Case study leaflets:

Agriculture

- **Sinistra Ofanto, Italy**
- **Monte Novo, Portugal**

Urban water systems

- **Sofia, Bulgaria,**
- **Zurich, Switzerland**

Water use in industrial sectors:

- **Biella textile industry, Italy,**
- **Water use for electricity and thermal energy production in the Amsterdam-Rhine Channel, The Netherlands,**
- **The dairy industry in Denmark,**
- **The automotive industry in Sweden**

Project leaflets:

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

EcoWater *A Collaborative Research Project of the 7th Framework Programme*

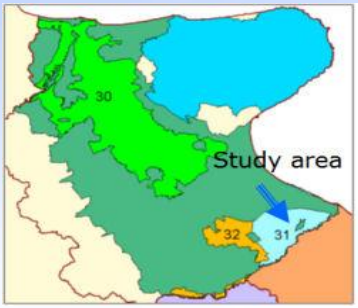
Theme: ENV.2011.3.1.9-2
Development of eco-efficiency meso-level indicators for technology assessment

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

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.

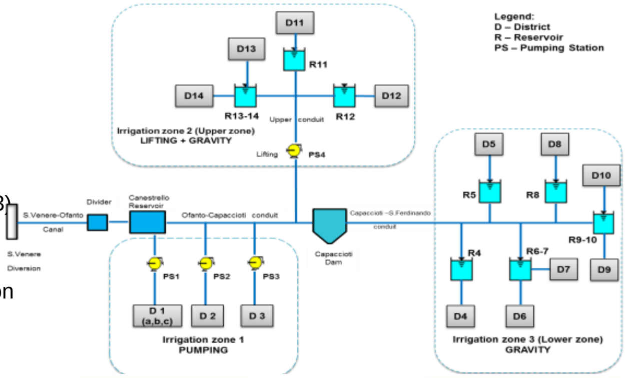
Main Challenges

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:

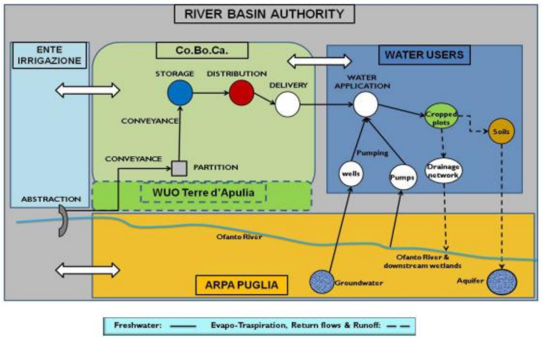
- Gravity-fed conveyance and distribution by pumping (Districts 1-3)
- Gravity-fed water conveyance and distribution (Districts 4-10)
- Conveyance by lifting and distribution by gravity (Districts 11-14)



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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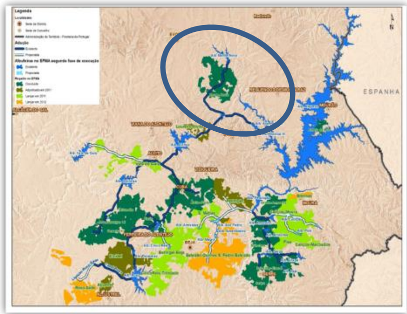
The Case Study context

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

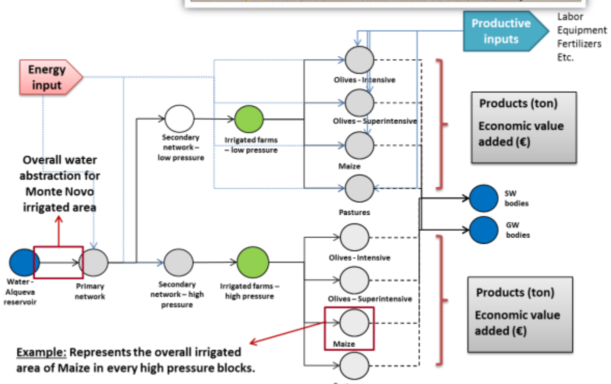
Water is supplied to farmers through two different types of water supply chains:

- 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.

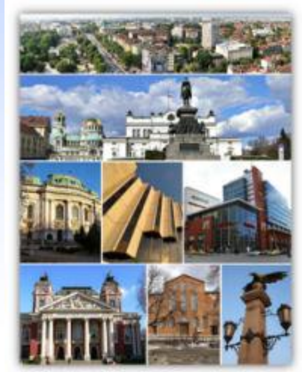
Sofia, Bulgaria

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

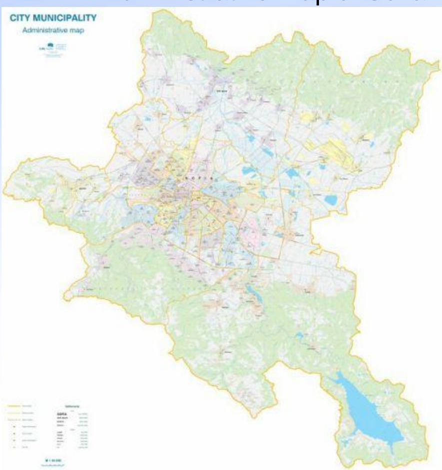
The Case Study context

The case study deals with the urban water system of Sofia - the capital and largest city of Bulgaria. It is located at the foot of Vitosha Mountain in the western part of the country, placed over four terraces of the Iskar River and its tributaries Perlovska and Vladayska rivers. The average altitude is 550 m, with natural denivelation between south part (above 900 m) and north part (around 520 m).

There are more than 100 000 enterprises making it the biggest industrial center of Bulgaria contributing around 50% to the national GDP. During the last years the population of Sofia has increased due to the favorable employment conditions and the high level of the service sector.



The Case Study Area – Administrative map of Sofia



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 system

•Hydropower generator which functions as a pressure reduction valve (PRV)

Water Use

•Water saving appliances

•Water reuse

Sewerage system

•Green roof structure

•Advanced phosphorus recovery

•Sludge drying with renewable energy

•Innovative combined sewer overflows

Case Study Contact Person

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Main Challenges

The water infrastructure of Sofia is more than 100 years old. It has been continuously improving, but there are still many problems to be solved. Among them are the high rate of the water leakages in the distribution network and the old combined sewer overflows, resulting in unwanted environmental pressure. The system has high potential for innovations, which could increase its eco-efficiency performance.

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

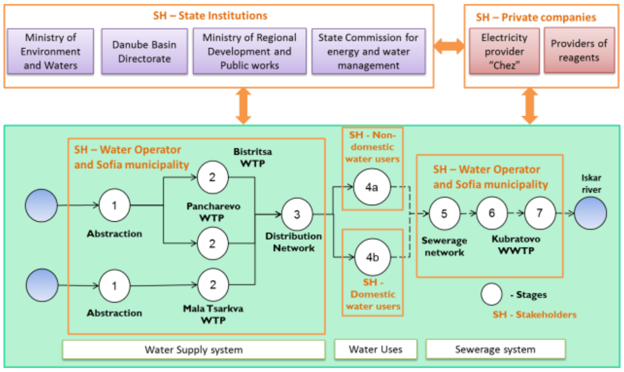
Sewerage system:

- Combined type gravity sewerage network with total length of 1485 km;
- Waste water treatment - WWTP “Kubratovo”;
- Water Discharge to Iskar river

The Actors Involved

The main directly involved actors of the system are :

- “Sofiyska voda” (Water and Sewage Utility);
- Domestic water users;
- Non-domestic water users.
- Indirectly involved actors of the system are:
- State institutions;
- Private companies (suppliers of chemicals, energy, etc.).



Eco-efficiency Indicators

Economic Indicator	Unit
Total value added	€/y

Environmental Indicators	Unit
Depletion of fresh water resources (abstracted water)	m^3/y
Depletion of non renewable energy resources (energy consumption)	kW/y
Depletion of abiotic resources (chemicals used)	tn/y
Waste pollution (non-utilized sludge)	tn/y
Water pollution (pollution loads to water recipient)	tn/y
Climate change (GHGs - CO2 emissions)	$tnCO_2$/y

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Eco-efficiency Indicators	Unit
Depletion of fresh water resources (abstracted water)	€/m^3
Depletion of non renewable energy resources (energy consumption)	€/kW
Depletion of abiotic resources (chemicals used)	€/tn
Waste pollution (non-utilized sludge)	€/tn
Water pollution (pollution loads)	€/tn
Climate change (GHGs - CO2 emissions)	€/tCO_2

Waedenswil, Switzerland

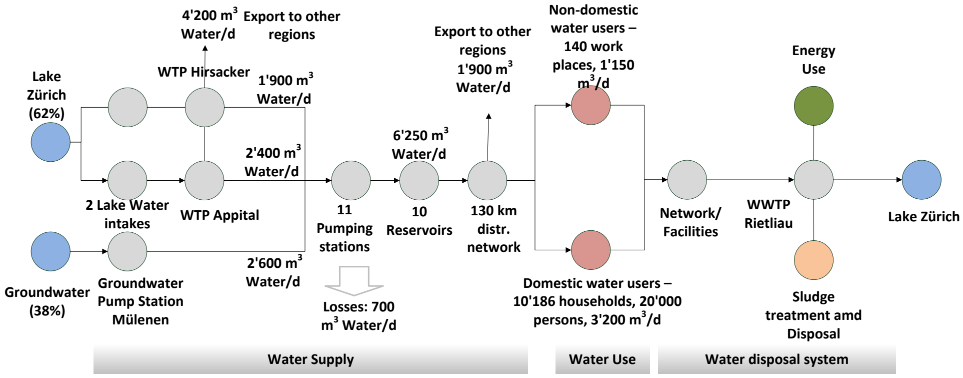
Meso-level assessment of eco-efficiency improvements through innovative technologies for urban water services

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% annually. 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 Case Study Area

General information
Location: Waedenswil, Switzerland
Population: 20`000 inhabitants
Area: 17 km²
Annual water used: 2.5 Mm³
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 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

Eco-efficiency Indicators

Economic Indicator	Unit
Total value added	€/y

Environmental Indicators	Unit
Abstracted water	m³/y
Energy consumption	kWh/y
Chemicals used	t/y
Sludge produced	t/y
Phosphorus released	t/y
Micropollutants released	kg/y
CO_2 emissions	$tCO_{2,\,eq}$/y

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Eco-efficiency Indicators	Unit
Abstracted water	€/m³
Energy consumption	€/kWh
Chemicals used	€/t
Sludge produced	€/t
Phosphorus released	€/t
Micropollutants released	€/kg
CO_2 emissions	€/$tCO_{2,eq}$

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

Biella Textile, Italy

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

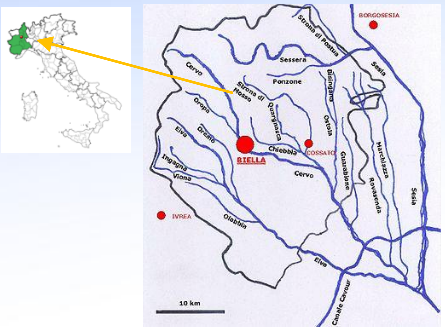
The Case Study context

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 about 1200 textile small/mid-size companies. The sector is strongly related to water resources availability and quality, which are both ideal in this area, particularly the dyeing processes that is the main wet process present in the area.

Main Challenges

The textile district is active since the beginning of the last century and the main resource mostly exploited is: groundwater. The risk of over-exploitation is not the main problem, but the cost of water for industries is becoming relevant. Moreover the environmental impact of massive use of water, in particular for wet processes of wool treatments, 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 on water saving by reusing the industrial waters, and the reduction of chemical agents with the use natural products as the ancient herbs infusion but with modern technologies.

The Case Study Area
Province of Biella
Cervo River Basin



General information
Location: Biella, Northern Italy
Area: 913 Km^2
Population: 185768
Textile units: ~1200
Water abstracted per industrial unit.: 50000 -100000 m^3/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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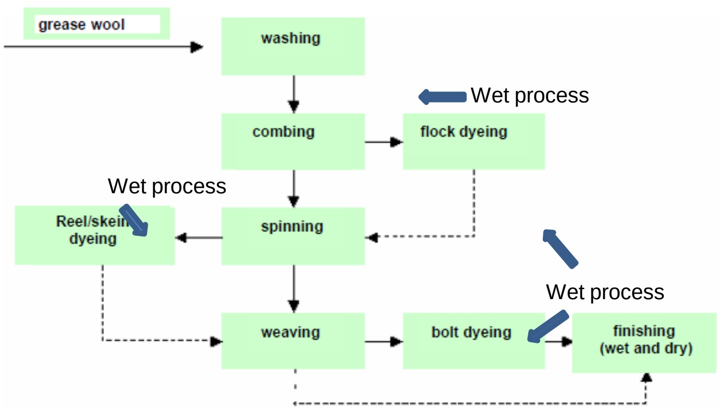
The wool cycle

The full cycle of wool processing is divided into the stages of washing, carding and combing, spinning and weaving and finishing operations. Dyeing is feasible at different stages.



The Actors Involve

- 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	m^3
Waste water release	m^3
Chemical dye agents	kg
Natural dye herbs	kg
Energy	kWh
Fossil fuels	m^3

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Environmental Indicators	Unit
Surface-ground Water withdrawal	€/m^3
Waste water release	€/m^3
Chemical dye agents	€/kg
Natural dye herbs	€/kg
Energy	€/kWh
Fossil fuels	€/m^3

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

Amsterdam-Rhine Channel

General information ARC
Location: Channel conduits south to north from the Rhine-river near Utrecht to Amsterdam, Netherlands
Length: 72 km
Average discharge: ca. 100 m^3/s
Output Energy plants
Nuon Diemen: 751 MW electrical 440 MW thermal
Nuon Merwede: 424 MW electrical 428 MW thermal
Nuon Lage Weide: 226 MW electrical 180 MW thermal
Innovative Technologies

Water system (Channel)
•Real Time Controlled inlet of water to provide required energy capacity
•Bubble screens for energy efficient cooling of water (pre/post discharge)
•Bio-friendly inlet design to prevent unnecessary loss of biodiversity
Energy plant
•Optimizing ratio electrical/thermal energy production
•Pre-discharge mixture of cooling water with ARC-water
Storage & Distribution Network
•Connection of adjacent districts
•Extension of the coverage
•***Energy usage***
•Adding low heat requiring uses

Case Study Contact Person

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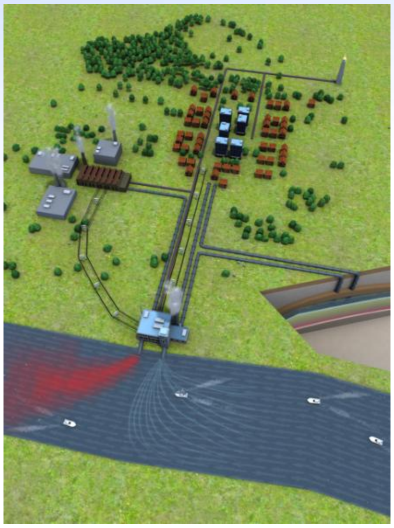
The Case Study context



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 used by a local energy plant for electricity and thermal energy production. It also consists of the local energy plant itself and the storage and distribution network and finally the houses 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 are the number of powered households (electrical & thermal), the industrial output and 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 discharge into the channel and the CO2-emission.

The way to optimize the eco-efficiency is by 1. matching energy supply and demand and by 2. re-using or avoiding excess thermal energy that otherwise would be discharged and by 3. reduction of electricity usage for heating purposes (high potential source for low level usage).

Intended results

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 fossil fuel based heating;
- Improved robustness of the energy sector, by reduced dependence on cooling water.

Economic Indicator	Unit
Total value added	€

Environmental Indicators	Unit
Water intake	m^3
ARC-channel flow	m^3
Thermal discharge	kW
Electrical & thermal energy use	kWh
Gas usage	m^3

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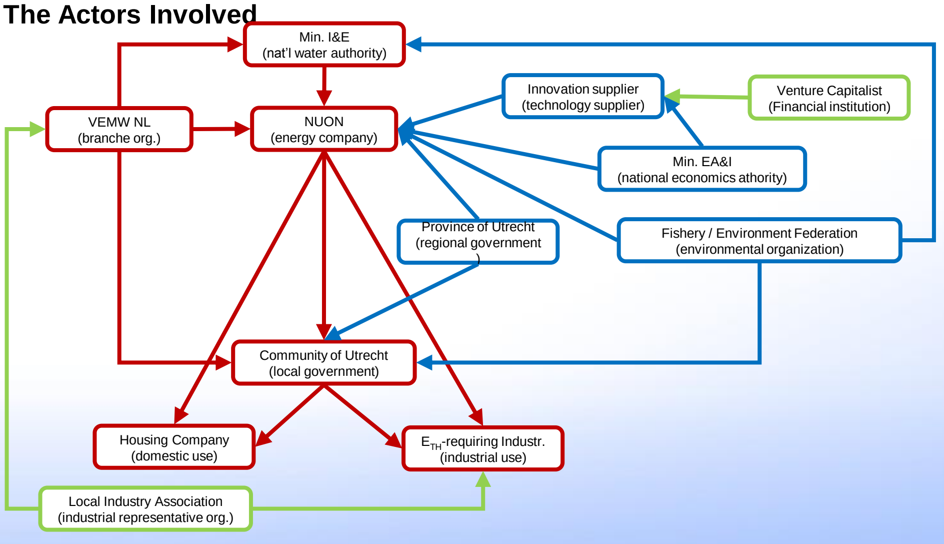
Eco-efficiency Indicators

Eco-efficiency Indicators	Unit
Biodiversity	#
Temperature gradient water	°C/m
Energy use	€/kWh
CO2 emissions	€/tCO_2

The Actors Involved



Dairy industry, Denmark

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

The Case Study Area

General information
Location: Rødkærsbro and Holstebro, Jutland, Denmark
Annual water use Holstebro
Annual water abstracted: 0.9 mil.m3
Economic Output
Mozarella and shredded Cheese
Caseinate
Milk powder
Milk minerals
Intermediary products
Innovative Technologies

Reduce water consumption for sealing water
Reuse internal process (RO)water to cooling towers
Reduce energy consumption for vacuum pumps
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

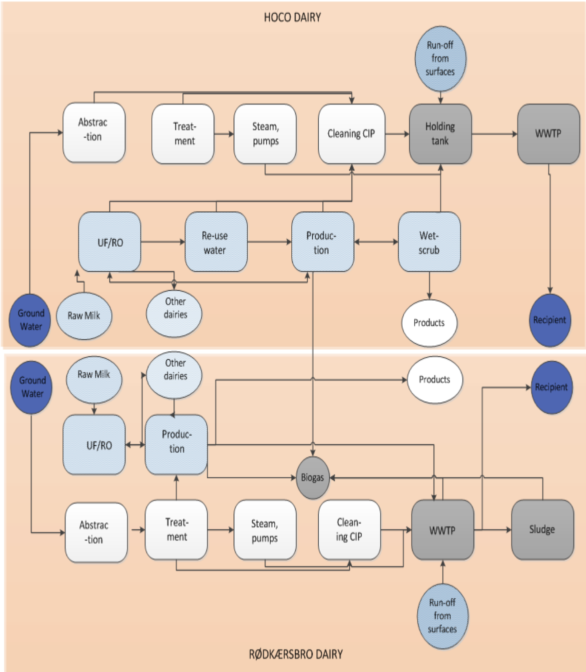
The dairy case focusses on two of Arla Food´s dairies in Denmark. Arla is a cooperative owned by farmers. The two case dairies are located in Jutland: in Rødkærsbro and Holstebro. At Rødkærsbro dairy the production is specialised to Mozarella and shredded cheese. The dairy in Holstebro (HOCO) is one 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 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

The Rødkærsbro site has its own water supply system and waste water treatment plant while HOCO is supplied with municipal water and discharges waste water to a munipal treatment plant. Both plants are supplied with groundwater.



The Actors Involved

The main directly involved actors of the system are :
Arla dairies in Holstebro and Rødkærsbro
Water utility (Vestforsyning)
Waste water treatment plan (Vestforsyning)
Indirect actors local environmental authorities and national authorities

Eco-efficiency Indicators

Economic Indicator	Unit
Total value added	€

Environmental Indicators	Unit
Ground water use	m^3
Energy use	kWh
Emission of chloride	Kg
CO2 emissions	tCO_2

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Eco-efficiency Indicators	Unit
Ground water use	€/m^3
Energy use	€/kWh
Emission of chloride	€/Kg
CO2 emissions	€/tCO_2

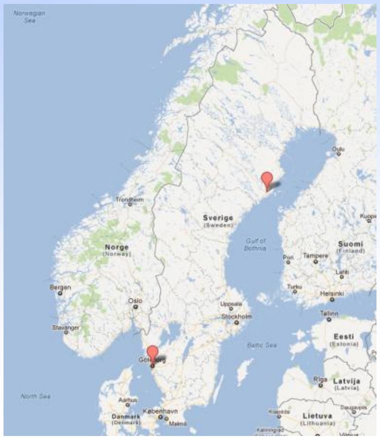
Driver and Barriers for Technology Uptake

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
- •Ultra filtration
- •Micro filtration
- •Reverse osmosis
- •Ion exchange

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

Wastewater treatment
- •Oil and water separation
- •Chemical precipitation

Case Study Contact Person

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The Case Study context

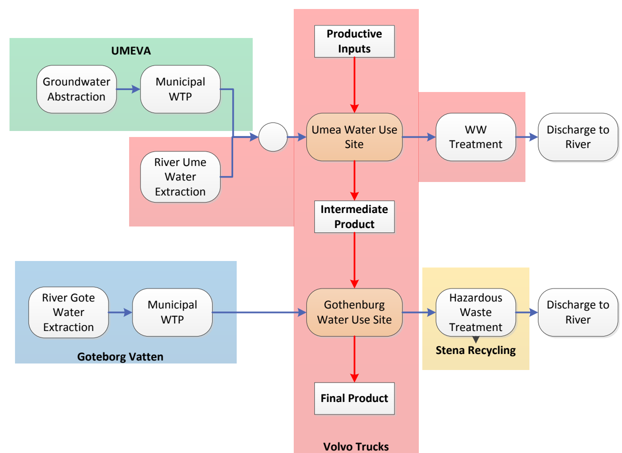
Volvo Trucks belongs to the Volvo Group, one of the world's leading manufacturers of trucks, buses, construction equipment, drive systems for marine and industrial applications. The Case Study is implemented for the two Volvo Trucks manufacturing sites in Sweden and their respective water supply/value 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

Eco-efficiency Indicators

Economic Indicator	Unit
Total value added	€

Environmental Indicators	Unit
Fresh water abstraction	m^3
Energy use	kWh
Chemical use (Zn, Ni, Zr, P)	kg
Sludge production	kg
Heavy metals to water	kg

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Eco-efficiency Indicators	Unit
Fresh water abstraction	€/m^3
Energy use	€/kWh
Chemical use (Zn, Ni, Zr, P)	€/kg
Sludge production	€/kg
Heavy metals to water	€/kg

Drivers and Barriers for Technology Uptake

The main drives 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 it has not been able to provide the same quality of corrosion protection as traditional technology.

EcoWater

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

1. The Challenges

- Addressing the existing gap in eco-efficiency metrics by adopting a systems' approach to develop **meso-level eco-efficiency indicators**
- Interpreting & applying the meso-scale & value chain concept to **water systems**
  - Adapting and refining the generic concept to very diverse Case Studies
- Studying meso-scale dynamics
  - Mapping economic relations across the value chain
  - Developing coherent scenarios on technology uptake

2. The Objectives

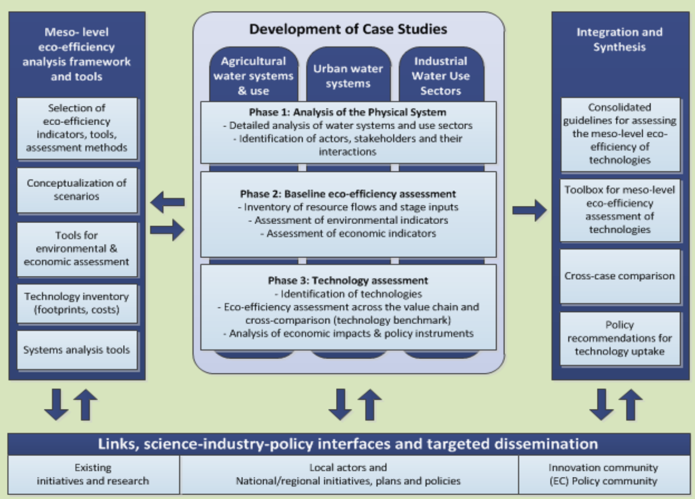
- Selection of meso-level eco-efficiency indicators, suitable for assessing the systemic eco-efficiency improvements or deteriorations from innovative technologies
- Integration of methods & tools into a coherent modeling environment, for the system-wide environmental and economic benchmark of innovations
- Elaboration of **Case Studies** in different water use systems to assess innovative technologies in terms of their holistic contribution to eco-efficiency improvements
- **Analysis and characterization** of existing structures and policies that could foster technology uptake

3. Methodological Framework

The EcoWater methodology is based on three research components:

- The **elaboration of an analytical framework** for quantitative meso-level eco-efficiency assessment
- The **development of the Project's Case Studies** (CS), each with its own thematic and regional focus (two agricultural water systems, two urban water systems and four industrial sectors)
- The **integration and synthesis of the project's results**, producing step-wise methodological guidelines

The development each CS is divided into the following **three phases**:



The EcoWater Methodological Framework

- **Phase 1**: Analysis of the physical system
- **Phase 2**: Eco-efficiency assessment for the baseline scenario
- **Phase 3**: Identification and assessment of the new technologies/ innovations

4. Expected Results

- A coherent, validated and tested, **methodological framework** for assessing technology impacts on the eco-efficiency of water systems, including relevant eco-efficiency indicators, assessment methods and tools
- A **web-based toolbox** which could be used by actors for the eco-efficiency analysis of their system
- Improved understanding of the **socio-technical dynamics** that influence **technology uptake** and implementation, and insight on policies to **foster eco-efficiency improvements**, focusing on different sectors of water use

More information on the EcoWater Project can be found at:
http://environ.chemeng.ntua.gr/ecowater

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

The EcoWater Consortium

1. National Technical University of Athens, GR
2. Centro Internazionale Di Alti Studi Agronomici Mediterranei – Istituto Agronomico Mediterraneo di Bari, IT
3. Stichting Deltares, NL
4. University of Applied Sciences, Northwestern Switzerland, CH
5. Universidade Do Porto, PT
6. University of Architecture, Civil Engineering & Geodesy, BG
7. The Open University, UK
8. DHI, DK
9. IVL Swedish Environmental Research Institute, SE
10. MITA SAS, IT

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

The EcoWater Toolbox

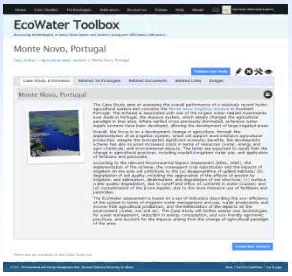
The **EcoWater Toolbox** is an integrated suite of on-line tools and resources for assessing the system-wide eco-efficiency improvements from innovative technologies, applicable to different water systems and sectors of water use.

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

Step 1 – Case Study Framing

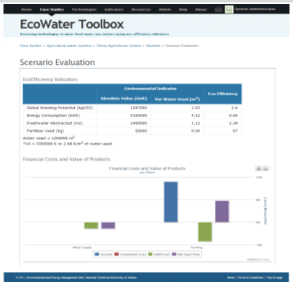
Supports the:

- 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:

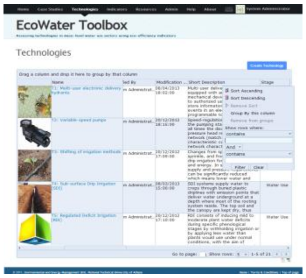
- Environmental impact indicators
- Total value added to the system from water use
- Net economic output of all the involved actors
- Eco-efficiency indicators

Facilitates the interpretation of the baseline eco-efficiency assessment results

Step 3 – Identification of Technologies

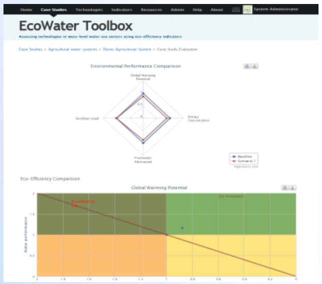
The toolbox integrates a **technology inventory**, with detailed information on the possible technologies/ practices for the eco-efficiency improvement of the water system.

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

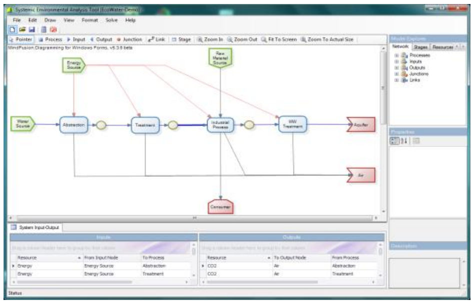
The EcoWater Modeling Tools

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)

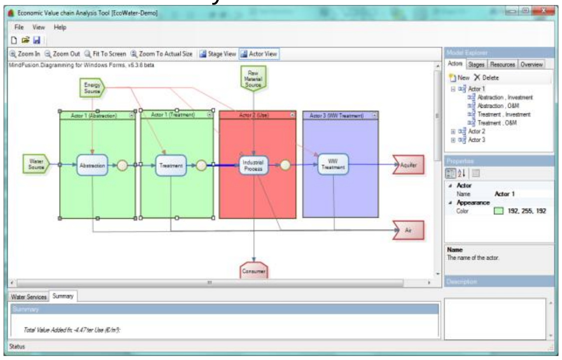
Addresses the supply chain, its components, processes & interactions. It provides the flows of the materials (water, resources, products, etc.) that can be used for estimating the environmental components of the eco-efficiency indicators.



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.

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