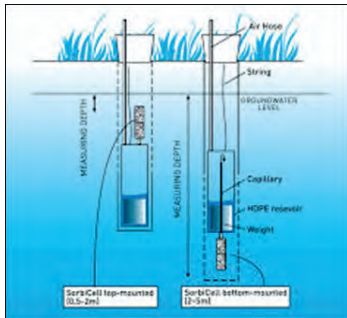
The identification and prioritization of European technological water innovations (TWI) that have potential for application in China and the identification of water challenges where neither Europe nor China has suitable technologies to offer and hence opportunities may exist for the joint development of technological solutions were carried by *Work Package (WP) 2 within the Policies, Innovations and Networks for enhancing Opportunities for China Europe Water Cooperation (PIANO) project*. For the technological water innovations in both Europe and China, five core water domains) were delineated: 1) agricultural water management (AWM), 2) municipal water management (MWM), 3) industrial water management (IWM), 4) river basin management and flood control (RBMFC) and 5) water for energy (WfE). TWIs have been mapped for both Europe and China for each of these five water domains. An overview of the state-of-the-art for both Europe and China was necessary in order to provide a list of European TWIs that can be prioritized according to their technology readiness level (TRL) and their suitability for addressing the water challenges in China, as determined by the China Europe Water Platform (CEWP); and enable a comparative analysis that will allow the TWIs to be categorized according to the following criteria: category 1 - established (conventional) technology solutions (TS) available in both the EU and China ; category 2 - established technology solutions (TS) available in Europe, but not in China; category 3 - similar/joint innovative solutions (TWI) available in both the EU and China; category 4 - innovative solutions (TWI) available in Europe but not China; category 5 - innovative solutions (TWI) available in China but not the EU, and category 6 - no innovative solutions currently available in either region. As the project focus is on innovative solutions, the TWIs identified in categories (3) and especially (4) are of most interest for the PIANO project. Data have only partially been provided from China, limiting the analyses possible on the Chinese aspects. Nevertheless, it has been possible to undertake a comparison of European and Chinese water innovation performance to a quite high degree. In the scoring survey, experts in Europe and China were asked to determine for each TWI – among other assessments – the degree of European technological leadership and of novelty to China, hence giving indications on the relative innovative performance of the two regions.

This catalogue shows the resulting inventories of the ranked TWIs. It should be emphasized, however, that data quality on the Chinese side is somewhat limited in the current report, except for the agricultural water management domain, which was also scored by our Chinese partner. We expect in ongoing follow-up work to have the results of a more extensive Chinese cross-checking. A repetition and expansion of the current method in the coming years could substantially improve the analysis and establish a database. In order to more comprehensively answer objective two, an in-depth survey in China would be needed, starting with the environmental challenges rather than the technologies, the latter having been the focus in the current study.

# Agricultural Water Management

## TWIEU A36 Groundwater sampling system

<b>WATER DOMAIN</b>	<b>Agricultural Water Management</b>
CATEGORY	<i>Groundwater Technologies</i>
Subcategory	<i>Monitoring Technologies</i>
Technology	<b>Groundwater sampling system</b>



source: [www.sorbisense.dk](http://www.sorbisense.dk)

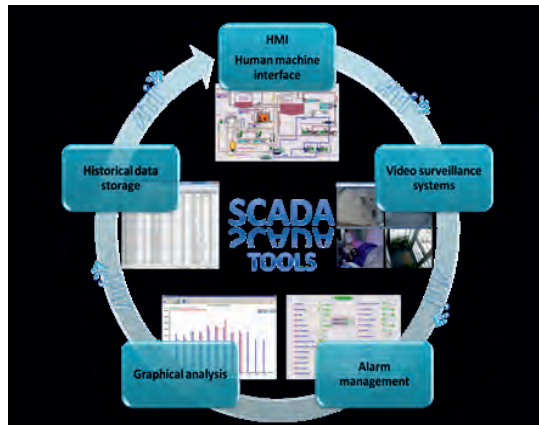
5. Stage of development of the technology:
a) TRL (1-10), possibly add comments: TRL 9
b) The product-system architectural match/mismatch 1-5 (5 highest match): 5
c) Time to market: already there, 1-5 y, 5-10 y, > 10 y, don't know; 5-10
d) Maturity of market: immature, medium, mature: mature
6. Contribution of TWI to meet Chinese Water Challenges:
Integrated systems of precision irrigation aim at saving water and total costs of water abstraction and supply for irrigation; therefore, they represent the first step for loss and waste reduction in agriculture and the environment.

Groundwater sampling system with passive samplers measuring volatile organic compounds such as chlorinated solvents and constituents of petroleum fuels in groundwater, including sampler analysis

# Agricultural Water Management

## *TWIEU A8 DSS, SCADA remote control system*

WATER DOMAIN	Agricultural Water Management
CATEGORY	<i>Irrigation Technologies</i>
Subcategory	<i>Real-time estimation tools (DSS)</i>
Technology	<b>SCADA remote control system (treated water to be used for irrigation purpose)</b>



source: <http://www.acmotec.com/>

Innovative remote management systems and remote control systems of irrigation and refinery **wastewater treatment** and irrigation plants (in wastewater purification systems)

Management technology, related to **wastewater treatment for reuse in agriculture**, consists in remote control and remote management systems of the plants realized on CLOUD platforms allowing to save data coming from onsite sensors with basic information (water qualitative and quantitative data) and to make smart irrigation planning

# Agricultural Water Management

## *TWIEU A16 DSS Groundbased multisensory platform*

<b>WATER DOMAIN</b>	<b>Agricultural Water Management</b>
<b>CATEGORY</b>	<b><i>Irrigation Technologies</i></b>
<b>Subcategory</b>	<b><i>Integrated systems for irrigation and</i></b>
<b>Technology</b>	<b>Multisensory platform for improving irrigation water use efficiency by</b>

Ground-based multisensory platforms, equipped with soil and plant sensors (geophysical sensors -EMI, GPR-, passive hyper-spectral sensor and active radiometric sensor connected to a DGPS) would allow in real time the acquisition of huge amount of data to characterise the soil and plant system and delineate homogeneous within-filed regions (management zones) to be subjected to uniform input supply.

Spatial variability occurring in crop production affects plant response and resource use efficiency.

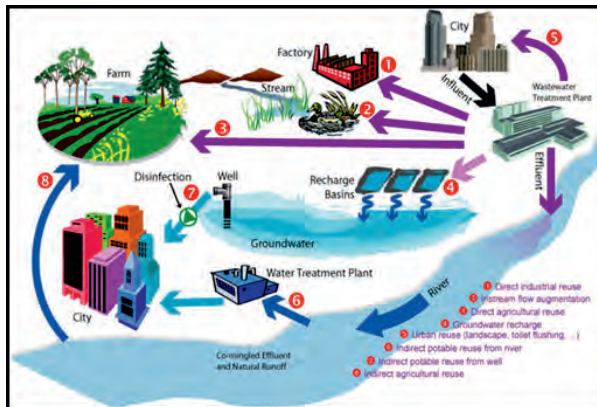
Among factors responsible for yield variation there are irrigation uniformity, field topography, soil fertility and mineral nutrient availability, variation of microclimate conditions. Water commonly has a crucial role among the factors responsible for spatial and temporal yield variability especially in dry and hot environments.

Monitoring the spatial variability of soil and plant water status, and using this information to manage irrigation water supply, would allow to improve water use efficiency, crop productivity and yield quality while decreasing environmental impact.

# Agricultural Water Management

## *TWIEU A24 Integrated water management system*

WATER DOMAIN	Agricultural Water Management
CATEGORY	<i>Irrigation Technologies</i>
Subcategory	<i>Integrated systems for irrigation and ferti-</i>
Technology	<b>Multisensory platform for improving irrigation water use efficiency by managing spatial</b>



source:

[http://www.coastlearn.org/water\\_quality\\_management/practice-twv.html](http://www.coastlearn.org/water_quality_management/practice-twv.html)

Implementing of a **new water management model**, inspired to the collection, recycle and reuse of urban wastewater for new forestry strategies in order to stimulate both alternative economic chains and environmental restoration in arid lands.

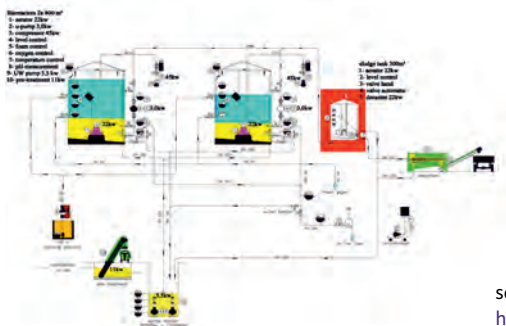
An integrated approach, using non conventional water resources for **sustainable forestry systems**, never competing with human and agricultural needs of fresh water but that protects natural water resources and implements the local productions:

<http://cra-journals.cineca.it/index.php/asr/article/view>

# Municipal Water Management

## *TWIEU B63 Vertical Sequencing Batch Reactor*

<b>WATER DOMAIN</b>	<b>Municipal Water Management</b>
<b>CATEGORY</b>	<b>Water Treatment</b>
<b>Subcategory</b>	Bioprocesses – for Carbon (and more) removal
<b>Technology</b>	<b>Vertical Sequencing batch reactor (VSBR)</b>



source: IMR E&T S.r.l. (Trieste)

<http://www.imr.it/>

Wastewater treatment plant for the biological purification of industrial and municipal sewages with high content of nutrients (N, P). The process implement the **Sequencing Batch Reactor technology (SBR)** and produces effluents highly purified which can be discharged or recycled for:

- Drinkable water production (Direct and Indirect Potable water reuse)
- Agricultural purposes
- Industrial processes
- Other water reuse

Due to the **vertical development of the reactor**, compared to a traditional basin, the retention time of the oxygen, provided for the aerobic purification processes, inside the reactor is strongly increased and the degree of utilization of oxygen is maximized. The automatic control system (SCADA) regulates the operative parameters optimizing the system and facilitating the microorganisms' activities responsible for the purification phases.



# Municipal Water Management

## *TWIEU D10 data-logging systems (leakages in water pipeline)*

<b>WATER DOMAIN</b>	<b>Municipal Water Management</b>
<b>CATEGORY</b>	<b>Water Use</b>
Subcategory	Distribution (incl. leakage detection, management)
Technology	<i>Data-logging system that detects leakages in water pipelines</i>



source

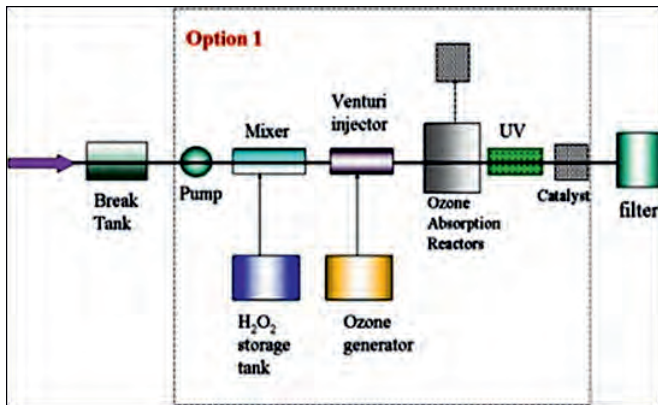
[http://formerwebsite.eurekanetwork.org/c/document\\_library/get\\_file?uuid=74cb94b2-7f21-4f8a-9d74-1a14b8f67de7&groupId=10137](http://formerwebsite.eurekanetwork.org/c/document_library/get_file?uuid=74cb94b2-7f21-4f8a-9d74-1a14b8f67de7&groupId=10137)

**The AZ100 Radio Data Logger is a data-logging system that detects leakages in water pipelines by analysing sound waves.** It is faster, cheaper and with more accuracy than any similar tool presently available. Data-logging is the process of using a computer to collect and analyse data through a set of remote sensors. In the AZ Radio case, it is also a way to make sure that taps do not run out of water. The device was developed during the Eurostars AZ RADIO Project by Germany's F.A.S.T GmbH and Austria's MTA Me-sstechnik GmbH, two engineering SMEs

# Municipal Water Management

## *TWIEU B59 Advanced chemical oxidation process*

<b>WATER DOMAIN</b>	<b>Municipal Water Management</b>
<b>CATEGORY</b>	<b>(Source) Water Extraction, Treatment, Distribution</b>
<b>Subcategory</b>	Water treatment- chemical (incl. advanced oxida-
<b>Technology</b>	<b>Advanced Oxidation Process <i>CATADOX</i><sup>®</sup> (Esco <a href="#">int.</a>)</b>



source : <http://www.esco.uk.com/products/ozone-generators/>

CATADOX<sup>®</sup> System is an (innovative) European technology which allows water treatment through several stages of treatment, depending on the type and use of the water.

ESCO International<sup>™</sup> has developed a unique advanced oxidation process, the CATADOX<sup>®</sup> which combines treatment by:

- Ozone
- UV
- Hydrogen peroxide

and, when required, a proprietary solid state catalyst.

# Municipal Water Management

## *TWIEU B20 Biologically - ecologically balanced filtration system (wastewater treatment)*

<b>WATER DOMAIN</b>	<b>Municipal Water Management</b>
<b>CATEGORY</b>	<b>Water Treatment</b>
Subcategory	Bioprocesses – for Carbon (and more) removal
Technology	<b>Bio filtration:</b> A biologically and ecologically balanced system (ACT Natural™ system), to treat wastewater in areas that lack connections to a municipal sewer system



source:

[http://www.alnarpcleanwater.se/?page\\_id=33&lang=en](http://www.alnarpcleanwater.se/?page_id=33&lang=en)

### **ACT Natural™ - Description**

(from: <http://www.alnarpcleanwater.se/?lang=en>)

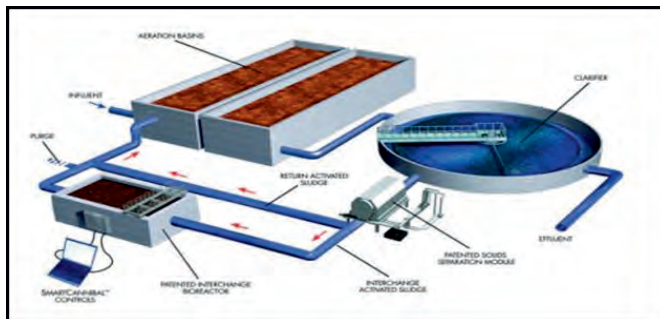
ACT Natural™ (patented by Alnarp Cleanwater Technology) is a biologically and ecologically balanced system, to treat wastewater in areas that lack connections to a municipal sewer system.

The system can also be used to clean dams in parks and to some extent handle storm water. The treatment system, called ACT Natural™, requires no chemicals and has a unique decomposition of sludge to obtain a low environmental impact. The ACT Natural™ process is similar to nature's own purification and can be seen as a natural way to treat wastewater, leading to a sustainable water cycle. The system can consist of up to three subsystems, one main treatment system, InterACT®, one optional pre-treatment container, ProACT®, and another optional treatment step ReACT® connected after InterACT® in areas where a 90% reduction of phosphorus is required.

# Municipal Water Management

## *TWIEU B37 Biological wastewater treatment: Solids reduction*

<b>WATER DOMAIN</b>	<b>Municipal Water Management</b>
<b>CATEGORY</b>	<b>Water Treatment</b>
<b>Subcategory</b>	Treatment/Biological
<b>Technology</b>	Reduce solids production from biological wastewater treatment (Cannibal™ process)



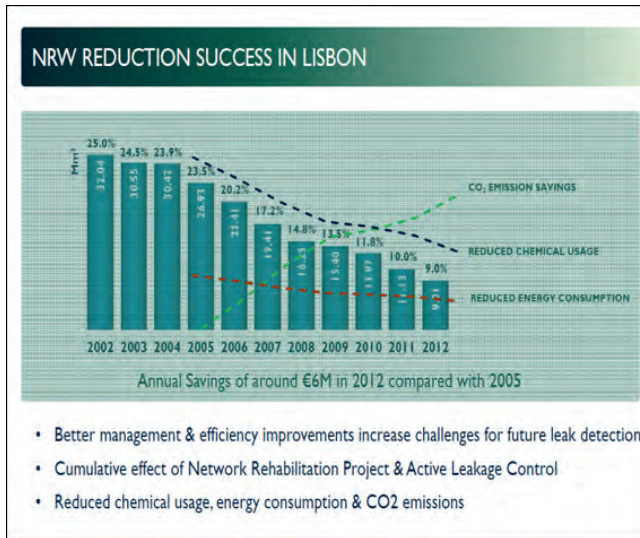
Cannibal™ process schema

The Cannibal™ process is a process for the drastic reduction of sludge production, based on the creation of a bacterial mass able to "cannibalize" the active sludge. The Cannibal™ process seeks to reduce solids production from biological wastewater treatment by adding an unaerated interchange tank to the process and cycling the biomass between the metabolic environments established in the interchange tank and the main bioreactor. A portion of sludge from the main treatment process is pumped to a sidestream interchange bioreactor where the mixed liquor is converted from an aerobic environment to a facultative environment. Some bacteria decay in the interchange reactor, while other bacteria break down and use the remains of the decaying organisms, their by-products, and anaerobically digestible organics.

# Municipal Water Management

## TWIEU 11 District metered areas Decision support system (DSS)

<b>WATER DOMAIN</b>	<b>Municipal Water Management</b>
<b>CATEGORY</b>	<b>Water Use</b>
<b>Subcategory</b>	Distribution (incl. leakage detection, management)
<b>Technology</b>	<i>Decision support system (DSS) based on the implementation of district metered areas</i>



source : <http://www.epal.pt/EPAL/en/menu/products-and-services/wone>

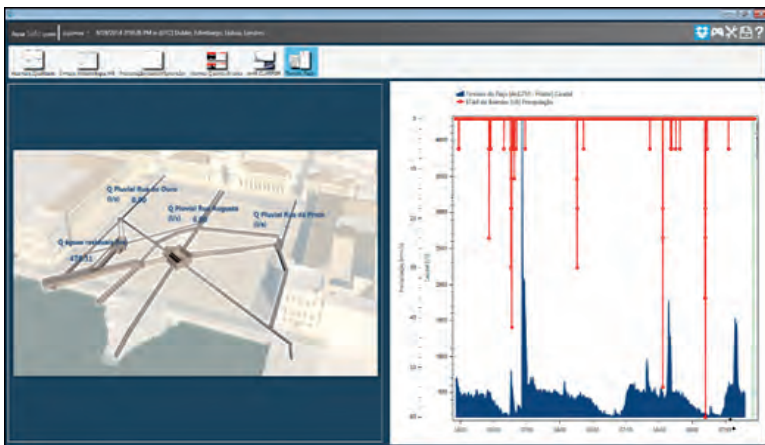
**The WONE® system is based on the implementation of district metered areas (dmAs) and analysis of their flow and pressure data, which allow the user to combine processes and integrate relevant information for network management and control water losses.**

The implementation of WONE®, within an active leakage control strategy, has reduced levels of Non-Revenue Water (NRW) in Lisbon Distribution Network from 23.5% in 2005 to 7.9% in 2013, positioning EPAL amongst an elite worldwide group of the most efficient water utilities

# Municipal Water Management

## *TWIEU 13 Wastewater management technology SCADA based*

<b>WATER DOMAIN</b>	<b>Municipal Water Management</b>
<b>CATEGORY</b>	<b>Water Treatment</b>
<b>Subcategory</b>	<b>Control/DSS</b>
<b>Technology</b>	<i>Wastewater management tools (DSS)</i>



*LNEC\_ Aquasafe - Smart tool for smart wastewater management operation*

*Developed and tested by EPAL, the oldest and largest water utility in Portugal*

**Aquasafe is the next-generation operational wastewater management tools which facilitates the wastewater utilities to dynamically combine and easily access multi-disciplinary data sources (including SCADA data and real time modelling forecasts).** It efficiently aggregates and processes them and provides business intelligence services, facilitating innovative procedures in what concerns the rain prediction, urban flood risk assessment, wastewater drainage and treatment, health risk assessment related to sewer overflows, and water treatment sector’s impacts and dependencies on biodiversity and ecosystem services.

# Industrial Water Management

**TWIEU, C25. Ultrasound based disinfection technology with combination of ozone**

<b>WATER DOMAIN</b>	<b>Industrial Water Management</b>
<b>CATEGORY</b>	<b>Used Water Collection, Treatment, Disposal</b>
<b>Subcategory</b>	Advanced treatment (Phys/Chem, incl. adv. oxida-
<b>Technology</b>	Industrial wastewater treatment

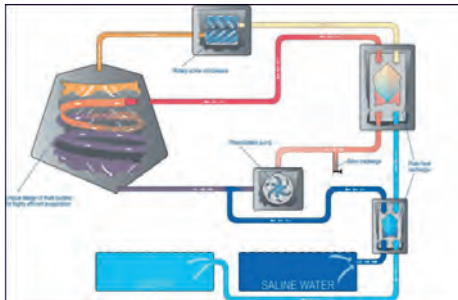


USO3 utilizes an advance oxidation process (AOP) that combines the advantages of ozone with ultrasound to apply in the areas of wastewater and water disinfection, improvement of wastewater plant performance and aeration along with disinfection/cod reduction, EDC + PCPP degradation, tank disinfection, rinse water disinfection, and ultra-pure water.

# Industrial Water Management

**TWIEU, C29. Dynamic Vapour Recompression to concentrate salt and carbonate rich liquids up till concentration level**

<b>WATER DOMAIN</b>	<b>Industrial Water Management</b>
<b>CATEGORY</b>	<b>Used Water Collection, Treatment, Disposal</b>
<b>Subcategory</b>	Advanced treatment (Phys/Chem, incl. adv. oxida-
<b>Technology</b>	Industrial wastewater treatment



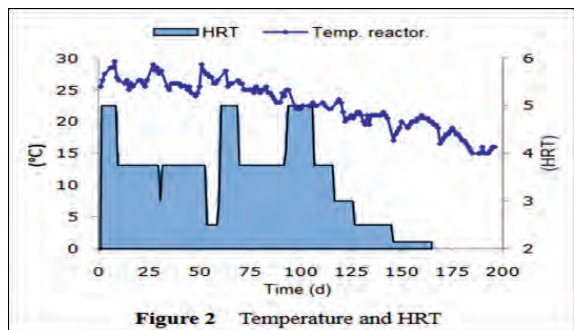
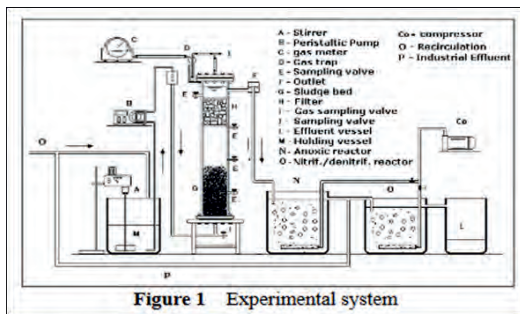
The DVR is an optimized version of the standard mechanical vacuum recompression, with a patented evaporation technology, can be used in wastewater treatment. With the DVR technology it is possible to an energy optimal evaporation without the rise of scaling insight the unit. It is possible to concentrate salt and carbonate rich liquids up till concentration level. The DVR can be applied anywhere where salts liquids needed to be concentrated for further processing or value creation with waste components.



# Industrial Water Management

TWIEU, C54. Combined Biologic process for removal of organic matter, sulphate and others nutrients in industrial wastewater.

<b>WATER DOMAIN</b>	<b>Industrial Water Management</b>
<b>CATEGORY</b>	<b>Used Water Collection, Treatment, Disposal</b>
<b>Subcategory</b>	<b>Bioprocesses for C (and more) removal</b>
<b>Technology</b>	<b>Industrial wastewater treatment</b>

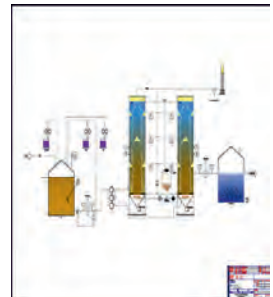


Combined Biologic process for removal of organic matter, sulphate and others nutrients in industrial wastewater. Tanning and others sulfate-rich organic wastewaters.

# Industrial Water Management

## TWIEU, C6. High-rate anaerobic reactor for wastewater treatment (primarily organic constituents) and biogas production

<b>WATER DOMAIN</b>	<b>Industrial Water Management</b>
<b>CATEGORY</b>	<b>Used Water Collection, Treatment, Disposal</b>
<b>Subcategory</b>	Bioprocesses for Carbon (and more) removal
<b>Technology</b>	Industrial wastewater treatment



The Biomar AHP is a new type of high-rate anaerobic reactor for wastewater treatment (predominantly organic constituents from e.g. food and beverage industry, pharmaceutical and chemical industries, and the paper industry) and biogas production.

It combines low footprint and effective mixing through recirculation of biogas, which is virtually non-dependent on biogas formation during anaerobic degradation. Inlet concentrations of more than 100.000 mg COD/L may be treated. The anaerobic reactor is vertically staged with typically three modules, which are implemented at a total height of around 20 m and may be equipped with external pressurized settling for improved effluent sludge separation.

# Industrial Water Management

**TWIEU, C11. Hybrid aerated activated carbon filtration technology, developed to add accurate and efficient amount oxygen (from air) to a classic activated carbon contactor**

<b>WATER DOMAIN</b>	<b>Industrial Water Management</b>
<b>CATEGORY</b>	<b>Used Water Collection, Treatment, Disposal</b>
<b>Subcategory</b>	Bioprocesses for Carbon (and more) removal
<b>Technology</b>	Industrial wastewater treatment



The Oxycon® filters is a hybrid aerated activated carbon filtration technology for industrial wastewater treatment applications. It has been developed to add accurate and efficient amount oxygen (from air) to a classic activated carbon contactor (even if already in use). The OXYCON-system stimulates a synergy of different reactions, adsorption, filtration, biological purification and oxidation.

# Industrial Water Management

**TWIEU, C13. Periodical Air/water cleaning of spiral wound membrane modules to control membrane fouling to reduce use of chemicals. Lower energy, less operational intervention needed. Longer membrane lifetime.**

<b>WATER DOMAIN</b>	<b>Industrial Water Management</b>
<b>CATEGORY</b>	<b>Used Water Collection, Treatment, Disposal</b>
<b>Subcategory</b>	<b>Solids Separation/Filtration (incl. membranes)</b>
<b>Technology</b>	<b>Industrial wastewater treatment</b>



The innovative AiRO process uses air/water cleaning in vertically positioned membrane elements to control membrane fouling. Thus less chemical cleaning has to be used to protect the environment and can also be done during production. Often only the first membrane in a system is fouled. By making a separate skid with only one membrane in a vessel upfront a membrane system fouling on the other membranes can be minimised. Innovative aspects: 1) Less membranes have to be cleaned. Only the first membrane instead of whole stack. 2) less (to no) additional chemical cleaning/ sanitation chemicals have to be used 3) environment friendly 4) can be done automatically without attendance. 5) total cost of ownership will decrease. All membrane systems can be equipped with upfront systems using AiRO.

# Industrial Water Management

**TWIEU, C2. Innovative stabilised hydrogen peroxide solution of food-grade quality to replace classical stabilizers or active substances**

<b>WATER DOMAIN</b>	<b>Industrial Water Management</b>
<b>CATEGORY</b>	<b>Used Water Collection, Treatment, Disposal</b>
<b>Subcategory</b>	Advanced treatment (Phys/Chem, incl. adv. oxida-
<b>Technology</b>	Industrial wastewater treatment



Innovative stabilised hydrogen peroxide solution of food-grade quality to replace classical stabilizers or active substances. The stabilisation of the product requires minimally a sugar alcohol. The product is especially useful for many applications where disinfection by-products are of concern and where classical H<sub>2</sub>O<sub>2</sub>-stabilisers (e.g. silver nitrate) or active substances different from H<sub>2</sub>O<sub>2</sub> (e.g. peracetic acid) are not wanted or accepted.

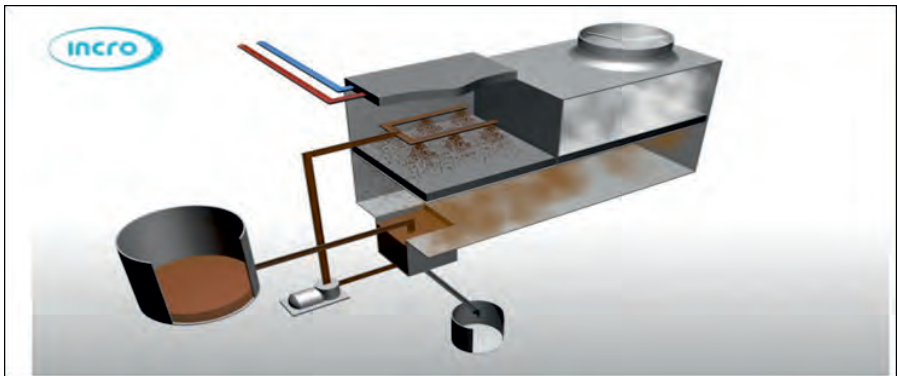
Innovative aspects:

- High stability
- Broad spectrum activity
- 100% food grade quality
- No generation of disinfection by-products

# Industrial Water Management

**TWIEU, C63. Atmospheric evaporation enhancement technology uses a proprietary evaporation equipment**

<b>WATER DOMAIN</b>	<b>Industrial Water Management</b>
<b>CATEGORY</b>	<b>Used Water Collection, Treatment, Disposal</b>
<b>Subcategory</b>	Advanced treatment (Phys/Chem, incl. adv. oxi-
<b>Technology</b>	Industrial wastewater treatment

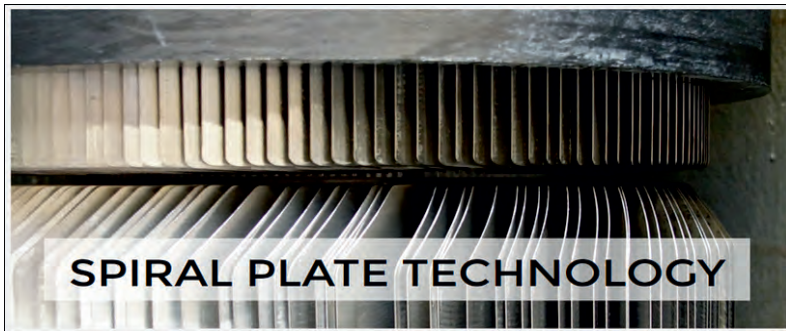


Atmospheric evaporation enhancement technology uses a proprietary evaporation equipment, through the principle of equal-enthalpy evaporation of the waste water in most of the water (96-98%) into the surrounding atmosphere, the remaining amount of concentrate can be resource use according to concentrate recycling or final disposal.

# Industrial Water Management

**TWIEU, C31. Spiralized vertical plates separator, for separation or clarification in wastewater treatment with low energy demand and without using flocculants, chemicals or polymers.**

<b>WATER DOMAIN</b>	<b>Industrial Water Management</b>
<b>CATEGORY</b>	<b>Used Water Collection, Treatment, Disposal</b>
<b>Subcategory</b>	Advanced treatment (Phys/Chem, incl. adv. oxida-
<b>Technology</b>	Industrial wastewater treatment

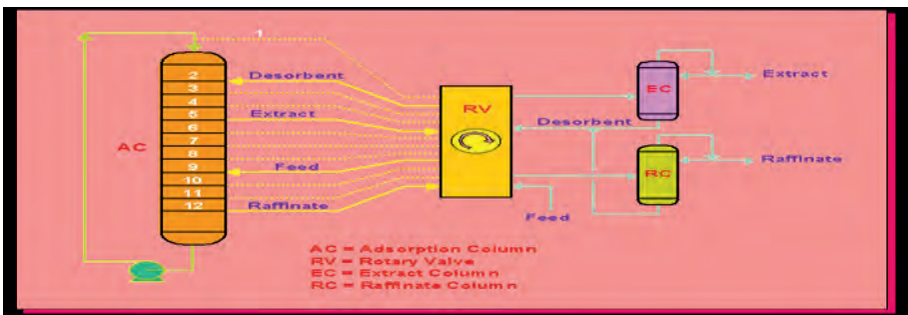


Evodos SPT is a technology can be used for separation or clarification in wastewater treatment, with spiralized vertical plates. Evodos SPT may be equipped as a liquid-liquid separator (Trenner), as a liquid-solid clarifier (Klärer) or a liquid-liquid-solid separator. The dry solid content of the discharged cake is far above industry standard. Designed to handle sticky/greasy/fatty and sharp/abrasive materials. No need to add flocculants, chemicals or polymers. Low energy consumption. Self adjusting on changes in process parameters (temperature, viscosity, mixture changes), no fixed interface level to be set. Simple, compact and rugged design, low operational cost.

# Industrial Water Management

TWIEU, C30. Moving Bed Adsorption combines moving sand bed filtration and carbon adsorption to remove suspended particles and dissolved organics in one step on milligram and microgram per litre levels.

<b>WATER DOMAIN</b>	<b>Industrial Water Management</b>
<b>CATEGORY</b>	<b>Used Water Collection, Treatment, Disposal</b>
<b>Subcategory</b>	Advanced treatment (Phys/Chem, incl. adv. oxida-
<b>Technology</b>	Industrial wastewater treatment



Moving Bed Adsorption can remove suspended particles and dissolved organics in one step on milligram and microgram per litre levels in wastewater treatment, with a small amount of carbon adsorption particles. Combination of two techniques in one apparatus: a) moving sand bed filtration and b) carbon adsorption; this leads to low investment costs. Best type of carbon sorption particles will be determined by laboratory experiments. Especially suitable for medium and large flows (> 10 m<sup>3</sup>/h) and for cleaning requirements of the organics between approx. 50 and 98%. Potential applications:

- effluent cleaning/polishing
- recycling of streams in textile industry (colour removal).



# River Basin Management and Flood Control (RBMFC)

**TWIEU, D2. Smart and sand engines (sensors that relay real-time status reports on the condition of the dike). Use of new natural materials (flexible concrete, durable grass) to bolster flood defenses**

<b>WATER DOMAIN</b>	<b>River Basin Management And Flood Control</b>
<b>CATEGORY</b>	Integrated River Basin Management Tools (Flood Protection)
<b>Subcategory</b>	<b>Preventative Technologies</b>
<b>Technology</b>	River Basin Flooding Abatement / Urban Flooding Abatement



source: <https://www.deltares.nl/en/projects/smart-dike-reinforcement-using-smooth-block-revetments>

source: [http://e360.yale.edu/feature/to\\_control\\_floods\\_the\\_dutch\\_turn\\_to\\_nature\\_for\\_inspiration/2621/](http://e360.yale.edu/feature/to_control_floods_the_dutch_turn_to_nature_for_inspiration/2621/)

To give nature a helping hand, Dutch researchers are working on new dike materials like flexible cement to attach energy-absorbing stones, geotextiles that prevent internal erosion — a major cause of breaches — and super-strong grass that dampens wave action. One intriguing process strengthens dikes with “bio grout” produced by bacteria fed a substance that makes them excrete calcium. So far, it only works on a small scale. The new designs provide a longer-term solution than barriers.

One new dike is protected by a widened beach and concealed beneath a pedestrian-friendly esplanade which combine ecological, recreational, and economic functions with flood control.

Devices like Smart Dikes are expensive, and haven’t yet proven their worth.

# River Basin Management and Flood Control (RBMFC)

TWIEU, E14. Smart buoy performing in-situ water quality monitoring and web platform receiving the information provided by the buoy

<b>WATER DOMAIN</b>	River Basin Management And Flood Control
<b>CATEGORY</b>	WATER MANAGEMENT TECHNOLOGIES
<b>Subcategory</b>	<b>INTEGRATED SYSTEMS (MONITORING TOOLS + DSS)</b>
<b>Technology</b>	RIVER BASIN MONITORING TECHNOLOGY



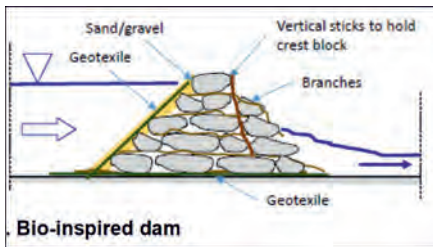
source: <http://freshwater.pt/>  
<http://originalsolutions.wix.com/originalsolutions#!aqualitas/c1f6h/>

Smart buoy to monitor in-situ water quality (like dissolved oxygen, pH, conductivity, temperature, redox potential, total dissolved solids and turbidity) and web platform to receive the information provided by the buoy. The main and global objective of the AQUALITAS product: to provide qualified and preventive information about water quality to entities managing hydric resources (for hydroelectric production, irrigation or human consumption). Such information is related to two phenomena with high environmental and public health impacts: Thermal Stratification and Eutrophication. The latter promotes, on dams with water for human consumption, hydroelectric or irrigation, the large scale production of biotoxins, produced by cyanobacteria. These toxins can cause severe problems, not only to human health but also to the surrounding aquatic ecosystems.

# River Basin Management and Flood Control (RBMFC)

**TWIEU, D16. Bio-inspired dams for ecosystem degradation management (sustainable ecosystem restoration in semi-arid regions)**

<b>WATER DOMAIN</b>	<b>River Basin Management And Flood Control</b>
<b>CATEGORY</b>	<b>INTEGRATED RIVER BASIN MANAGEMENT TOOLS (FLOOD PROTECTION)</b>
<b>Subcategory</b>	<b>PREVENTIVE TECHNOLOGIES</b>
<b>Technology</b>	<b>RIVER BASIN MONITORING TECHNOLOGY</b>



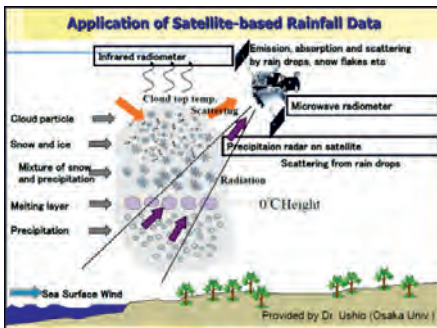
source:  
<http://www.southampton.ac.uk/engineering/>  
<https://www.baufachinformation.de/zeitschrift/Ingenieurtechnische-Aspekte-der-Biberd%C3%A4mme/2014039014144>

Bio-inspired dams built from stones, with branches in layers in between which add tensile resistance. A sealing layer made from impermeable geotextiles seals the upstream, so that a head difference can be maintained. Sticks are added on the downstream side to keep the crown blocks in position. This maintains dam integrity during flood events. The bio-inspired dams are built from local material, and constitute non-permanent structures so that financing and planning issues are minimized. Initial model tests indicate that the stability of rock dams is substantially enhanced by (a) the impermeable layer, which increases the vertical forces acting in the dam, and (b) the reinforcement provided by sticks and branches. Dams based on such construction techniques, using local rocks as main construction material, will provide for the retention of water / the reduction of the hydraulic gradient in restoration projects. Such dams and ponds constitute a sustainable and ecological solution to break through the downward spiral of ecosystem degradation observed in seasonal streams;

# River Basin Management and Flood Control (RBMFC)

TWIEU, D1. Improved river basin management including flood risk management using Space-based technology (SBT) and information and communication technology (ICT)

<b>WATER DOMAIN</b>	<b>River Basin Management And Flood Control</b>
<b>CATEGORY</b>	<b>WATER MANAGEMENT TECHNOLOGIES</b>
<b>Subcategory</b>	<b>REACTIVE TECHNOLOGIES / INTEGRATED SYSTEMS (MONITORING TOOLS + DSS)</b>
<b>Technology</b>	<b>RIVER BASIN FLOODING ABATEMENT /URBAN FLOODING ABATEMENT</b>



source: <http://www.sensors.co.uk/>

Space-based technology (SBT) and information and communication technology (ICT) have spread dramatically. For example, hourly global rainfall maps observed from satellites are provided via the internet about 4 hours after observation, and cellular phones have rapidly spread in the region. These technologies have the potential to improve the monitoring and warning system because (i) satellites can cover a wider area than existing ground observation systems, and (ii) messages can be conveyed directly and simultaneously to citizens in hazardous areas. Powerful non-structural measures to guard against water-related disasters, monitoring and warning systems have been implemented by combining ground observations (rain gauge, water-level gauge) and remote observations (radar rain gauge); improving prediction accuracy of extreme weather events; and strengthening capacities of both governments and communities for pre- and post-disaster actions, including effective utilization of mass media for early warning and evacuation;

# River Basin Management and Flood Control (RBMFC)

**TWIEU, D8. mO4Rivers (Web Mobile Application to report river water bodies status) for citizens participation**

<b>WATER DOMAIN</b>	<b>River Basin Management And Flood Control</b>
<b>CATEGORY</b>	<b>WATER MANAGEMENT TECHNOLOGIES</b>
<b>Subcategory</b>	<b>PREVENTATIVE TECHNOLOGIES / STAND-ALONE DSS</b>
<b>Technology</b>	<b>RIVER TRAINING BASIN SCALE</b>



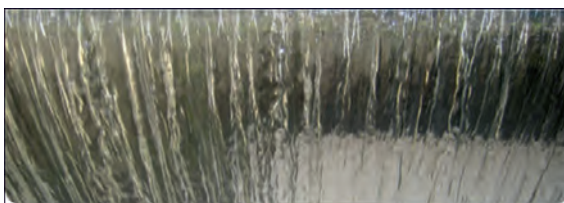
source:  
<https://webh2o.net/mo4rivers/frontend/index.php?d=live>

The web mobile application (App) allows common citizens, including students, scout groups or sport associations to characterise and report rivers water bodies and shores to a centralised database. The App supports the “Project Rivers”. This project aims to raise awareness and involve the citizens for the importance and relevance of the eco-services provided by the river network on the entire ecosystem. The project and the web mobile app are based on 500 m river stretches that can be given for adoption and be visited 2 times per year. The project was created in 2007 and since then involved more than 40.000 people in Portugal. The river network was edited for the all country to unically identify each river stretch. This work is executed by volunteers using GIS tools, including the OpenStreetMap project online ([www.openstreetmap.org](http://www.openstreetmap.org)). This methodology allows the volunteers to understand both the geographic information production tools and obtain the skills to manage the base information needed for the project.

# River Basin Management and Flood Control (RBMFC)

**TWIEU, D9. Microalgae dual-head biosensors for selective detection of herbicides with fibre-optic luminescent oxygen transduction.**

<b>WATER DOMAIN</b>	<b>River Basin Management And Flood Control</b>
<b>CATEGORY</b>	<b>WATER MANAGEMENT TECHNOLOGIES</b>
<b>Subcategory</b>	<b>SENSORS AND OTHER DEVICES</b>
<b>Technology</b>	<b>RIVER BASIN MONITORING TECHNOLOGY</b>



Source: [http://www.life-aquatik.eu/wp-content/uploads/2015/03/newsletter4\\_eng.pdf](http://www.life-aquatik.eu/wp-content/uploads/2015/03/newsletter4_eng.pdf)

AQUATIK tackles the issue of surface water contamination by priority pollutants which have been identified in the Water Framework Directive (WFD) 2000/60/EC. For these priority pollutants the WFD established concentration thresholds which should not be overlapped in the surface water bodies of the EU. AQUATIK aims to design a new monitoring tool of priority pollutants, using the technology of biosensors, able to quantify automatically and at real time their concentrations in order to ensure that the concentration thresholds are not overlapped. Since urban wastewater and a major part of industrial wastewater are transferred to wastewater plants, the monitoring tool is going to be placed at the outlet of wastewater treatment plant (WWTP). The monitoring system is developed for the quantification of seven target priority pollutants selected for their abundance in rivers and particularly in the Llobregat river basin (Catalonia, Spain) where the system is going to be implemented. Four of these compounds belong to the pesticides family (atrazine, diuron, isoproturon and simazine) and the other three are organic substances widely spread in rivers (octylphenol, nonylphenol and DEHP). This project investigates an innovative and promising system for the protection of our surface waters and explores new possibilities offered by biosensor technologies in real time .

# River Basin Management and Flood Control (RBMFC)

**TWIEU, D5. Floating technology for water retention and flood resilience in the urban fabric, based on modular composite technology which consists of fiber reinforced EPS structural panels for floating systems.**

<b>WATER DOMAIN</b>	<b>River Basin Management And Flood Control</b>
<b>CATEGORY</b>	<b>INTEGRATED RIVER BASIN MANAGEMENT TOOLS (FLOOD PROTECTION)</b>
<b>Subcategory</b>	<b>REACTIVE TECHNOLOGIES</b>
<b>Technology</b>	<b>URBAN FLOODING ABATEMENT</b>



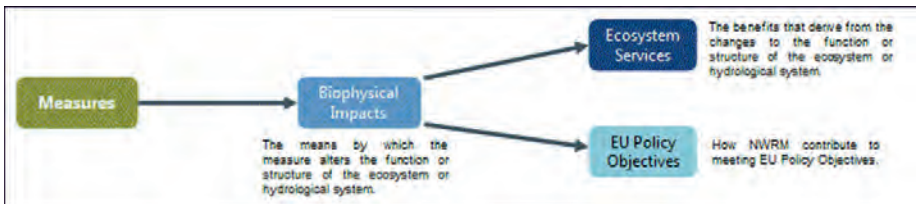
source: <http://www.eurekanetwork.org/content/e-4446-eurekabuild-floatec>  
<http://www.eurekanetwork.org/project/id/4446/>  
 source  
<http://www.eurekanetwork.org/sites/default/files/success-story-pdf/4446.pdf>

The FLOATEC project aims to develop a floating structure that enables multiple use of space, combining e.g. water retention with housing or infrastructure. FLOATEC is developed for multiple applications; large scale pontoons, multi-functional storage basins, amphibious flood proof buildings, multi-functional (semi) floating structures, floating infrastructure and floating greenhouses. The principle of FLOATEC is based on modular composite technology which consists of fiber reinforced EPS structural panels for floating systems. One of the most important prerequisites is to reduce the cost of a floating structure from 150 euro/m<sup>2</sup> to 75 euros/m<sup>2</sup>. Only with such a significant cost reduction will FLOATEC (financially) enable multiple use of space combining water retention with other functions to reduce flood risk and improve fresh water supply. The cost reduction and broad market applicability of the basic module are not only a market risk, but require multiple technological innovations with related technological risks such as: stiffness, durability, peak load resistance, flexibility of shape for specified applications and flexibility for production processes (modular, detachable).

# River Basin Management and Flood Control (RBMFC)

TWIEU, D15. Natural Water Retention Measures (NWRM) and DSS to provide multiple benefits, including flood risk reduction

<b>WATER DOMAIN</b>	<b>River Basin Management And Flood Control</b>
<b>CATEGORY</b>	<b>WATER MANAGEMENT TECHNOLOGIES</b>
<b>Subcategory</b>	<b>PREVENTATIVE TECHNOLOGIES / STAND-ALONE DSS</b>
<b>Technology</b>	<b>RIVER TRAINING ( PREVENTIVE TECHNOLOGIES) AT BASIN SCALE</b>



Source: (AF-Consult Switzerland Ltd (<http://www.afconsult.com/fr/worldwide/europe/switzerland/>) Hafren Water Ltd., UK (<http://www.hafrenwater.com/>) SMHI International Consulting Services, Sweden (<http://www.smhi.se/en/services/professional-services/environment>))

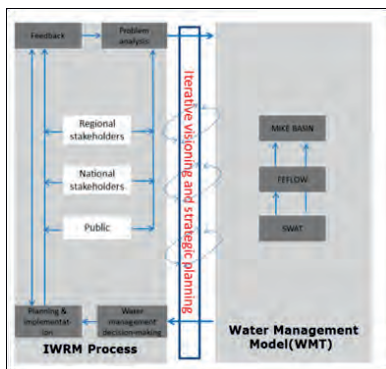
Retention basins are used to manage storm-water runoff to prevent flooding, downstream erosion, and improve water quality in an adjacent river, stream, lake or bay. In practice a retention basin differs from an infiltration one, commonly named MAR (Managed Aquifer Recharge), used for groundwater recharge. Natural water retention measures aim to safeguard and enhance the water storage potential of landscape, soil, and aquifers, by restoring ecosystems, natural features and characteristics of water courses and using natural processes. Natural Water Retention Measures (NWRM) innovative technological solutions including hydrological-hydraulic (including groundwater) models able to optimally assimilate data from different data sources with varying information value such as standard monitoring networks, remote sensing and citizens through mobile applications (crowdsourcing), promoting a new water quality and turbidity monitoring.



# River Basin Management and Flood Control (RBMFC)

TWIEU, D23. Integrated water resources management (IWRM) tool that combines a hydrological (SWAT), a river basin management (MIKE Hydro Basin) and a groundwater

<b>WATER DOMAIN</b>	<b>River Basin Management And Flood Control</b>
<b>CATEGORY</b>	<b>WATER MANAGEMENT TECHNOLOGIES</b>
<b>Subcategory</b>	<b>INTEGRATED SYSTEMS (MONITORING TOOLS + DSS)</b>
<b>Technology</b>	<b>RIVER TRAINING ( PREVENTIVE TECHNOLOGIES) AT BASIN SCALE</b>



source:  
<http://www.inter3.de/>  
<http://www.dhigroup.com/>  
<http://www.iwrm-isfahan.com/en/home/home.php>

The TWI is being developed as part of the “Integrated Water Resources Management Zayandeh Rud” project, funded by the German Federal Ministry of Education and Research (BMBF) - <http://www.iwrm-isfahan.com/en/home/home.php>. To counteract the decline in fresh water resources in a region with difficult climatic conditions, high water demand and salinization of the groundwater, a water management tool (WMT) is being developed which combines soil and water assessment (SWAT), river basin management (MIKE Hydro Basin) with groundwater processes (FEFLOW). The acquired information from the WMT will provide information to the water management decision-making and to the planning and implementation process, while involving stakeholders and the public. The resulting feedback and problem analysis is again transferred to the WMT, allowing a continuous IWRM process through an iterative visioning and strategic planning

# River Basin Management and Flood Control (RBMFC)

TWIEU, D22.

<b>WATER DOMAIN</b>	<b>River Basin Management And Flood Control</b>
<b>CATEGORY</b>	<b>WATER MANAGEMENT TECHNOLOGIES</b>
Subcategory	<b>Integrated systems (monitoring tools + DSS)</b>
Technology	<b>RIVER TRAINING ( PREVENTIVE TECHNOLOGIES) AT BASIN SCALE</b>



source: <http://www.bmbf.wasserressourcen-management.de/en/606.php>

The work has been developed for the Guanting-Yonding basin in Northeast of Beijing, as part of the project “Sustainable water and agricultural land use in the Guanting watershed under limited water resources”, funded by the German BMBF. The method is based on stochastic analysis to provide information for long-term water management planning, in areas where no or little data is available, under consideration of different climatic conditions. It contains:

- deterministic simulation of water uses in the catchment, including consideration of ranking,
- registration of relevant systems states (water levels in reservoirs / filling of reservoirs, discharges at particular river profiles in comparison to minimum flows, deficits in water supply, etc.),
- statistical analysis of the registered systems states as a basis for assessment of each examined management variant.

The resulting water resources planning model created with WBalMo is an abstraction of the real-world catchment area Guanting. Severe conflicts of water scarcity could be illustrated and measures of water transfer could be studied with this technology.

# Water for Energy

## TWIEU, E19. Geothermal energy pump to harvest geothermal energy

<b>WATER DOMAIN</b>	<b>WATER FOR ENERGY</b>
CATEGORY	<b>ENERGY PRODUCTION TECHNOLOGIES</b>
Subcategory	<b>OTHER SOURCES / GEOTHERMAL ENERGY</b>
Technology	<b>NOVEL ENERGY PRODUCTION TECHNOLOGIES</b>



source: <http://www.bmbf.wasserressourcen-management.de/en/606.php>

Across Europe, there are plentiful sources of geothermal energy: heat stored in the ground which can be tapped to provide a renewable and inexhaustible energy supply. Using the right technology to access this power at varying depths and temperatures, we can use this heat to reduce our dependence on imported and climate-damaging fossil fuels.

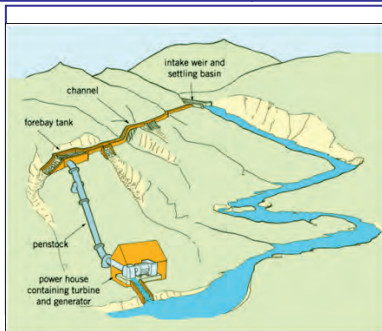
Until recently, the technology to exploit geothermal energy in a cost-effective way has remained under-developed. However, in response to the growing economic and policy pressures to cut CO<sub>2</sub> emissions and improve energy security, one company set out to change this state of affairs, with remarkable results.

Klima and its parent company Mayekawa in Belgium designed the compressor, with unexpectedly good results: for each kW of energy consumed, the pump delivers 6.4kW of heat. The project had delivered a world-class result.

# Water for Energy

**TWIEU, E23. Micro-hydro generators: system that do not require a dam or storage facility to be constructed**

WATER DOMAIN	WATER FOR ENERGY
CATEGORY	ENERGY PRODUCTION TECHNOLOGIES
Subcategory	SMALL SCALE HYDROPOWER
Technology	NOVEL ENERGY PRODUCTION TECHNOLOGIES



Source: <http://practicalaction.org/small-scale-hydro-power-2>  
[http://practicalaction.org/energy/micro\\_hydro\\_expertise?utm\\_source=S000&utm\\_medium=PPC&utm\\_campaign=C10105&src=Grant\\_PPC&subsrc=sub\\_source&gclid=CjwKEAajwwbyxBRCS74T049iEp0wSJACkO5v1WFcuUkp8ajc6gLNRCS0FXEXGung\\_LTevc8j0GBgJfxoC2pDw\\_wcB](http://practicalaction.org/energy/micro_hydro_expertise?utm_source=S000&utm_medium=PPC&utm_campaign=C10105&src=Grant_PPC&subsrc=sub_source&gclid=CjwKEAajwwbyxBRCS74T049iEp0wSJACkO5v1WFcuUkp8ajc6gLNRCS0FXEXGung_LTevc8j0GBgJfxoC2pDw_wcB)

Micro-hydro power is the small-scale harnessing of energy from falling water, such as steep mountain rivers. Using this renewable, indigenous, non-polluting resource, micro-hydro plants can generate power for homes, hospitals, schools and workshops. Small-scale hydro schemes generate up to 500 kilowatts of power. The microhydro station, which converts the energy of flowing water into electricity, provides poor communities in rural areas with an affordable, easy to maintain and long-term solution to their energy needs.

These systems, which are designed to operate for a minimum of 20 years, are usually "Run of the river" systems do not require a dam or storage facility to be constructed. Instead they divert water from the stream or river, channel it in to a valley and drop it in to a turbine via a pipeline called a penstock.

The turbine drives a generator that provides the electricity to the local community. By not requiring an expensive dam for water storage, run-of-the-river systems are a low-cost way to produce power. They also avoid the damaging environmental and social effects that larger hydroelectric schemes cause, including a risk of flooding.

# Water for Energy

**TWIEU, E12. Behavioral fish barrier (using a strobe light, sound and a bubble curtain as stimuli) to e.g. divert fish from turbine blades of hydropower structures**

<b>WATER DOMAIN</b>	<b>WATER FOR ENERGY</b>
<b>CATEGORY</b>	<b>WATER MANAGEMENT TECHNOLOGIES</b>
Subcategory	<b>MITIGATION TECHNOLOGIES</b>
Technology	<b>PRESERVATION OF NATURAL ECOSYSTEMS IN DAMMED RIVERS</b>



Source:  
<http://originalsolutions.wix.com/originalsolutions#!projects/c243u>

The PISCIS product consists in a behavioural barrier developed for freshwater fish using, as stimuli, a strobe light, sound and a curtain of bubbles, which allow to divert and/or guide the potamodromous species. For example, diverting fish from turbine blades of hydroelectric structures and guiding shoals for the fish passages. This allows, in the first case, a substantial reduction in the mortality of species with high conservation interest and, in the second case, to restore the genetic continuous of those species.

This behavioural fish barrier represents a new generation of dynamic biodiversity protection systems in altered and fragmented watercourses, where ecological disruptions imposed restrictions on migratory genetic flows and where the existing hydraulic structures do not respond favourably to the migratory and reproductive impulses of this fauna. This innovation can safeguard the ecological integrity of the biota, without interfering with the functional productivity and profitability of the systems of water use (whether they are used for electricity production, irrigation or consumption). Its action is directed at the behaviour of fish species without any physical obstacle or constraint interfere with these structures.

# Water for Energy

**TWIEU, E5. Very low head turbine generator (Kaplan type) for up to 4.5 m head**

<b>WATER DOMAIN</b>	<b>WATER FOR ENERGY</b>
CATEGORY	<b>ENERGY PRODUCTION TECHNOLOGIES:</b>
Subcategory	<b>TURBINES AND COMPONENTS</b>
Technology	<b>INCREASE ELECTRICITY EFFICIENCY OF SMALL SCALE HYDROPOWER</b>



source: <http://www.small-hydro.com/IT-Documents/121-1-Very-Low-Head-Turbine-Generator.aspx>

The Very Low Head Turbine (VLH Turbine) is designed specifically for very low head sites (1.4 to 3.2 meters and up to 4.5 with reinforced structure). The objectives of the designers of the VLH turbine was to develop a unit that requires very few civil work, is easy to install and offers a high degree of reliability at a reasonable cost per installed KW. To achieve these goals, the VLH concept takes a completely different approach from the traditional turbine design, using large runners to practically eliminate the expensive civil structures of the traditional concept. It includes advanced technological characteristics such as Directly driven Permanent Magnet Variable speed Generator. The VLH offers a very good environmental integration, it is noiseless and submersed, and it has a unique fish friendly capacity.

# Water for Energy

## TWIEU, E1. Hooped Pelton turbine designed based on the separation of function between buckets and hoops

WATER DOMAIN	WATER FOR ENERGY
CATEGORY	<b>ENERGY PRODUCTION TECHNOLOGIES: SMALLSCALE HYDROPOWER</b>
Subcategory	<b>TURBINES AND COMPONENTS</b>
Technology	<b>INCREASE ELECTRICITY EFFICIENCY OF SMALL SCALE HYDROPOWER</b>



source: <http://www.small-hydro.com/Documents/112-4-Hooped-Pelton-Turbine.aspx>  
<http://www.small-hydro.com/Programs/innovative-technologies.aspx>  
<http://www.small-hydro.com/Documents/112-4-Hooped-Pelton-Turbine.aspx>

The hooped Pelton is an innovative new design based on the separation of function between buckets and hoops. This runner is composed of separate buckets mechanically attached to a hub consisting of 2 flanges. This is a great advantage for maintenance, with in addition improved mechanical characteristics. The Pelton wheel runner of this technology has a structure in which a bucket is fitted in the peripheral ring. Compared to the one-piece casting structure, this structure can reduce the manufacturing cost, as well as other costs, by partial replacement of the bucket. This technology requires no spare runners, and it allows the bucket to be replaced partially, to be installed correctly, and to be replaced quickly, all of which make the maintenance easy. Advantages: Improved behavior of the runner under operation; Controlled and shorter delivery time; Minimized risk of cracking during operation due to improved metallurgical quality and dynamic stresses redistribution; Reduction of cost of ownership due to less stock (optimization of spare parts stock) and due to possibility to replace few buckets instead of an entire runner; Easy maintenance due to removable buckets.

# Water for Energy

**TWIEU, E3. Screw Turbine Generating System, a screw type small (up to 300 Kw) hydro unit applicable to existing channel or weir**

<b>WATER DOMAIN</b>	<b>WATER FOR ENERGY</b>
<b>CATEGORY</b>	<b>ENERGY PRODUCTION TECHNOLOGIES: SMALLSCALE HYDROPOWER</b>
<b>Subcategory</b>	<b>TURBINES AND COMPONENTS</b>
<b>Technology</b>	<b>INCREASE ELECTRICITY EFFICIENCY OF SMALL SCALE HYDROPOWER</b>



source:

<http://www.small-hydro.com/Programs/innovative-technologies.aspx> )

<http://www.small-hydro.com/Documents/311-5-Screw-Turbine-Generating-System.aspx>

A screw type small hydro unit applicable to existing channel or weir. It is robust, long wearing, no fine screens necessary and fish friendly. Water flow: up to 5,500 L/s, Head: up to 10 m, Power: up to 300 kW.

The water turbine is designed to protect fish. Applications of this technology are extended to areas of an extremely low head below 10m. This technology has been widely applied in Europe. The structure of the screw-shaped waterwheel is sturdy and simple. This structure is designed to remove suspended sediment from the water column. These factors contribute to a greatly simplified maintenance regime. Advantages: No control system necessary; The efficiency is greater than with comparable waterwheels and small turbines; Flat, stable efficiency gradient; Robust, long wearing, trouble free, fish friendly.



# Water for Energy

**TWIEU, E4. Vertical Micro Pelton Turbine with composite runner buckets in package type generating unit for small rivers with relative low discharge and high head**

<b>WATER DOMAIN</b>	<b>WATER FOR ENERGY</b>
<b>CATEGORY</b>	<b>ENERGY PRODUCTION TECHNOLOGIES: SMALLSCALE HYDROPOWER</b>
<b>Subcategory</b>	<b>TURBINES AND COMPONENTS</b>
<b>Technology</b>	<b>INCREASE ELECTRICITY EFFICIENCY OF SMALL SCALE HYDROPOWER</b>



source:

<http://www.small-hydro.com/Programs/innovative-technologies.aspx>

[www.3d-verksted.no](http://www.3d-verksted.no)

<http://www.small-hydro.com/Documents/112-1-Vertical-Micro-Pelton-Turbine.aspx>

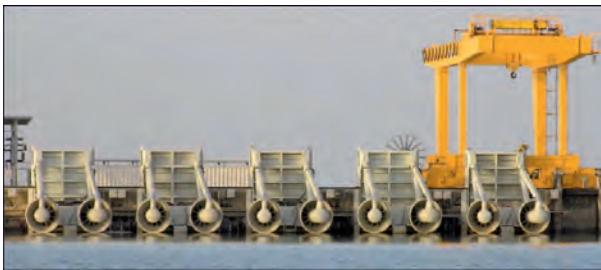
Composite runner buckets in package type generating unit for small rivers with relatively low discharge and high head. The system can be provided with remote control and be adapted to customer needs. Advantages:

Composite runner buckets have low cost and are easily replaced. Package type generating unit is easy to install at site. Easy maintenance due to simplified structure. Available between 15 kW and 150 kW, Net head >30 meters, 1-5 automatically controlled nozzles with servo engines. Production of electricity in rivers with high head and low run-off. Standard equipment: Automatic closing of nozzles by no run-off or power failure, power meter, control panel.

# Water for Energy

**TWIEU, E6. Small turbines to be retrofitted e.g. intake towers, unused ship locks, canal weirs and navigation and irrigation dams**

<b>WATER DOMAIN</b>	<b>WATER FOR ENERGY</b>
<b>CATEGORY</b>	<b>ENERGY PRODUCTION TECHNOLOGIES: SMALLSCALE HYDROPOWER</b>
<b>Subcategory</b>	<b>TURBINES AND COMPONENTS</b>
<b>Technology</b>	<b>RETROFITTING OF EXISTING SMALL SCALE HYDROPOWER SCHEMES</b>



source <http://www.small-hydro.com/Programs/innovative-technologies.aspx>  
<http://www.andritz.com/hy-hydromatrix-en.pdf>

Use at existing structures HYDROMATRIX® technology enables customers to tap into the unused hydropower potential of intake towers, unused ship locks, canal weirs and navigation and irrigation dams by using these existing structures as a profitable and renewable energy resource.

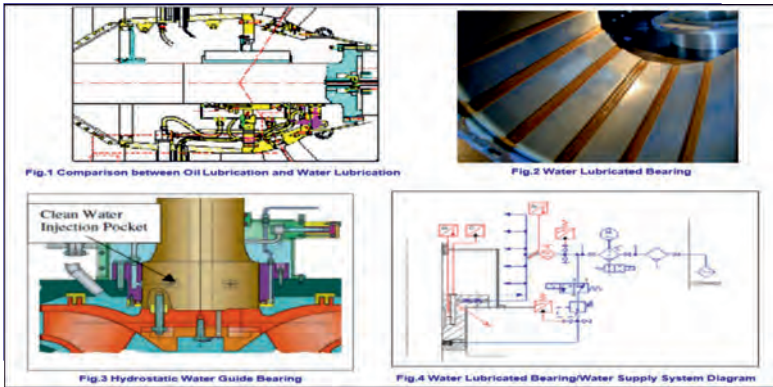
Flexibility in arranging the small TG-units and associated electromechanical equipment allows integration of HYDROMATRIX® plants in existing structures that fulfil the basic application criteria. High profitability HYDROMATRIX® turbines can operate with only minimal tailrace submergence. Deep excavation and other costly civil work can be avoided, thus leading to significant cost savings. State-of-the-art hydraulic runner design and generator technology guarantee highest possible energy generation through high levels of hydraulic and electrical efficiency.

In 2010 ANDRITZ HYDRO received the Austrian State Prize for Environmental and Energy Technology for its HYDROMATRIX® concept.

# Water for Energy

TWIEU, E13. Water Lubricated Bearings guarantee the non-pollution of the river that can happen with the oil lubricated alternatives

<b>WATER DOMAIN</b>	<b>WATER FOR ENERGY</b>
CATEGORY	<b>ENERGY PRODUCTION TECHNOLOGIES: SMALLSCALE HYDROPOWER</b>
Subcategory	<b>TURBINES AND COMPONENTS</b>
Technology	<b>PRESERVATION OF NATURAL ECOSYSTEMS IN DAMMED RIVERS</b>



Source : <http://www.small-hydro.com/Documents/522-1-Water-Lubricated-Bearings.aspx>

Water lubricated bearings technology guarantee the non-pollution of the river that can happen with oil lubricated installations. In addition of this great advantage, the technology features improved performances, low maintenance, simplified and compact design.

PRO: This technology is environmentally friendly because it uses no oil. Simplified design. Improved performances with better dynamic behaviour and lower losses. Reduction of costs of ownership due to low maintenance. No risk of pollution by oil in the rivers

# Water for Energy

## TWIEU, E15. Earthquake safety assessment for concrete dams foundation failure by application of integrated numerical tools

<b>WATER DOMAIN</b>	<b>WATER FOR ENERGY</b>
<b>CATEGORY</b>	<b>ENERGY PRODUCTION TECHNOLOGIES</b>
<b>Subcategory</b>	<b>DECISION SUPPORT SYSTEMS (DSS)</b>
<b>Technology</b>	<b>RISK ASSESSMENT &amp; PRESERVATION OF NATURAL ECOSYSTEMS IN DAMMED RIVERS</b>



Source: <http://www.lnec.pt/barragens-betao/en/>  
<https://drive.google.com/file/d/0Bzk4EuaNUsx5Vl9QWnc2Q3BSVUE/view?usp=sharing>

Earthquake safety assessment for concrete dams foundation failure involves application of the existing and the development of new integrated numerical tools to assess the safety of dam foundations in rock masses considering extreme actions, such as those imposed by high intensity seismic events.

Two major roles are anticipated for their use: assess the safety level of existing dams, in order to support decisions regarding the need for rehabilitation works; define and the major potential failure modes allowing a more effective design of new dams, and expediting the interpretation of data collected during or after the seismic events, and thus allowing an adequate support to the definition of emergency decisions.

# Water for Energy

## TWIEU, E17. Integrated assessment and structural modelling of swelling processes in concrete dams

<b>WATER DOMAIN</b>	<b>WATER FOR ENERGY</b>
<b>CATEGORY</b>	<b>ENERGY PRODUCTION TECHNOLOGIES</b>
<b>Subcategory</b>	<b>DECISION SUPPORT SYSTEMS (DSS)</b>
<b>Technology</b>	<b>RISK ASSESSMENT &amp; PRESERVATION OF NATURAL ECOSYSTEMS IN DAMMED RIVERS</b>



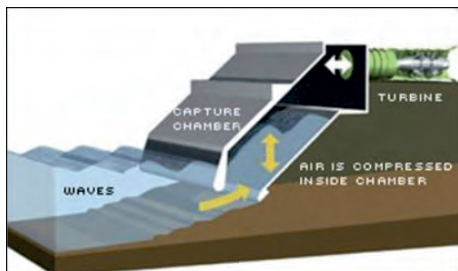
Source: <http://www.Inec.pt/barragens-betao/en/>  
<https://drive.google.com/file/d/0Bzk4EuaNUsx5eGIUTkVHQUmwcFk/view?usp=sharing>

Small to moderate swelling strains do not cause, in general, adverse consequences in concrete dams. However, more intense strains can compromise, initially, the serviceability conditions, namely related with gate operation, and after can introduce damage that affect the durability of the concrete and the structural safety. In concrete dams the structural evidences of AAR development can be dissimulated by the creep response, which causes some difficulties on the AAR phenomena identification. For detection of early AAR signs, the main technological innovations that resulted from recent research are in the following areas: detailed visual inspections; proper interpretation of monitoring results obtained from plumb-lines, geodetic instrumentation, joint meters, rod extensometers, stress meters and strain meters, particularly stress-free strain meters; laboratory testing for AAR evaluation (petrography, chemical and expansion tests); laboratory tests to evaluate the depreciation of the mechanical properties of concrete (compressive and tensile strengths, elasticity modulus and creep); and measurement of concrete stress, using flat jacks and over-coring techniques.

# Water for Energy

## TWIEU, E20. Oscillating water columns, device that generates electricity from waves

WATER DOMAIN	WATER FOR ENERGY
CATEGORY	ENERGY PRODUCTION TECHNOLOGIES
Subcategory	OTHER SOURCES / WAVE ENERGY
Technology	NOVEL ENERGY PRODUCTION TECHNOLOGIES



Source: <http://www.eurekanetwork.org/content/e-2278-wwec>  
<http://www.eurekanetwork.org/sites/default/files/success-story-pdf/2278.pdf>  
<http://www.environmental-expert.com/companies/wave-energy-35805>

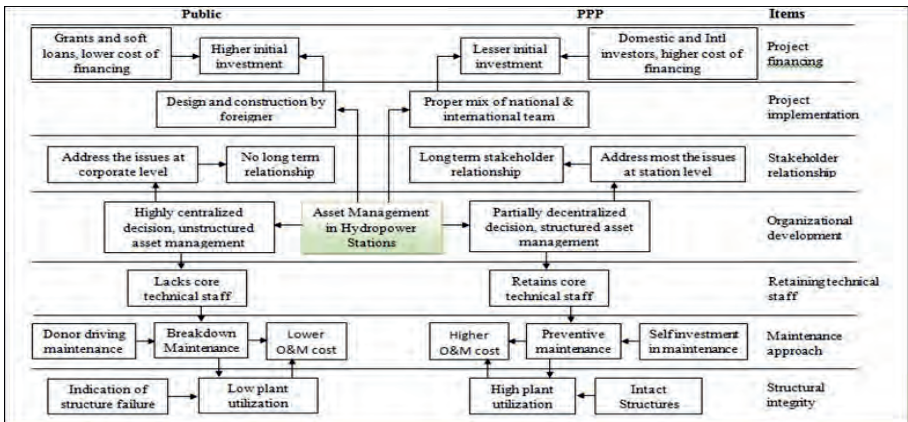
The fundamental functions of wave power devices are to capture waves and then absorb energy from the captured waves, which then are converted into electricity. Most of these devices are called oscillating water columns. These oscillating water columns consists of a "partially submerged, hollow structure" (as seen in diagram one), which is open to the sea below the water line for waves to pass through. The principle of operation of an oscillating water column is that as waves enter the shell chamber or capture chamber (as noted in diagram 2), the level of water rises, compressing and depressurizing the air in the top of the chamber or air column, which is then forced through a blow-hole into the turbine to generate electricity. When the waves draw back, air returns under pressure into the chamber, keeping the turbine moving at all times. The air that blows in both directions produces enough movement for the turbine to drive a generator. This generator than converts the energy into electricity. Most often the turbines used in an oscillating water column is the Wells Turbine. A Wells Turbine is a low-pressure air turbine developed for use in oscillating-water-column wave power plants.



# Water for Energy

TWIEU, E9. DSS: Hydropower plant simulator (HPPSW) for simulating the refurbishment and maintenance decisions of hydropower plants.

<b>WATER DOMAIN</b>	<b>WATER FOR ENERGY</b>
<b>CATEGORY</b>	<b>ENERGY PRODUCTION TECHNOLOGIES: SMALL</b>
<b>Subcategory</b>	<b>Tool to predict and map resources flows and</b>
<b>Technology</b>	<b>INCREASE ELECTRICITY EFFICIENCY OF SMALL HYDROPOWER SCHEMES</b>



Source: <http://www.ite.tuwien.ac.at/>  
<http://www.small-hydro.com/Documents/423-1-Assessment-Methods-for-Rehabilitation-and-Sa.aspx>

A new tool for simulating the refurbishment and maintenance decisions of hydropower plant. Presentation of the latest investigations and the results of some simulations. The Simulator is programmed on a Webserver and therefore no additional installation is necessary. The user just needs access to the internet and a commercial internet browser. The rest is done by the administrator and the programme himself. Advantages: The technological advantage of this feature is the webbased platform. It needs just an administrator and an internet access. The rest is done at the webserver, which is installed here at the University; Can reduce the time and especially the costs by varying different maintenance and operation strategies before any work starts; By training the operators and planners they get an impression about the results of their decisions in this case.



中欧水源合作机会增进政策, 创新和联网

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The project PIANO (*Policies, Innovation, And Network for enhancing Opportunities for China-Europe water cooperation*) aims at strengthening the international cooperation in the field of water between Europe and China and promoting the creation of networks of companies, SMEs, entrepreneurs, NGOs, policy makers, regulators and funding agencies to create business and social opportunities.

Its objectives are:

- ***Strengthening and expanding the existing network of the China-Europe Water Platform (CEWP) to cover all actors relevant for cooperation between China and Europe in the water research and innovation domain***
- ***Identification of European technological water innovations and areas for joint development of innovative technological solutions that have a potential for their implementation in China***
- ***Identification of drivers and barriers concerning this cooperation and elaboration of strategies to overcome such barriers and take advantage of drivers for the implementation and replication of technological water innovations in China***
- ***Promotion of knowledge exchange and policy dialogue to build an enabling environment for the uptake of technological water innovations with a great potential for implementation, further replication and market uptake in China***
- ***Consolidation of a shared strategic research and innovation agenda (SRIA) between Europe and China water sector***
- ***Effective dissemination and mainstreaming of the project results to Chinese, European stakeholders and international target audiences***

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