meso-level eco-efficiency indicators to assess technologies & their uptake in water use sectors

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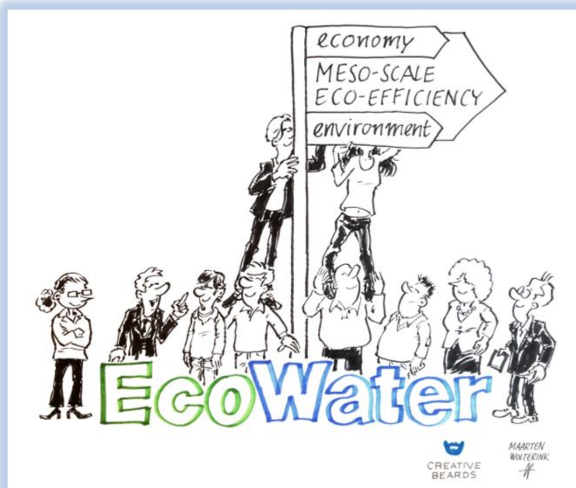
Project leaflets:

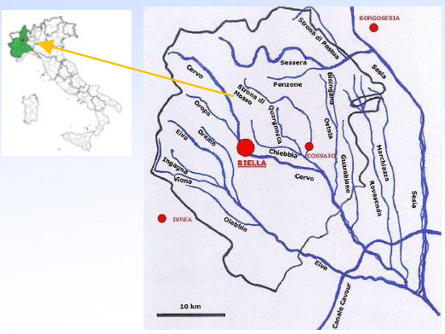
- General leaflet
- A Web-based Toolbox for Eco-Efficiency Assessment of innovative Technologies in Water Systems



Biella Textile, Italy

Meso-level assessment of eco-efficiency improvements through innovative technologies for wastewater treatment in the textile industry

The Case Study Area
Province of Biella
Cervo River Basin



General information
Location: Biella, Northern Italy
Area: 913 Km²
Population: 185768
Textile units: ~900
Water abstracted per industrial unit.: 50000 -100000 m³/y
Economic Output
Wool and cashmire products
Waste water treatments
Use of sludge as fertiliser
Innovative Technologies
Water saving •Water recycling *Color baths* •Natural colors *Waste water treatment* •Nano-filtration •Bio -flotation •Granular activated carbon •Ozone treatment •Reverse osmosis •Thermal compression
Case Study Contact Person
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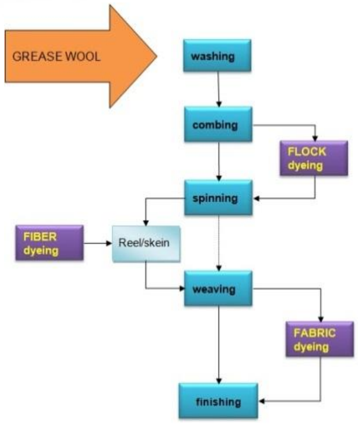
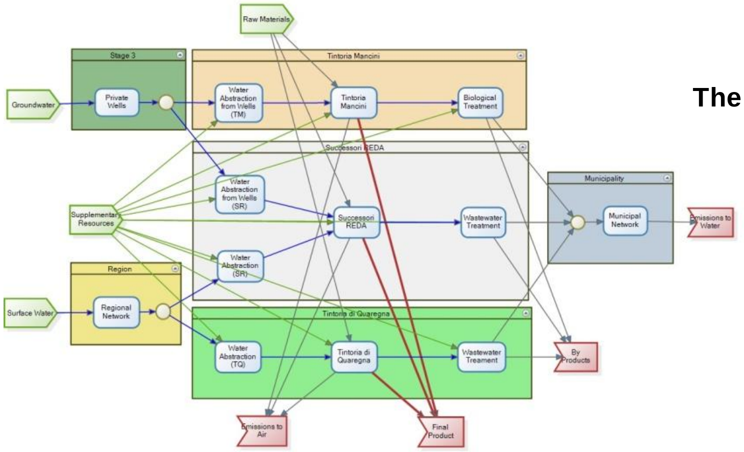
The Case Study context

The Biella textile district is one of the largest and most qualified in the world production of wool fabrics for clothing and fine fibers (cashmere, alpaca, mohair). The Case Study area is characterized by the presence of several textile small/mid-size companies facing a period of a very serious economic crisis. The textile sector is strongly related to water resources depletion and industrial water's quality, especially for those wet processes as dyeing and finishing .

Main Challenges

The textile district is active since the beginning of the last century and the main resource mostly exploited is: surface water. The risk of over-exploitation is quite remote, but the cost a for industries is becoming relevant, mostly for waste waters release in the drainage system. Moreover the environmental impact of massive use of water, is also affected by heavy use of chemicals for the dyeing bath processes. For those reasons the case study focuses into dyeing industries, and the innovations related to the reduction of chemical agents, the alternative with natural dyers mixture and waste water treatments integrated inside the textile units.





The Actors Involved

- Industrial units
- CORDAR (public water & wastewater service)
- ARPA (Regional Authority)
- Po River Basin Authority
- Industrial association

Eco-efficiency Indicators

Economic Indicator	Unit
Total value added	€

Environmental Indicators	Unit
Surface-ground Water withdrawal	m³
Waste water release	m³
Chemical dye agents	kg
Natural dye herbs	kg
Energy	kWh
Fossil fuels	m³

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Environmental Indicators	Unit
Surface-ground Water withdrawal	€/m³
Waste water release	€/m³
Chemical dye agents	€/kg
Natural dye herbs	€/kg
Energy	€/kWh
Fossil fuels	€/m³

Cogeneration of thermal energy and electricity, Amsterdam-Rhine Channel, The Netherlands

Meso-level assessment of eco-efficiency improvements through innovative technologies for water use in energy production

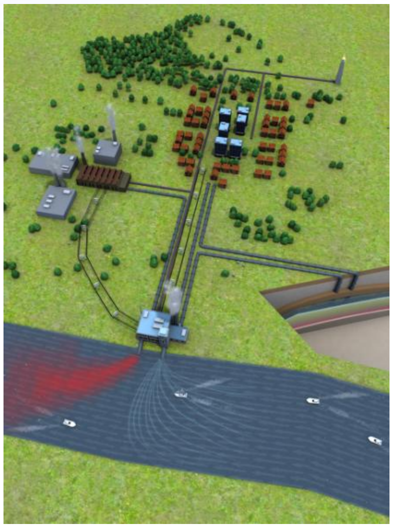
The Case Study context

The case study addresses a system that consists of a river water system (Amsterdam Rhine Channel or ARC), which provides in supply and discharge of cooling water for a local energy plant for electricity and thermal energy production. The system consists of the local energy plant itself, including the intake and discharge of cooling water, the storage and distribution network, and the domestic areas and industries where the energy is used.

Main Challenges

The challenge is to optimize the eco-efficiency of this meso-level system. This is defined by the ratio between the economical value (service/product) and the ecological impact on the system. The value in this case is the total sold energy (Power and Heat) to households and industry, plus the electrical and thermal surplus that is exported via the grid. The impact is determined by the amount of cooling water extracted, the magnitude of thermal energy discharge into the channel and the CO2-emissions. Preliminary results indicate that maximizing thermal energy use more than compensates losses of power generation efficiency.

An additional challenge is to provide insight in the stakeholder interactions, a necessary requirement to realize improvements in the real world. .



Intended results

The improvement of the eco-efficiency is by

1. Matching energy supply and demand
2. (re-)Using and/or avoiding excess thermal energy that otherwise would be discharged
3. Cooperation between stakeholders in innovations.of the energy system

By addressing the main challenge three results are intended to be achieved:

- Improvement of the water quality of the ARC by reducing thermal discharges
- Improved sustainability in the energy sector by better accommodated electrical and thermal demands, leading to reduction of waste of fossil fuel based thermal energy
- Improved robustness of the energy sector, by reduced dependence on cooling water.

Economic Indicator	Unit
Total value added	€

Environmental Indicators	Unit
Climate change	tn CO2,eq
Eutrophication	kgPO43,eq
Acidification	kgSO2,eq
Fossil fuels depletion	TOE
Thermal Pollution	MJ

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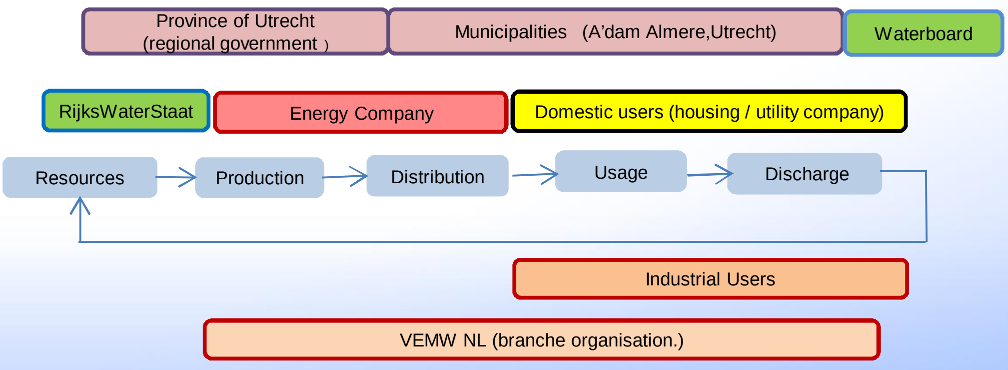
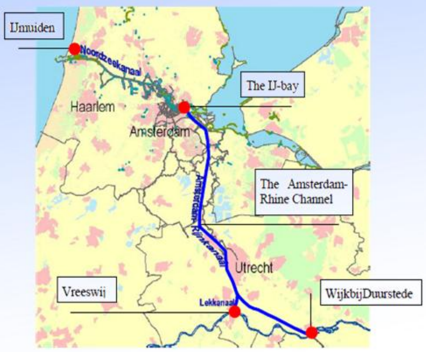
Eco-efficiency Indicators	Unit
Climate change	€/tnCO2,eq
Eutrophication	€/kgPO43-,eq
Acidification	€/gSO2-,eq
Fossil fuels depletion	€/TOE
Thermal Pollution	€/MJ

The Actors Involved



Amsterdam-Rhine Channel



General information ARC

Location: Channel conduits south to north from the Rhine-river near Utrecht to Amsterdam, the Netherlands

Length: 72 km

Average discharge: ca. 100 m^3/s

Output Energy plants

Diemen: 751 MW electrical
440 MW thermal

Innovative Technologies

Water system (Channel)
•Bubble screens for energy efficient cooling of water (pre/post discharge)
Energy plant
•Adaptive ratio electrical/thermal energy production
Storage & Distribution Network
•Aquifer Thermal Energy Storage (ATES)
•*Energy usage*
•Domestic - Combined Heat Power production, in house (DCHP)
•Low Temperature uses

Case Study Contact Person

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Dairy industry, Denmark

Meso-level assessment of eco-efficiency improvements through innovative technologies for dairy industries

The Case Study Area

General information
Location: Holstebro, Jutland, Denmark
Annual water abstracted: 0.5 mil.m3
Economic Output
Caseinate (powder)
Hydrolysed protein (powder)
Milk Minerals (powder)
Intermediary products for other Arla dairies
Innovative Technologies
Reduce water consumption for sealing water Reuse internal process (RO)water to cooling towers Reduce energy consumption for vacuum pumps, spray drying, transportation Avoid discharge of ion exchanger regeneration concentrate to WWTP Increase dry solids in concentrate for biogas production Energy efficient water extraction from milk using biomimic membranes
Case Study Contact Person
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The Case Study context

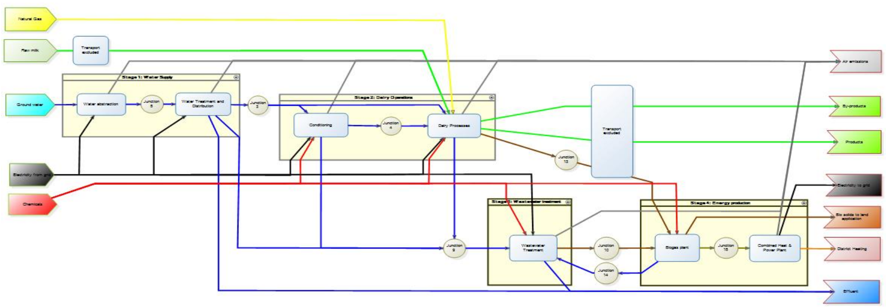
The dairy case focus on of Arla Food´s dairies in Denmark. Arla is a cooperative owned by farmers. The case dairies is located in Jutland in Holstebro. The dairy in Holstebro (HOCO) is one of the Arla milk powder plants receiving milk from farmers and produces caseinates, hydrolisates and milk minerals

Main Challenges

Arla is striving to improve its productivity, food quality and at the same time reduce its environmental impacts. The environmental strategy´s aim is to reduce the use of water and energy by three percent each year, reduce waste production and increase use of non-fossil fuels. A long term goal is to move towards closed production systems in which the water in the milk is used as the water source.

The Water System

HOCO is supplied with municipal water and discharges waste water to a munciipal treatment plant. The plants is supplied with groundwater.



The Actors Involved

The main directly involved actors of the system are :

Arla dairies in Holstebro

Water utility (Vestforsyning)

Waste water treatment plan (Vestforsyning)

Biogas plant

Local authorities and national authorities

Eco-efficiency Indicators

Eco-efficiency Indicators	Unit
Freshwater depletion	895 $€/m^3$
Global Warming	1469 €/ t CO2 eq
Eutrophication	10 mio. €/ t PO4 eq

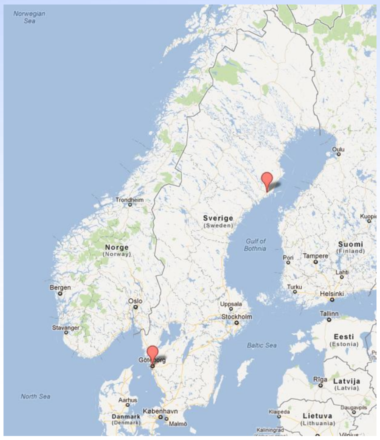
Driver and Barriers for Technology Uptake

Main drives and barriers that influence the large scale implementation of innovative technologies are production cost reduction goals, the companies environmental strategy which aims at both reducing the use of water and climate gas emissions and the environmental regulation.

Volvo Trucks, Sweden

Meso-level assessment of eco-efficiency improvements through innovative technologies for the automotive industry

The Case Study Area



General information
Locations: Umeå, Northeast Sweden
Gothenburg, Southwest Sweden
Annual water used: 370,000 m^3
For processing: 25,000 m^3
For cooling: 345,000 m^3

Economic Output
Trucks: 30,000 units

Innovative Technologies

Water purification
•Membrane distillation
•Electro-deionisation

Water use
•Silane based corrosion protection
•Separation technologies and configurations for internal water recycling

Case Study Contact Person

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The Case Study context

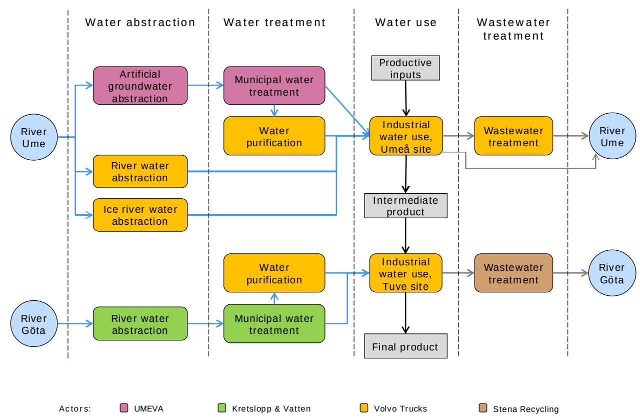
Volvo Trucks belongs to the Volvo Group, one of the world's leading manufacturers of trucks, buses, construction equipment, drive systems for marine and industrial applications. The Case Study is implemented for two Volvo Trucks manufacturing sites in Sweden and their respective water supply/value chain. The Umeå site produces truck cabins and the Gothenburg site produces frame beams, both of which are used in the assembling of the final truck in Gothenburg. The main water use, apart from cooling water, is in the metal surface treatment process and in painting lines using liquid coatings.

Main Challenges

Even though this Case Study does not have a problem with water scarcity, Volvo Trucks still aims at reducing the amount of water used in processing. Reduced water use can result in a reduction of both the energy use and the amount of hazardous wastewater that needs special treatment. Furthermore, there is a challenge in finding alternative technologies for metal surface treatment without use of heavy metals (in chemicals), which end up in the sludge and wastewater.

The Water System

The water system is composed of two geographically distinct water supply chains. In each of the supply chains water is abstracted, used at the industrial site, treated and discharged to the recipient. The two parts of the system are connected by the link of intermediate products, truck cabins, from Umeå to Gothenburg.



The Actors Involved

The main directly involved actors of the system are:

- Volvo Trucks
- Municipal water suppliers in Umeå and Gothenburg
- Stena Recycling

Baseline Assessment of Eco-efficiency Indicators

Eco-efficiency Indicator	Baseline value	Unit
Aquatic Ecotoxicity	530	€/CTUe
Climate Change	590 000	€/tCO_2-eq
Freshwater Ecosystem Impact	180 000	€/m^3
Aquatic Eutrophication	980 000	€/kgPO_4-eq
Human Toxicity	180 000	€/kg 1,4-DB eq
Minerals Resource Depletion	290 000 000	€/kgSb-eq

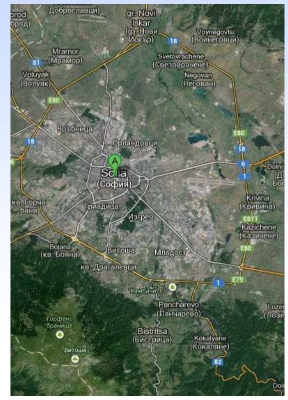
Drivers and Barriers for Technology Uptake

The main drivers for new surface treatment technology are water and energy reduction in processing as well as use of less harmful substances (heavy metals are replaced by other substances). The main barrier of the same technology is that the quality of corrosion protection remains to be proven in field tests over long time.

Sofia, Bulgaria

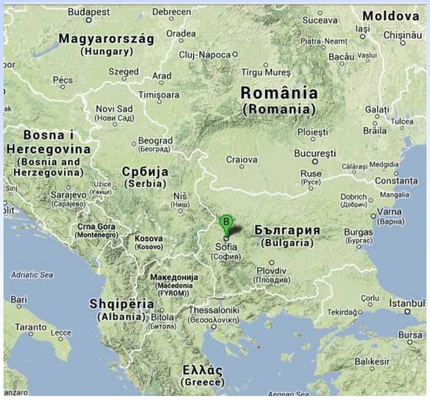
Meso-level assessment of eco-efficiency improvements through innovative technologies for urban water management

The Case Study context



The case study deals with the urban water system of Sofia - the capital and largest city of Bulgaria. During last years the population of Sofia has increased as a result of more favorable employment conditions and higher services in comparison with the rest of the country. However, the industrial activities have decreased, due to national political changes as well as the world economic crises. In year 2011, which is used for baseline assessment, the water consumption for domestic needs was above 80% of the total consumed water. Because of this, but also considering the impossibility to model the heterogeneous industrial activities, domestic water use is the main focus of the case study together with water supply and sewerage systems.

The Case Study Area



General information
Location: Sofia, Bulgaria
Population: 1 291 591 inhabitants (census 2011)
Area: 492 km^2
Annual abstracted water: 206.2 Mm^3
Economic Output
Water and wastewater services for Domestic and Non-domestic customers
Possible Innovative Technologies

Water supply and discharge chain technologies
- Pressure reduction valve (PRV) - hydropower generator
- Solar sludge drying

Water use technologies
- Water saving and low-energy appliances
- Solar water heating
- Drain water heat recovery

Case Study Contact Person

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Main Challenges

ISO14045 standard for assessment of the eco-efficiency (2012) is considered as a basic methodological framework. In compliance with its principles, a scientific approach is applied in order to adapt the general standard framework to the specific case of urban water system. In this process several challenges were faced: determination of the product, system boundaries and product system value; application of LCA for fresh water impact, assessment of CO_2 emissions, generated from the use of hot water, etc.

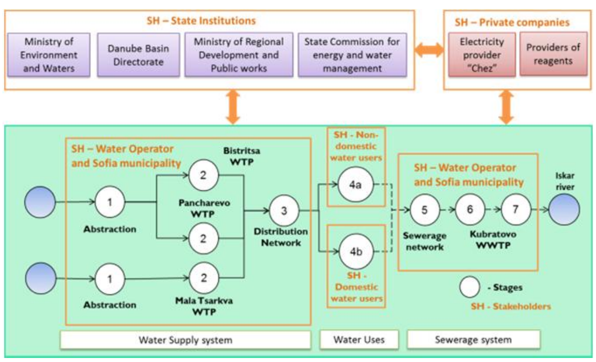
The Urban Water and Wastewater Systems

Water supply system:
- Water abstraction - from two surface sources: "Iskar" and "Beli Iskar" reservoirs;
- Water purification – 3 water treatment plants;
- Water distribution – gravity distribution network with overall length of 4106 km

Sewerage system:
- Combined type gravity sewerage network with total length of 1485 km;
- Waste water treatment - WWTP "Kubratovo";
- Water Discharge to Iskar river

The Actors Involved

- "Sofiyska voda" (Water and Sewage Utility);
- Domestic water users;
- Non-domestic water users.
- State institutions;
- Suppliers of reagents;
- Energy providers



Baseline assessment of eco-efficiency Indicators

Eco-efficiency indicator	Baseline value	Unit
Global warming potential	89.00	€/tCO2,eq
Resource depletion (fossil fuels)	14.14	€/MJ
Aquatic eutrophication potential	86.96	€/tPO43-,eq
Freshwater ecosystem impact	1.71	€/m3

Drivers and Barriers for Technology Uptake

The study focuses on implementation of new technologies in the stage "Domestic water use", considering its highest negative environmental impact in the baseline scenario. Main driver for water and energy reduction for citizens is economic, namely reduction of their water and energy bills. The main barriers are cultural and economic, associated with the investment costs of the technologies. In regard to the other two technologies, which will be implemented in water supply and discharge chain, the main drivers are legislative, while the main barriers are economic.

Waedenswil, Switzerland

Meso-level assessment of eco-efficiency improvements through innovative technologies for urban water services

The Case Study Area

General information
Location: Waedenswil, Switzerland
Population: 20`000 inhabitants
Area: 17 km^2
Annual water used: 2.5 Mm^3
Economic Output
Water and wastewater services from domestic and non-domestic water users in the case study area
Innovative Technologies

Water supply system
- Pressure reducing valves
- Smart pumping

Water use
- Water reuse for domestic water users
- Water reuse for non-domestic water users
- Water saving appliances for domestic water users
- Water saving appliances for non-domestic water users

Wastewater treatment system
- Micropollutants removal technologies
- Advances phosphorus recovery technologies

Case Study Contact Person

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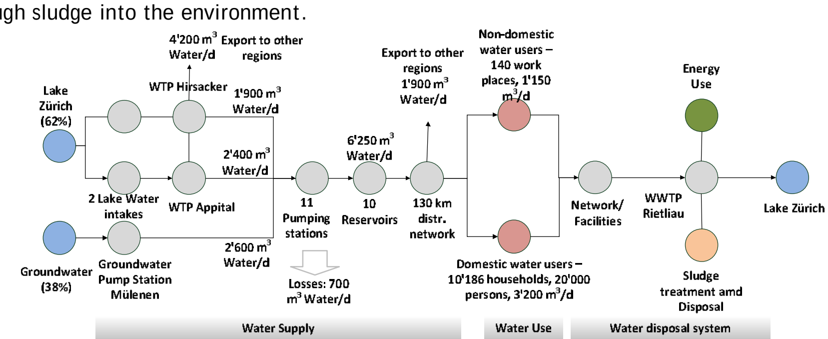
The Case Study context

The municipality of Waedenswil is located in Canton Zurich, which is the Canton with the highest population of 1.4 million inhabitants in Switzerland. It is an economically important part of the country. Water supply sources in this Canton are mainly groundwater and lakes, partly also spring water. The Lake Zurich plays an important role as provider of raw water, especially for the communities which lie by the lakeside. In Waedenswil 62% of drinking water comes from the lake. The applied waste water treatment in this area is technologically on an advanced standard.

Main Challenges

The water service system in Waedenswil is in overall good condition. The drinking water distribution network is renewed by 1.6% yearly. The drinking water treatment plant Hirsacker has been rebuild in 2012 and equipped with modern membrane filtration technology. Main challenges in Waedenswil are the relatively high energy consumption related to drinking water and wastewater treatment as well as the release of micropollutants and phosphorus through sludge into the environment.



The Water System (figure above)

- Water is abstracted from the lake (60%) and groundwater 40%
- Lake water is treated in two plants, Hirsacker and Appital
- Water distributed through a 130 km main distribution network
- Wastewater is treated in the WWTP Rietliau, where heat is recovered from wastewater and biogas is generated from sludge and used in a combined heat and power plant

The Actors Involved

The main directly involved actors of the system are :
- Office of Waste, Water, Energy and Air of Canton Zurich
- Association of municipalities for water treatment Hirsacker-Appital
- Municipality Waedenswil (networks owner and owner of WWTP Rietliau)
- Domestic water users
- Non-domestic water users
- Private companies planning, maintenance, installation of WTPs and WWTPs

Eco-efficiency Indicators

Economic Indicator	Unit
Total Value Added	€/y

Environmental Indicators	Unit
Freshwater Abstraction	m^3/y
Aquatic Eutrophication	$tPO_4^{3-}{}_{,eq}$/y
Aquatic Ecotoxicity	CTUe/y
Micropollutants released	kg/y
Climate change	$tCO_{2,eq}$/y
Fossil Fuels Depletion	GJ/y

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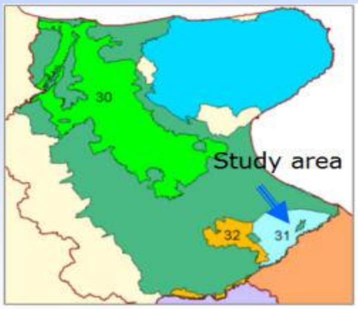
Eco-efficiency Indicators	Unit
Freshwater Abstraction	€/m^3
Aquatic Eutrophication	€/$tPO_4^{3-}{}_{,eq}$
Aquatic Ecotoxicity	€/CTUe
Micropollutants released	€/kg
Climate change	€/$tCO_{2,eq}$
Fossil Fuels Depletion	€/GJ

Sinistra Ofanto, Italy

Meso-level assessment of eco-efficiency improvements through innovative technologies for irrigation water management

The Case Study Area



General information
Location: Apulia, Southern Italy
Area: 38,815 hectares
Annual water used: 45.5 Mm^3

Economic Output
Grapes: 12,634 ha
Olive: 7,702 ha
Orchards: 1,978 ha
Wheat: 4,763 ha
Other vegetables: 3,205 ha

Innovative Technologies

Abstraction

•Solar powered pumps

•Remote control of water withdrawal from the aquifer

•Use of treated waste water

Distribution

•Network sectoring & dynamic pressure regulation

•Variable speed pumps

Water use

•Real-time measurement of SPAC

•Weather forecasting

•Accurate irrigation scheduling

•Micro-irrigation methods (drip/subsurface)

•Remote control multi-user water delivery device

•Change of cropping pattern

Case Study Contact Person

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The Case Study context

The Sinistra Ofanto constitutes an important agricultural district and irrigation system, located within Ofanto River Basin, in the Apulia region. The area, where the Case Study is implemented, covers a surface of about 39,000 ha; it is bound in the south by the Ofanto river and in the south-east by the town of Cerignola. The local irrigation system was constructed during the 1980s for on-demand delivery schedule, and has been designed to satisfy water requirements of a cropping pattern based on olive trees and field crops.

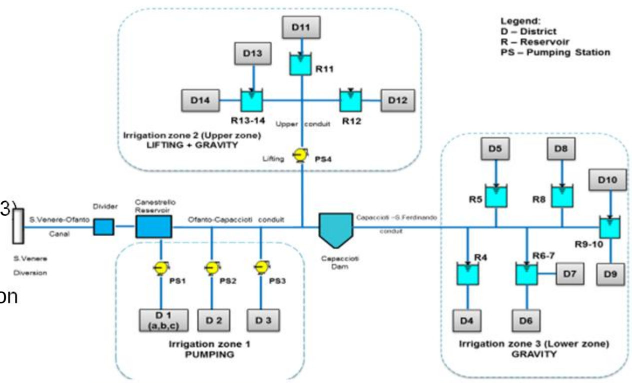
Main Challenges

The uncontrolled withdrawal of groundwater (about 2000 local wells exist, managed directly by farmers) periodically causes excessive drops of the groundwater table with risk of saltwater intrusion in the aquifers and, subsequently, the use of salty water for irrigation with degradation of soil quality. Overall, the excessive exploitation of water resources causes reduction of water quantity and degradation of surface and groundwater quality, compromising the conditions of ecosystems.

The Water System

Water is supplied to the farmers through three different water supply chains:

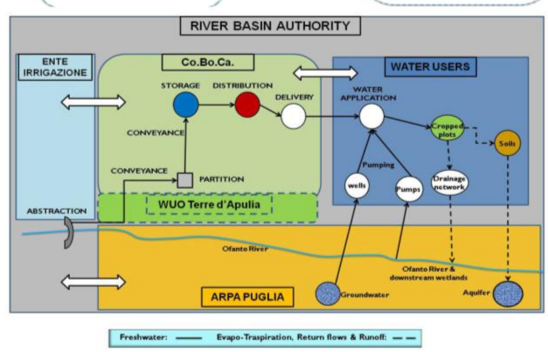
- Gravity-fed conveyance and distribution by pumping (Districts 1-3)
- Gravity-fed water conveyance and distribution (Districts 4-10)
- Conveyance by lifting and distribution by gravity (Districts 11-14)



The Actors Involved

The main directly involved actors of the system are :

- Consortium per la Bonifica dela Capitanata (Water Utility Organization)
- Farmers' Association
- Regional River Basin Authority



Eco-efficiency Indicators

Economic Indicator	Unit
Total value added	€

Environmental Indicators	Unit
Surface water use	m^3
Ground water use	m^3
Energy use	kWh
Fertilizers (N, P) use	kg
CO_2 emissions	t CO_2

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Eco-efficiency Indicators	Unit
Surface water use	€/m^3
Ground water use	€/m^3
Energy use	€/kWh
Fertilizers (N, P) use	€/kg
CO_2 emissions	€/t CO_2

Driver and Barriers for Technology Uptake

Main drives and barriers that influence the large scale implementation of innovative technologies refer to the regional/national policy targets and priorities, availability of funds/incentives, implementation costs …

Monte Novo, Portugal

Meso-level assessment of eco-efficiency improvements through innovative technologies for irrigation water management and agricultural

The Case Study Area

General information
Location: Alentejo, Southern Portugal
Area: 7,800 hectares
Annual water used: 25 Mm^3

Economic Output
Olives: 1,681 ha
Maize: 877 ha
Pastures: 617 ha
Horticultures: 368 ha
Vineyards: 259 ha

Innovative Technologies

Abstraction

•Variable speed pumps

Distribution

•Variable speed pumps

•Water tariffs change

•Pressure head delivery change

Water use

•Alternative irrigation technologies (e.g. subsurface drip irrigation) & techniques (e.g. Regulated Deficit Irrigation - RDI);

•Change of cropping patterns

•Alternative production techniques (e.g. biological production, intensive and superintensive olives production).

Case Study Contact Person

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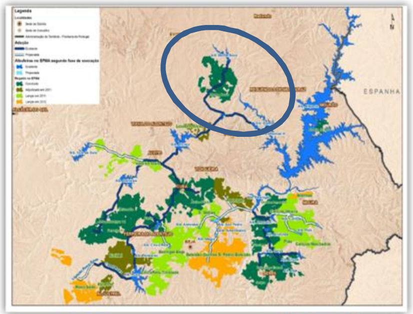
The Case Study context

The Monte Novo constitutes an important irrigated agricultural district, located within Guadiana's River Basin, in the Alentejo region. The Case Study area covers a surface of about 7,800 ha. It is a new agricultural district (started in 2010), built as part of the Alqueva's infrastucture project. The main water source (Alqueva reservoir) has a useful storage capacity of 3.150 Mm3, to serve a global irrigated area of 110.000ha and also public and industrial water supply for certain areas. The water supply chain is constituted by a primary network (for different irrigation areas) and by a secondary network (inside Monte Novo area) that delivers water to farmers.

Main Challenges

There is a transition from traditional rain fed to irrigation crops production in the area, fostered by the construction of Alqueva's system, that considerably increased water storage capacity in the area. Nonetheless, water intensive crops are now being produced (e.g. maize, superintensive olive production) that can lead to a fast degradation of soils and water resources, compromising the conditions of ecosystems.

The Water System



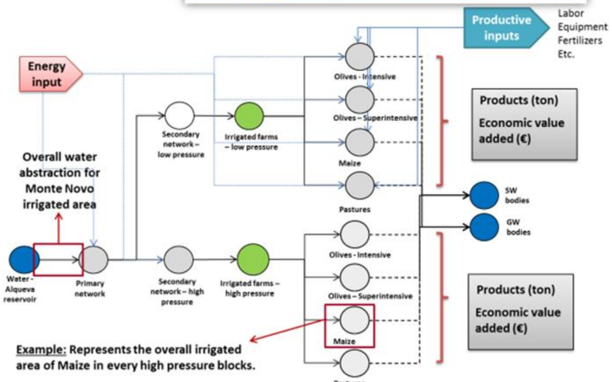
Water is supplied to farmers through two different types of water supply chains:

- Low pressure head, by gravity (Blocks 1.1, 3 and 4.A – total of 4,850 ha)
- High pressure head, by pumping (Blocks 1.2, 2 , 4.1, 4.2 – total of 2,950 ha)

The Actors Involved

The main directly involved actors of the system are :

- Alqueva's Development and Infrastructures Company (EDIA)
- Association of Monte Novo Irrigation Scheme Users" (ABMonte Novo)
- Farmers



Eco-efficiency Indicators

Economic Indicator	Unit
Total value added	€

Environmental Indicators	Unit
Water use	m^3
Energy use	kWh
Fertilizers (N, P) use	Kg
CO2 emissions	tCO_2

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Eco-efficiency Indicators	Unit
Water use	€/m^3
Energy use	€/kWh
Fertilizers (N, P) use	€/Kg
CO2 emissions	€/tCO_2

Drivers and Barriers for Technology Uptake

EU and National policies encouraging efficiency of water, energy use and also reduction of CO_2 emissions; economic constrains due to EU and national crisis; increase of water and energy prices; farmers difficulty to deal with innovation (ageing and poor education); availability of innovative technologies; accomplishment of strict EU and national legislation; problems of water quality and soil quality and erosion.

Meso-level Eco-efficiency Indicators to Assess Technologies & Their Uptake In Water Use Sectors

Objectives

EcoWater develops **meso-level eco-efficiency indicators** for assessing the systemic eco-efficiency improvements from **innovative technologies** in water use

A meso-level water use system

EcoWater maps the interrelationships and dynamics of the different actors in the meso-level system

The analysis includes the water value chain with all the processes needed to render the water suitable (both qualitatively and quantitatively) for this use, and the treatment and discharge of the generated effluents to the environment

The ultimate goal is to understand how **innovative technological changes** in water systems interrelate and influence the economic and environmental profile and the **overall eco-efficiency of water use** in different sectors

The economic analysis of the meso-level water use system also entails the consideration of the interdependencies and the **socio-economic interactions of all the heterogeneous actors** involved in the water supply and production chain

EcoWater addresses eight distinct Case Studies of water use systems:

- **Energy production systems**
- **Automotive industry**
- **Textile industry**
- **Dairy industry**
- **Agricultural production**
- **Urban water supply systems**

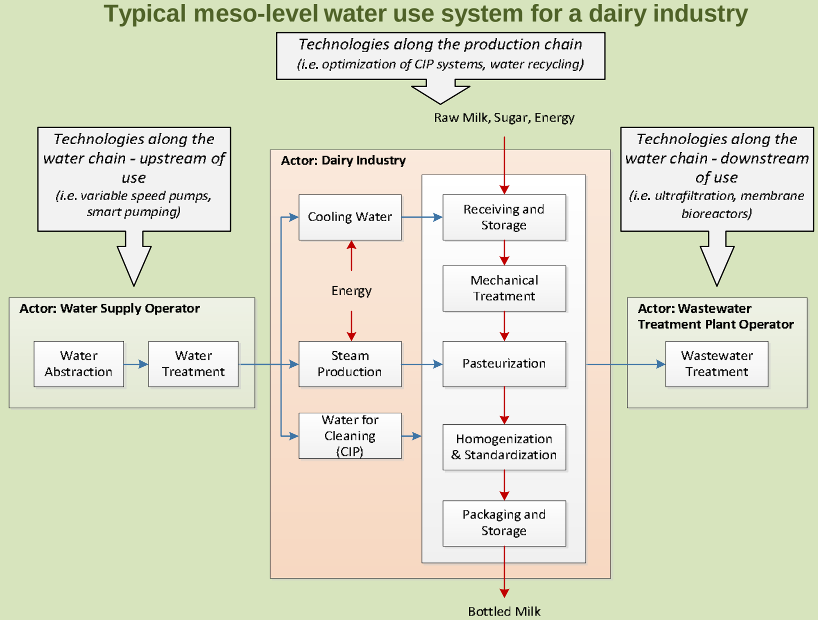
Upgrading the meso-level water use system

The system value chain is the full range of activities required to bring a product or service from its inception to the time it is delivered to final consumers, and disposed of after use; innovative mechanisms that can upgrade the system value chain include:

- **Process upgrading** - Introducing new technologies/processes to increase efficiency
- **Product upgrading** - Introducing higher-value products
- **Functional upgrading** - Acquiring new functions/changing the mix of products or activities to add value

In EcoWater, the focus is on **process or product upgrading**, by introducing **innovative technologies** which will reduce the overall environmental impact or improve the quality/quantity of the final product

Typical meso-level water use system for a dairy industry



Technology Classification

Technologies are classified according to the stage at which they are implemented:

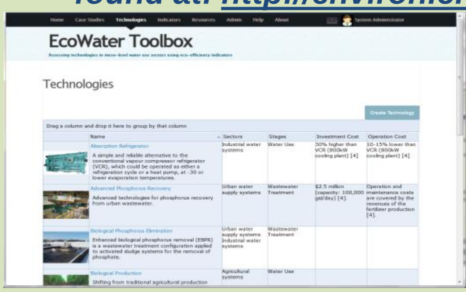
- Technologies in the water chain implemented either upstream or downstream of the water use
- Technologies in the production chain

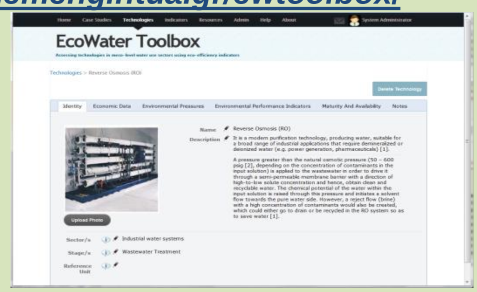
Technology Selection

The criteria for the selection of innovative technologies are:

- Innovation
- Technical Maturity
- Market Availability
- Economic & Environmental Performance

An preliminary inventory of innovative technologies can be found at: http://environ.chemeng.ntua.gr/ewtoolbox/





A Web-based Toolbox for Eco-Efficiency Assessment of Innovative Technologies in Water Systems

The EcoWater Toolbox

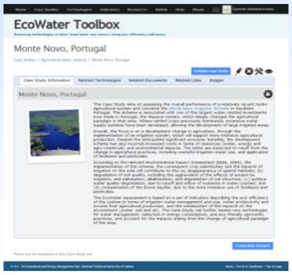
The **EcoWater Toolbox** is an integrated suite of on-line tools and resources for assessing the system-wide eco-efficiency improvements from innovative technologies, applicable to different water systems and sectors of water use.

It has been designed to support the step-by-step implementation of the **EcoWater Methodological Framework.**

Step 1 – Case Study Framing

Supports the:

- Definition of the system boundaries
- Mapping and description of the water supply chain (stages, processes and existing technologies)
- Value chain mapping, including all the actors (directly or indirectly involved) and their interrelations



Case Study Framing

Step 2 – Baseline Eco-Efficiency Assessment

Baseline Assessment

Provides tools for modeling the:

- Water supply chain (SEAT)
- Water value chain (EVAT)

Estimates the:

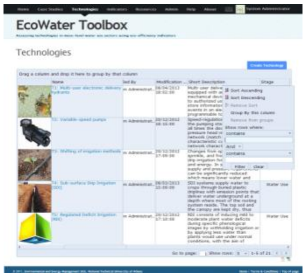
- Environmental impact indicators
- Total value added to the system from water use
- Net economic output of all the involved actors
- Eco-efficiency indicators

Facilitates the interpretation of the baseline eco-efficiency assessment results

Step 3 – Identification of Technologies

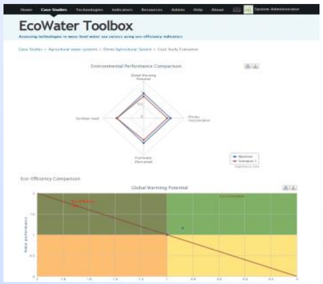
The toolbox integrates a **technology inventory**, with detailed information on the possible technologies/ practices for the eco-efficiency improvement of the water system.

Technologies can be selected from the inventory for implementation either throughout the water supply and wastewater treatment stages (common for all water use sectors) or within the water use processes (sector specific technologies).



Technology Inventory

Step 4 – Technology Scenario Assessment



Technology Scenario Assessment

The toolbox enables the assessment of innovative technologies by:

- Supporting the development of **technology scenarios**
- Providing tools for modeling the impacts on the water system from the technology implementation
- Facilitating the comparison of technology scenarios to the baseline results

The EcoWater Toolbox and the installers for the two modeling tools can be found at: http://environ.chemeng.ntua.gr/ewtoolbox

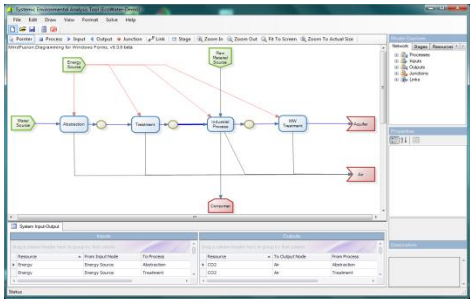
The EcoWater Modeling Tools

The EcoWater tools model the two components of a water system:

- The **water supply chain**, which is the physical representation of the various processes that are involved in producing goods (and services)
- The **water value chain**, consisting of the various actors, directly and indirectly involved in the water supply chain, and their economic interactions

Systemic Environmental Analysis Tool (SEAT)

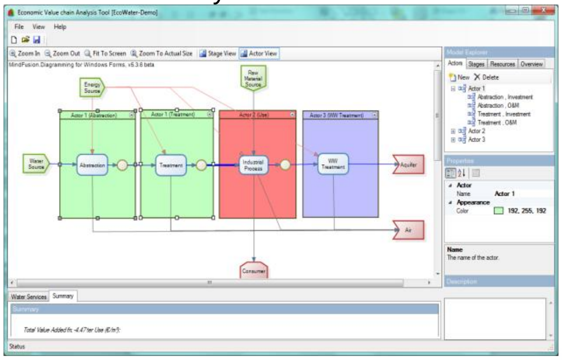
Addresses the supply chain, its components, processes & interactions. It provides the flows of the materials (water, resources, products, etc.) that can be used for estimating the environmental components of the eco-efficiency indicators.



The SEAT interface – Mapping the Water Supply Chain

Economic Value chain Analysis Tool (EVAT)

Addresses the value chain, its actors and their interactions. It provides monetary flows that can be used for estimating the economic component of the eco-efficiency indicators.



The EVAT interface – Mapping the Water Value Chain

System Requirements

Both SEAT and EVAT are Windows Applications developed with the Visual Basic .NET programming language. The software requirements are:

(a) Microsoft® Windows XP Service Pack 2 (32bit or 64bit), Microsoft® Windows Vista (32bit or 64bit) or Microsoft Windows 7 (32bit or 64bit) and

(b) NET framework 4.0.

EcoWater Details

A Collaborative Research Project of the 7th Framework Programme

Theme: ENV.2011.3.1.9-2

Development of eco-efficiency meso-level indicators for technology assessment

Project Duration: 01/11/2011 - 31/10/2014

SEVENTH FRAMEWORK PROGRAMME

EcoWater

EcoWater A Collaborative Research Project of the 7th Framework Programme

Theme: ENV.2011.3.1.9-2
Development of eco-efficiency meso-level indicators for technology assessment

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