EcoWater

Meso-level eco-efficiency indicators to assess technologies and their uptake in water use sectors

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The EcoWater Tools and Toolbox

The final versions of the EcoWater tools EVAT and SEAT have been officially released!

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The EcoWater Team in AquaTech

The 2nd Large Scale targeted event of the EcoWater project was organized in Amsterdam in conjunction with the AquaTech Trade Exhibition. The key focus of the event was to demonstrate the benefits of a meso-scale eco-efficiency analysis to technology developers / providers and buyers as well as consultants .

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EcoWater Animation

An animation has been created in order to better communicate the EcoWater project's concept to a larger audience.

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Upcoming Events

Upcoming EcoWater events include the Urban Water System Case Studies Workshops and the 3rd EcoWater Annual Interim Meeting. A second round of Case Study workshops will also be held from April 2014 until the end of the project.

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Dairy Industry Workshop

The 4th EcoWater Case Study Workshop was held in Holstebro, Denmark on the 20th September 2013 , focusing on eco-efficiency indicators and technologies that can be assessed in the ARLA dairy industry case study.

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Textile Industry Workshop

The 5th EcoWater Case Study Workshop was held in Biella, Italy on the 28th October 2013, focusing on the factors that can drive or impede the adoption of eco-innovative practices in the Biella textile industry case study.

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EcoWater Second Annual Meeting

The 2nd Annual Project Meeting of EcoWater was held on November 8th-9th 2013 in Amsterdam, the Netherlands, and was combined with a Project Steering Group Meeting and the 2nd External Advisory Board Meeting

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Energy Industry Workshop

The 6th EcoWater Case Study Workshop was held in Amsterdam, Netherlands on the 7th November 2013., focusing on the identification of the drivers and barriers for the uptake of new and innovative technologies in the Case Study area.

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THE MESO-LEVEL WATER USE SYSTEM

During the 2nd year of the project, the EcoWater approach to the eco-efficiency assessment of meso-level water use systems has been explicitly defined. The system presented under the EcoWater scope is a meso-level water use system that combines the typical water supply chain with the corresponding water use chain. It incorporates a specific water use 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. It is not limited to the production chain of a specific enterprise or firm, but it considers the whole water cycle from abstraction to disposal.

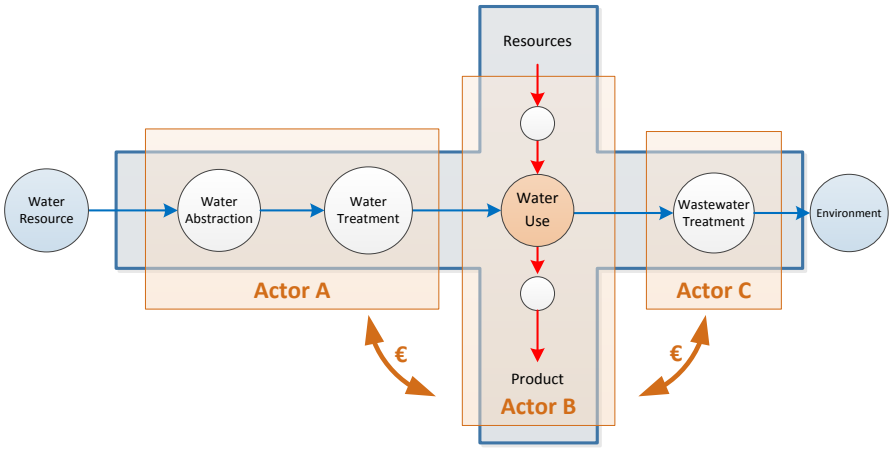

Figure 1. *The EcoWater meso-level water use system*

Furthermore, a distinction is made between "foreground" and "background" systems:

- The boundaries of the foreground system encompass all the processes related to the water supply and the water use chains and can be grouped into four generic stages, as depicted in Figure 1.
- The background system includes all other activities and is that which delivers energy and materials to the foreground system, usually via a homogeneous market so that individual plants and operations cannot normally be identified.

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. It also involves the sharing of resources, services and by-products among the actors (symbiosis) in order to add value and reduce costs. As a result, the meso-level water use system has a third significant component, the water value chain, as presented in Figure 1.

The assessment of the environmental performance of the EcoWater system will follow a life-cycle oriented approach using the midpoint environmental impact categories, while the economic performance will be evaluated by using the Total Value Added (TVA) to the product due to water use, expressed in monetary units per period, in general per year (Euros/year).

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THE ECOWATER TOOLS AND TOOLBOX

Systemic Environmental Analysis Tool — SEAT

SEAT is the core model building tool of the EcoWater project and supports the assessment of the environmental impacts of alternative technological configurations of a meso-level water use system. It is based on the principles of Material Flow Networks (MFN) which model material and energy flows in production chains. It addresses the supply chain, its components, processes & interactions and provides the flows of the materials that can be used for estimating the environmental components of the eco-efficiency indicators.

Economic Value Chain Analysis Tool — EVAT

EVAT is the tool that extends the information included in a SEAT model incorporating economic data. It supports the assessment of the economic performance of alternative technological configurations of a meso-level water use system and provides the monetary flows that can be used for estimating the economic performance of the system.

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

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. It integrates:

- A Technology Inventory, which provides detailed information on innovative technologies (Economic & Environmental Performance, Innovation and Maturity, Availability in market).
- An Inventory of Eco-efficiency Indicators and the rationale used in their evaluation.

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Release of SEAT and EVAT

The final versions of the EcoWater tools EVAT and SEAT has been officially released. Both tools can be easily downloaded free of charge by all registered users from the EcoWater Toolbox website: http://environ.chemeng.ntua.gr/EWToolbox/.

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ECOWATER PARTICIPATION IN AQUATECH EXHIBITION

The AquaTech exhibition, a large-scale exhibition of water technologies and part of the International Water Week, was the selected venue for the 2nd Large-Scale Targeted event of the EcoWater project that took place in Amsterdam (5-7 November 2013) with the aim to develop operational science-industry links.

AquaTech participants at one of the EcoWater AquaStages

The EcoWater participation in the exhibition proved to be a major success as it had great appeal to different target audience (consultants, technology buyers and technology developers) and proved to be an excellent way to ensure wide dissemination and applicability for the EcoWater project. The EcoWater team participated in Aquatech with the aim to present to the audience of this large event, which brought together over 750 exhibitors and some 18,500 visitors from the national and international water sector, how a meso-scale view of a water value chain may bring new opportunities for innovation and new arguments for the development of more eco-efficient technologies.

In view of the AquaTech Exhibition, an animated video was developed, on the opportunities afforded by the meso-scale, in order to communicate the EcoWater project's concept to the participants. In four AquaStage exhibition halls – low fenced areas, where people can sit inside but also listen while passing by - the EcoWater team had the opportunity to encourage technology buyers and consultants to think about making a water value chain more eco-efficient via a meso-scale analysis in the course of four 45 minute sessions. Visitors could watch the video, as well as three presentations by the EcoWater Consortium participants. At the AquaStages, visitors and as exhibitors were informed about the EcoWater concepts and the availability of the EcoWater tools and toolbox. They also had the opportunity to see an example of the project's applicability on the dairy industry case study.

Frame taken from the animated video on the meso-scale, created for the Aquatech Exhibition

Demonstration of the tools and Toolbox at the EcoWater Booth

Simultaneously, at the EcoWater staffed booth there were project leaflets/flyers and the EcoWater team provided the visitors with a live demonstration of the tools and the EcoWater toolbox.

Apart from the linkage with the industry community, the International Water Week Conference was an excellent opportunity for participants of the EcoWater Consortium to present their work and develop a connection with the scientific and research community too through the presentations of Prof. Les Levidow ("Eco-efficient Innovation in Industrial Water-service Systems: Analysing Options, Drivers and Barriers") and Ms. Olga Steiger ("Meso-level Eco-efficiency Indicators to Assess Technologies in Urban Water-Use Sectors").

The presentations of the event and the EcoWater project's animation are available at the Project website: http://environ.chemeng.ntua.gr/ecoWater

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Dr. Palle Lindgaard-Jørgensen,DHI: plj@dhigroup.com

THE SECOND ECOWATER ANNUAL MEETING

The Second EcoWater Annual Meeting Participants

The 2nd Annual Project Meeting of EcoWater was held on November 8th - 9th 2013 in Amsterdam, the Netherlands, and was combined with a Project Steering Group Meeting and the Second External Advisory Board Meeting. The Annual Meeting was attended by representatives of all Project Partners and all three members of the External Advisory Board.

The first three sessions of the meeting were dedicated to the presentation of the progress made in the Project Case Studies since the 1st Annual Meeting (Bari, October 2012) and the identification of the next steps in the development of the Case Studies. To that end, the Case Study presentations included three main sections:

- Reporting on the eco-efficiency of the baseline scenario;
- Identifying opportunities for upgrading the value chain;
- Technology uptake and distributional issues.

Each of the three Case Study Sessions also included the presentation of an integrated proposal of technology innovations.

The fourth session was aimed at the presentation of the final version of the EcoWater Tools and Toolbox, which now completely support the Case Study Development process, calculate the eco-efficiency indicators and produce all the relevant graphs. The fifth session involved a consortium-wide discussion, together with the EcoWater External Advisory Board, on the overall progress of the Project, focusing on:

- Recommendations on enhancing the already developed Project outputs to support the development of the EcoWater Case Studies and ensure their wider applicability;
- Identification of critical aspects that need to be addressed in the 3rd year, in order to ensure that the Project attains its envisaged results and outputs.

The last session of the annual meeting focused on the scheduling of forthcoming meetings and events and the work planning for the next 6 months.

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The 2nd Annual Meeting was a fruitful event where important decisions were made to be implemented during the project's third year. Regarding the methodological framework, it was decided that the system boundaries of the Case Studies' system will not change but the list of the eco-efficiency indicators to be used will be subject to major changes. Given the fact that there is a wide spectrum of indicators that could measure the environmental performance of the water use system, the selection of the most appropriate ones is directly related to the information needed in order to make concrete proposals for specific policies. Thus, it was decided that the assessment of the environmental performance of the EcoWater meso-level water use system should follow a life-cycle oriented approach using the midpoint impact categories, making it possible to characterize different environmental problems, such as climate change, ozone depletion, photochemical ozone formation, acidification, eutrophication and resource depletion.

In addition to the modifications in the list of indicators that will assess the environmental performance of the eight case studies, it was also decided that a distinction will be made between the foreground and the background processes of the studied systems. Concerning the latter, a list with all the supplementary resources used in the 8 Case Studies will be created and the characterization factors for their production processes will be collected, using open access databases.

SECOND EXTERNAL ADVISORY BOARD MEETING

In parallel with the Second Annual Meeting, a project-wide evaluation with the EcoWater External Advisory Board (EAB) was held. The EcoWater team summarized the recommendations made by the External Advisory Board and the External Reviewer during the previous evaluation, and the corresponding responses of the Project Consortium.

The discussions included recommendations on ways to enhance the already developed Project outputs, to support the development of the EcoWater Case Studies and to ensure their wider applicability. The critical aspects that need to be addressed in the 3rd year in order to ensure that the Project attains its envisaged results and outputs were also identified.

The most important outcome of this meeting concerned the development of the Case Studies. It was agreed that the adoption of a homogenous approach by all Case Studies is necessary. It was also mentioned that there are technological innovations that could be used across the project in all the Case Studies (i.e. smart metering systems) and which could help the cross-case study comparisons. However, it was pointed out that in case the methodological approach cannot be fully harmonized among the different case studies, it would be interesting to explain why this was not achieved

It was also confirmed that a second round of workshops will be organized at the Case Study areas, where results will be presented to the stakeholders who will have the opportunity to find out how they can benefit from the eco-efficiency concept. This second round will also serve as a means to collect feedback on the assessment process.

Finally, it was suggested that the ongoing discussions and the exchange of opinions among consortium members should focus on the results of the Baseline Eco-efficiency assessment and the final recommendations should also focus on the benefits and the limitations of the eco-efficiency assessment approach.

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DAIRY INDUSTRY WORKSHOP

The 4th EcoWater Case Study Workshop was held in Holstebro, Denmark on the 20th September 2013. The event focused on the eco-efficiency indicators and technologies that can be assessed in the ARLA dairy industry Case Study.

Discussion among actors during the Holstebro Workshop

The workshop also included a site visit to the HOCO Dairy Plant in Holstebro with the aim to provide insight into the dairy production processes focusing on the use of raw materials, water and energy. Kirsten Hansegaard, the HOCO plant production manager presented Arla's water and energy consuming processes, with a focus on resources used and technologies applied. The rinse process in casein-plant, the cleaning in place (CIP) and the standardization/diafiltration of products have been identified as the processes with the largest water consumption in the dairy industry.

A simplified view of the water use stage of the studied system was presented in order to familiarize the external audience with water use in the dairy industry. Prof. Dionysis Assimacopoulos (NTUA) introduced to the local actors the EcoWater concepts, its objectives and the concept of eco-efficiency and presented an example from the Greek Dairy Industry. Martin Andersen (DHI) presented the preliminary model prepared for the Danish Case Study, its boundaries, the selected indicators and the results from the baseline eco-efficiency assessment. He also presented the assessment of anaerobic pre-treatment as an alternative technology applied in HOCO Plant, and highlighted that the overall eco-efficiency of the system is improves. Dr. Palle Lindgaard-Jørgensen (DHI) briefly explained the steps of the PESTLE analysis and the status of the analysis for the dairy industry.

Discussions focused on the baseline and scenario assessment of eco-efficiency for HOCO and future steps were identified and agreed upon. Some next steps highlighted were the following:

- More detailed modeling of the dairy operations;
- Inclusion of transport processes in the model;
- Addition of indicators in the eco-efficiency assessment (e.g. minerals depletion from chemicals);
- Validation of assumptions made during the preliminary baseline assessment (e.g. milk pricing).

TEXTILE INDUSTRY WORKSHOP

The 5th EcoWater Case Study Workshop was held in Biella, Italy on the 28th October 2013 and was attended by 6 EcoWater participants and 9 local stakeholders. The event focused on the PESTLE factors that can drive or impede the adoption of eco-innovative practices in the Biella textile industry Case Study.

The EcoWater team presented to the external audience the Biella Case Study and a preliminary baseline eco-efficiency assessment for two representative Biella textile industries, comparing the chemical dyeing processes to the ones with natural herbal dyes. The results have

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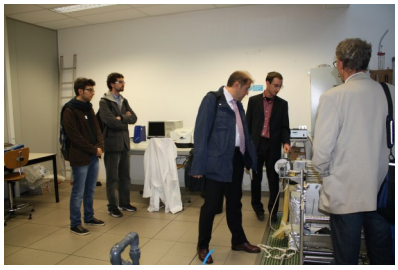
shown that despite the higher operating costs, the natural herbal dyeing industry is more eco-efficient than the chemical dyeing industry.

Anna Mello (Tintoria di Quaregna) presented her company's innovation in herb-based dyes replacing chemical-synthesis agents, that resulted in "cleaner" wastewater which can be potentially reused. Giuseppe Actis Grande (Politecnico Torino-Biella) presented the Politecnico's research programme on 'Water recycling for wet textile production', focusing on various methods of wastewater treatment, especially as a basis to facilitate water recycling.



Visit to the laboratory of the Polytechnic Textile Engineering

Dr. Palle Lindgaard Jørgensen (DHI) explained the general method of identifying PESTLE factors. During the discussions among the EcoWater team and the local actors, the following issues were identified as the major drivers and barriers for promoting eco-innovative technologies:

- The competition of European textiles with the cheaper and less environmentally friendly products produced in Asia;
- The lack of national/European legislation to protect the textile production of the "Made in Europe" label as a quality standard and the traceability of the "made in Italy" label;
- The need to extend the consumer's interest in fashion towards environmental and consumer health criteria;
- The potential costs of an investment on innovative technologies.

The workshop ended with a guided visit to the laboratory of the Polytechnic Textile Engineering (Pilot study dept.– Campus Città Studi)

ENERGY INDUSTRY WORKSHOP

Discussions among the actors during the Dutch CS Workshop

The 6th EcoWater Case Study Workshop was held in Amsterdam on the 7th November 2013. The event focused on the EcoWater Case Study on the Energy Production Industry. It was aimed mainly at the identification of the drivers and barriers for the uptake of new and innovative technologies in the Case Study area.

At the Workshop, the system models for the Diemen CHP power plant were presented. Hans Goossens (Deltares) gave a narrative description of the Business As Usual scenario and presented an inventory of alternative technologies based on the outputs of SEAT and EVAT. The main objective of the workshop was to have a group model building session, in order to explain how the studied system currently operates, to identify the PESTLE factors and define their impact on the various stakeholders.

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RECENT ECOWATER RELEASES

The following EcoWater Deliverables were developed from April 2013 to December 2013, and are publicly available in the Project Website:

D1.3: Populated Technology Inventory

The deliverable presents the populated technology inventory, i.e. the database compiled after collecting information on the technologies relevant to the EcoWater Case Studies. In addition to the generic database information, the inventory holds data on technology economic, environmental and efficiency parameters. It also describes the methodological concepts concerning the water use system and the innovative technologies researched in the project, as well as the environmental midpoint impact categories used to assess the environmental performance of technologies in the Case Studies.

D1.5: Finalized Systemic Environmental Analysis Tool – SEAT

D1.6: Finalized Economic Value chain Analysis Tool – EVAT

For more information on the two EcoWater Tools , see Page 3.

D6.1: Synthesis report from the 1st Round of Case Study events

The deliverable presents the main outcomes from the first 3 EcoWater Case Study Workshops: (a) Monte Novo Workshop (Évora, Portugal, April 2012); (b) Sinistra Ofanto Workshop (Bari, Italy, October 2012); and (c) Volvo Automotive Industry Workshop (Gothenburg, Sweden, March 2013). The Case Study Workshops were aimed at introducing the EcoWater concept and objectives to local audiences and strengthen linkages and collaborations with local actors.

D6.3: Proceedings of the 1st targeted event—Research Links

The deliverable includes the proceedings of the EcoWater scientific event that took place as a one-day side event during the AquaConSoil 2013 conference and had as main objectives to: (a) present EcoWater and expose the project to scientific peers, discussing concepts and results so far; and (b) learn from other projects/initiatives to enrich the EcoWater development.

Videos

In order to better communicate the EcoWater project's concept to a larger audience, an animated video was developed, on the opportunities afforded by the meso-scale. The animation is available at the EcoWater website: http://environ.chemeng.ntua.gr/EcoWater.

Furthermore, three different videos have been created which explain in detail the basic concepts and the main functionalities of the EcoWater Tools and Toolbox. They are available at the EcoWater Toolbox website: http://environ.chemeng.ntua.gr/EWToolbox/.

EcoWater contribution to the international scientific community

Apart from the project's deliverables there is a significant contribution of the project's team to the scientific community as presented in the following list:

- Levidow, L. (2013). "*Environmental Innovation in Water-service Systems: which Eco-efficiency Improvements?*", European Sociological Association Conference, 28-31 August, Torino, Italy.
- Levidow, L., Lindgaard-Jørgensen, P., Nilsson, A., Alongi Skenhall, S. (2013). "*Eco-efficient Innovation in Industrial Water-service Systems: Analysing Options, Drivers and*

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Barriers", IWW Conference, 5-6 November, Amsterdam, Netherlands.

- Levidow, L., Maia, R., Todorovic, M., Vivas, E., Zaccaria, D., Scardigno, A. (2013). "*Agri-irrigation systems under innovation: Prospects and difficulties of eco-efficiency improvements*", 1st Inter-Regional Conference on Land and Water Challenges, 10-14 September, Bari, Italy.
- Mehmeti, A., Scardigno, A., Assimacopoulos, D., Todorovic, D., Pereira, L.S. (2013). "*Eco-efficiency of a large irrigation scheme in Southern Italy: system mapping and evaluation of different management options*", 1st Inter-Regional Conference on Land and Water Challenges, 10-14 September, Bari, Italy.
- Ribarova, I., Stanchev, P., Dimova, G., Assimacopoulos, D. (2013). "*A First Iteration of an Eco-efficiency Assessment of Sofia's Urban Water System*", CCWI Conference, 2-4 September, Umbria, Italy.
- Steiger, O. (2013). "*Meso-level Eco-efficiency Indicators to Assess Technologies in Urban Water-use Sectors*", IWW Conference, 5-6 November, Amsterdam, Netherlands.
- Todorovic, M., Assimacopoulos , D., Zaccaria, D., Scardigno, A. (2013). "*Assessing eco-efficiency of Sinistra Ofanto irrigation scheme*". 8th EWRA International Conference, 26-29 June, Porto, Portugal.

UPCOMING EVENTS

EcoWater Events

Upcoming EcoWater events include the Workshops for the Urban Water System Case Studies and the second round of Case Study workshops that will be held from April 2014 until the end of the project. More specifically:

- The Case Study #3 (Urban Water System of Sofia) Workshop will take place on 25 February 2014 in Sofia, Bulgaria; and
- The Case Study #4 (Urban Water System of Zurich) Workshop will be held on 19 March 2014 in Waedenswil, Switzerland.

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Ms. Olga Steiger, FHNW: olga.steiger@fhnw.ch

Other Events on Eco-Innovation, Eco-efficiency and Resource Efficiency

The 16th European Forum on Eco-Innovation will be held in Hannover, Germany, on 7 and 8 April 2014.It is organized by DG Environment in the context of the Eco-Innovation Action Plan and will examine enabling factors and challenges of transitioning to a circular economy model in an urban context. It will also identify and showcase eco-innovations that can facilitate the shift to a circular economy and support cities in meeting the new targets for municipal waste treatment.

Other important relevant events are:

- The 2nd Innovation Convention (10-11 March 2014, Brussels, Belgium)
- The Cleantech Innovate Showcase 2014 (13 February, London, UK)
- The World Resources Forum 2014: "Innovation, Resource Efficiency & Low Carbon" (19-22 October 2014, Arequipa, Peru).