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

Collaborative project, Grant Agreement No: 282882

Deliverable 6.2

Synthesis report from the 2nd Round of Case Study events

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Executive summary

The Deliverable 6.2 presents the main outcomes from the 1st and 2nd Round of the EcoWater Case Study events, which took place between May 2013 and December 2014.

The 1st Round of Case Study Workshops was focused on introducing the EcoWater concept and objectives to local audiences by strengthening linkages and collaborations with local actors. The 1st Round also included field visits and joint activities towards the familiarization of the Project Partners with the Study areas, and for the identification of the main points to be included in the analysis based on the input provided by the local stakeholders.

The Case Study Workshops of the 1st Round, which were organized in the second half of the project duration, include:

- Dairy Industry Case Study Workshop (Holsterbro, Denmark, September 2013);
- Textile Industry Case Study Workshop (Biella, Italy, October 2013);
- Energy Industry Case Study Workshop (Amsterdam, Netherlands, November 2013);
- Sofia Case Study Workshop, (Sofia, Bulgaria, February 2014);
- Zurich Case Study Workshop, (Au, Switzerland, March 2014).

The 2nd round of events included a Workshop for each Case Study and was dedicated to summarizing the final EcoWater outcomes to local actors and identifying the externals factors that affect the adoption of innovative technologies or actions. The 2nd Round also fostered the dissemination of the Project and its preliminary results to the local actors and provided useful outcomes for the Case Study Development processes and the research activities of the Project.

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1 Introduction

The EcoWater Project's Dissemination Strategy focuses on involving key policy actors, decision makers and representatives of the private sector in the Case Study Development processes to obtain feedback, adapt research to actual (decision making) needs, and ensure that results are sound applicable to the local context.

The aim of this document is to present the main outcomes of the two series of the Case Study Workshops, enhancing the discussion among the local actors and stakeholders and the EcoWater consortium members. Furthermore, the 2nd round events were concentrated on the analysis of socio-technical dynamics of each Case Study and the applicability of the proposed set of actions towards eco-efficiency improvement. The document is divided into two parts:

The first part is dedicated to the 1st Round events that took place during the second half of the Project (the events that took place during the first half of the project are reported in Deliverable 6.1), in:

a. Case Study #7 (Dairy Industry Case Study Workshop, Holstebro, September 2013)
b. Case Study #5 (Textile Industry Case Study Workshop, Biella, October 2013)
c. Case Study #6 (Energy Industry Case Study Workshop, Amsterdam, November 2013)
d. Case Study #3 (Sofia Case Study Workshop, February 2014)
e. Case Study #4 (Zurich Case Study Workshop, March 2014)

The second part includes the reports from the 2nd Round of Case Study Workshops for all 8 EcoWater Case Studies.

2 1st Round Events

This section presents the reports from the 1st Round of Case Study Workshops that took place during the second half of the Project. It follows from Deliverable 6.1, which presents the synthesis of the first three workshops.

2.1 The Holstebro Workshop

The fourth EcoWater Workshop took place in Holstebro (Denmark) on the 20th of September in 2013 and concerned Case Study #7: Assessment of eco-efficiency improvements through innovative technologies in Dairy Industry. The event was organized by DHI and its main objectives were to introduce to the participants the concept of eco-efficiency, to strengthen the linkages with local actors and to facilitate their involvement to the analysis of the Case Study. Overall, the Workshop aimed to:

- Inform stakeholders about the main EcoWater objectives and anticipated results concerning meso-level and eco-efficiency;
- Highlight the relevance of the Project approach in supporting stakeholder decisions and actions;
- Obtain feedback on the preliminary results of the baseline eco-efficiency assessment of the Case Study;
- Determine the energy and water consuming processes of the water chain and determine possible innovative technologies to improve the overall eco-efficiency of the system;
- Identify drivers and barriers for introducing new technologies in water using processes of the automotive industry;

The Arla Workshop lasted half a day and included a field visit to the HOCO Dairy plant for the familiarization of the Project Partners with the processes that are being studied.

The overall program of the one day Workshop is presented in Table 1.

2.1.1 Discussion summary

Welcome note and presentation of the EcoWater project

Kirsten Hansegaard and **Birgitte Koch** (Arla Foods) welcomed the participants and stakeholders and **Palle Lindgaard-Jørgensen** (DHI) introduced them to the EcoWater concept. The welcome note included the main goals of the Workshop related to the collaboration among participants in order to disseminate the appropriate information for the eco-efficiency assessment. Furthermore, Palle Lindgaard-Jørgensen stated that the scope of the Workshop is to see how the actual process can be represented by a model in order to identify the opportunities to optimize the process, not only from the point of view of Arla but in the broader water value chain.

Table 1: Agenda of the Holstebro Workshop

Friday, 20 September 2013		
08:30	Arrival of participants in the workshop	
08:45	Welcome note and introduction to the dairy and how the site visit will take place	Kirsten Hansegaard, HOCO
09:00	Preparations for the site visit	All
09:15	Site visit	HOCO staff
11:00	End of field visit and transfer to Nupark for the workshop	All
11:30	Arrival and start of workshop	
11:30	Welcome note	Kirsten Hansegaard and Birgitte Koch, Arla Foods and Palle Lindgaard-Jørgensen, DHI
11:45	Introduction of participants	All
12:00	Introducing the EcoWater concepts: Relevance and research relating to Case Studies • What are we doing, and why? • What is eco-efficiency? • The EcoWater approach	Dionysis Assimacopoulos, Project leader, EcoWater Project, NTUA, Greece
12:30	Presentation of HOCO´s water and energy consuming processes and HOCO´s aims at reducing the water and energy use and follow up on the site visit	Kirsten Hansegaard, HOCO (tbc)
13:00	Lunch break	
14:00	Presentation of system level eco-efficiency assessment in the case study for a few technology scenarios (Baseline assessment)	Gert Holm Kristensen and Martin Andersen, DHI
14.30	Discussion of the dairy eco-efficiency assessment with stakeholders	Palle Lindgaard-Jørgensen, DHI
15:00	Drivers and barriers for introducing new technologies Mapping with PESTLE in the dairy industry	Palle Lindgaard-Jørgensen, DHI
15:20	Conclusions: What is next in the project?	Dionysis Assimacopoulos, NTUA
15:30	End of stakeholder workshop	

Ms. Birgitte Koch presented the environmental strategy of Arla for 2020 and the main focus areas which are:

- Sustainable Agriculture;
- Greenhouse gas emissions (Target: Reduction by 25%);
- Water and energy (Target: Consumption Reduction by 3%);
- Waste (Target: 100% recyclable packaging materials and food waste reduction by 50%).

Introducing the EcoWater concepts: Relevance and research relating to Case Studies

Prof. Dionysis Assimacopoulos (Project Coordinator, NTUA) presented an overview of the EcoWater project, and then described the methods that are applied to all of the eight case studies. In this context **Prof. Assimacopoulos** mentioned several objectives of the European Policy Framework for smart, sustainable and inclusive growth by linking them to the research focus and goals of the Project.

Presentation of HOCO´s water and energy consuming processes

Kirsten Hansegaard (HOCO) presented the key points of the operation of HOCO plant. The presentation included a brief description of the industrial plant and the related actors. **Kirsten Hansegaard** (HOCO) emphasised on the company's energy management strategy and mentioned the processes with the higher energy requirements, pointing out that these should be the focus of the value chain upgrading. The presentation ended with the objectives that the company has set:

- CO_2 neutral energy source in 2015 by entering supplier agreement with Måbjerg Bioenergy,
- "Natural" milk protein ingredient through development of a new casein process avoiding use of acid/hydroxides,
- Reduction in the use of energy, water and chemicals as well as of the amount of waste water by 25% per kg powder (2011-2014) through optimization and development of processes,
- Maximum exploitation of the milk,
- Reduction in transportation costs by increasing the container lots, e.g. through increasing maximum lot in a container from 15 tons to 20 tons powder.

Baseline assessment of the Case Study & discussion of the dairy eco-efficiency assessment with stakeholders

Gert Holm Kristensen and **Martin Andersen** (DHI) presented the baseline eco-efficiency assessment for the dairy industry (HOCO) and the assessment of one alternative technology. The physical system (water supply and value chain) and the technology scenarios were described, followed by a discussion with the industrial and environmental actors, focusing on their opinion on:

- The importance of the presented indicators;
- Other alternative technology scenarios; and
- The interpretation of results.

Mapping with PESTLE for the dairy industry

The scope of this session was to further discuss the developed scenarios for the Dairy Industry. **Palle Lindgaard-Jørgensen** (DHI) introduced the steps of the PESTLE-analysis and the status of the PESTLE analysis for the dairy industry. The main results from the discussion are presented in Annex I.

2.1.2 Field visit

One field visit was organized during the Holstebro Workshop at the HOCO plant. The site visit aimed at providing insight into the dairy production processes. Participants were introduced to the dairy processes in HOCO and saw how the production took place and how water, energy and resources were used and products produced. The field visit provided important background information for the discussion later in the Workshop.

2.1.3 Workshop conclusions

The Dairy Industry Workshop was a successful forum for the dissemination of the project and its preliminary results to the local actors and provided significant input for the development of the dairy industry Case Study.

Local stakeholders showed significant interest in the overall concept and objectives of the EcoWater Project while Arla Foods is interested in upgrading the production process in order to improve its eco-efficiency.

2.1.4 List of participants

The actors/stakeholders and the Project Partners who attended the event, are briefly described in Table 2. Unfortunately, no representative of the municipal water supplier was able to attend despite being invited to the Workshop.

Table 2: The Holstebro Workshop Participants

Actor/stakeholder	Agency/Organisation
Kirsten Hansegaard	Production manager, HOCO
Helle Nielsen	Arla Food, Innovation
Birgitte Koch	Sustainability Manager
Avi Gaye	Head of water and wastewater, Vestforsyning A/S
Jesper Madsen	Head of Water, Vestforsyning A/S
Jette Fleng Jensen	Head of WasteWater, Vestforsyning A/S
Anette Christiansen	Danish Agriculture and Food Council
NN Municipality of Holstebro	Nature and Environment
Anne Mette Kloster/Christine Ellegård	Danish EPA Aarhus (Miljøcenter Aarhus)
Marina Snowman Møller, Danish EPA	Ministry of Environment

Anne Christine Duer, Nature Agency Aarhus	Ministry of Environment
Project Partner	**Affiliation**
Dioniysis Assimacopoulos	NTUA, Athens
Palle Lindgaard Jørgensen	HOCO
Kirsten Hansegaard	Open University, UK
Martin Andersen	DHI, Copenhagen
Gert Holm Kristensen	DHI, Copenhagen

2.2 The Biella Workshop

2.2.1 Scope of the Workshop

The 1st Round Textile Industry Workshop took place in Biella, Italy, on the 28th of October 2013 and concerned the Industrial Case Study: Assessment of eco-efficiency improvements through innovative technologies in Textile Industry. The main purpose of the Workshop was to present the concept of eco-efficiency to local stakeholders and the necessity for technological innovations to the water value chain.

The overall program of the one-day Workshop is presented in Table 3.

Table 3: The agenda of the Biella Workshop

Monday, 28 October 2013		
08:30	*Registration of participants*	
08:45	Welcome and programme	*Anna Balzarini and Michele Spagarino, MITA(Biella)*
08:55	Introduction of participants	*All participants*
09:00	Short presentation of EcoWater project	*Anna Balzarini, MITA (Biella)*
09:10	Innovation and eco-efficiency for protecting the environment and natural resources	*Dionysis Assimacopoulos (NTUA)*
09:30	The case study "Textile Industry Biella"	*Anna Balzarini, MITA(Biella)*
09:45	Textile company “Tintoria di Quaregna”	*Anna Mello (owner of Tintoria di Quaregna)*
10:00	The method of analysis through the Cases of 2 industrial units	*Dionysis Assimacopoulos (NTUA)*
10:15	Water recycling for wet textile production	*Giuseppe Actis Grande PhDc (Politecnico Torino)*
10:30	*Coffee break*	
10:45	**AGORÀ TEXTILE:**	*Participants: ALL*

Monday, 28 October 2013		
	The square of the dialogue, confrontation and sharing *Meeting point between companies, local institutions, operators of the sectors directly or indirectly related to the textile case study of Biella (guide to the comparison provided by the EcoWater researchers)* *Which technologies are needed by the national legislation and EU* *How to improve the processes of dyeing with lower operating costs and adding value creation?* *How to improve and make more clean and competitive companies?* *How to combine economic benefit with water quality, valuable products and water saving?* *What are the incentives and opportunities to achieve these improvements?* *How to recover investment powers?* *Experiences and problems in the area, open space to interventions and questions*	*Moderator:* *Les Levidow (Open University – UK)* *Rapporteur:* *Anna Balzarini, MITA (Biella)*
12:15	Final Report of the "Agora textile"	*Summary (A.Balzarini)*
12:30	*Lunch*	
14.00	**Perspectives for the future:** *Exercise with P.E.S.T.L.E. : for analysis of the factors Political, Economic, Social, Technical, Legal and Environmental* *Opportunities for the enterprises to promote their initiatives, activities and services*	*Moderators:* *Mladen Todorovic (IAMB-Bari)* *Palle Lindgaard Jørgensen (DHI)*
15:30	Closing of the workshop	
16:00	Guided visit to the laboratory of the Polytechnic Textile Engineering (Pilot study dept. - Campus Città Studi)	*Giuseppe Actis Grande PhDc (Politecnico Torino-Biella)*

2.2.2 Discussion summary

Welcome note and presentation of the EcoWater project

Anna Balzarini and Michele Spagarino (MITA) welcomed the local stakeholders and participants and thanked them for their interest in Biella Workshop. In addition, **Anna Balzarini** (MITA) described the main goals of the Workshop and made a brief presentation of the EcoWater Project including general information.

The EcoWater concepts: Relevance and research relating to Case Studies

Prof. Dionysis Assimacopoulos (Project Coordinator, NTUA) presented an overview of the EcoWater project, and then described the methods applied to all of the eight case studies. Each Case Study examines the intersection of the production chain and the water supply chain, and tries to identify potential sites for implementation of innovations, which could enhance meso-level eco-efficiency. The presentation highlighted that the Textile Industry Case Study also seeks for companies' participation in investigating questions, such as:

- How to improve dyeing processes with lower operating costs and creation of added value?
- Which technologies and environmental practices should be used?
- How to combine economic benefit with water quality (preservation, improvement?), valuable products and water saving?
- How to optimize the process of post-industrial waste water, both from the environmental point of view, also containing costs?

The Biella Case Study

Anna Balzarini (MITA) presented the Biella Case Study, characterized by the historical relevance, hydrogeomorphological position and water availability for textile industry. At the same time, there are several constraints that the modern textile industry in Italy faces, such as the economic crisis, either at a national level or in the textile sector (as expressed by declining production over the past decade). The study was focused on the wool-dyeing process, as the main finishing process, which is the largest user of water and producer of wastewater within the overall textile production process. For that specific phase, the study proposed several options for reducing environmental burdens.

Company's innovations and strategy

Anna Mello (Tintoria di Quaregna) presented the company's innovation in herb-based dyes, by replacing chemical-synthesis agents. Comprising approximately 1/5 of the company's production, the naturally-dyed process results in less-polluted wastewater, which could be more easily reused. The toxicity of this wastewater has not yet been the subject of detailed studies, but it is assumed to be lower than those of wastewater from dyeing with chemical components. Moreover, the herbal dyes help staff and consumers to avoid contact with synthetic chemicals (some of which are allergens or suspected carcinogens). The substitution has helped to revive cultivation of traditional plants, e.g. the indigo plant in France. Woolmark has created a special label for products from Quaregna's herbal dyes. Tintoria di Quaregna works on behalf of third parties, which are concerned with the dyeing of fibers, yarns and fabrics. Simultaneously, the company is trying to develop a new strategy allowing a real production line of clothing under the brand name Natural, in order to find a more direct route for its environmental message to consumers.

Eco-efficiency Analysis

Prof. Dionysis Assimacopoulos (NTUA) presented the EcoWater eco-efficiency approach, comparing chemical dyeing and natural dyeing processes, as used in one

of the Biella industries. The latter option had a relatively lower environmental burden (except for the GHG emissions) and better eco-efficiency performance, for every indicator. Afterwards, he presented three possible ways to upgrade the textile-dyeing value chain, in order to achieve higher eco-efficiency.

Analysis of the the Politecnico's research programme

Giuseppe Actis Grande (Politecnico Torino) presented the Politecnico's research programme on 'Water recycling for wet textile production', a three year research project, which involves the selection, construction and start-up of 15 pilot plants. Companies co-fund several pilot plants at their industrial sites, where the Politecnico researches various methods of WW treatment to facilitate water recycling. Regarding platforms, which could commercialize such innovations, the research investigates two different scenarios:

I. The WWT company CORDAR; and

II. A consortium based in one textile-dying company (Filidea).

2.2.3 PESTLE Analysis

Analysis of the PESTLE factors

Palle Lindgaard Jørgensen (DHI) explained the general method of identifying PESTLE factors, which can impede or drive to specific decisions. The EcoWater team had already sent a template with standard PESTLE factors to several companies, with a request to list specific factors potentially influencing their own innovation process. Two companies had sent responses, which were then combined in a single table elaborated for further improvements.

PESTLE Exercise

At the Biella workshop, **Anna Balzarini** (MITA) presented the overall table of PESTLE factors as a basis for the discussion and tried to make the factors more specific and to identify future uncertainties. The discussion clarified the need to specify how each factor corresponds to specific innovations. The participants agreed to do a follow-up PESTLE exercise, focusing on two different options for the dyeing process: (1) internalising WWT (or pre-treatment), and (2) reducing toxicity for environmental and consumer health protection.

As far as the prospect of internalising WWT is concerned, the discussion identified potential difficulties for textile companies and for the WWT Company (CORDAR). As their clients would be reduced and pay fewer fees, the water purification (m^3) could not cover the company's costs. The EcoWater team proposed to facilitate a discussion – between CORDAR, the environmental protection agency and textile companies – about potential changes in the WWT process. Such a discussion could clarify options and provide a cooperative basis for decision making. This proposal was welcomed by representatives of the two textile companies.

Campaign concerning health issue

Another aspect mentioned during the general discussion was the need of an awareness campaign for the consumers about health problems. In particular, the

risks of dermatologic reactions or allergies due to wearing very low quality clothes, and the use of dangerous chemical agents or unclean cloths is high as a result of products imported from East countries. Due to the economic recession, consumers prefer low cost products imported from the East even if their quality is characterized as low. To that end a future campaign should point out that skin health is significant so the Europe Label in clothes should be a priority for the consuming pattern.

2.2.4 Field visit

One field visit was organized during the Biella Workshop, which was guided by ***Giuseppe Actis Grande***. The Project Partners were given the opportunity to visit the laboratory of the Polytechnic Textile Engineering (Pilot study Department - Campus Città Studi) and familiarize themselves with the area and the practises of the specific system.

2.2.5 Workshop Conclusions

During the morning discussion, the following points were made:

- The European Union (EU) promotes eco-innovation, but EU products are competing against cheap Asian imports, which have been produced in environmentally more polluting ways. Some products labelled 'Made in Italy' are merely assembled from pieces produced in Asia.
- There is a lack of national and European legislation/regulation protecting the textile production from the "Made in Europe" mark as quality excellence.
- If Biella's companies did recycle their wastewater, then this could be environmentally beneficial but would not save their businesses from the competitive pressures because recouping the investment would require a long timescale and protection from declining prices.
- The textiles companies of Biella need to promote their environmentally better techniques; the consumer interest in fashion must be extended to environmental criteria and consumer health. Cittadellarte-Biella runs a campaign *Tessile & Salute* [Textiles & Health] informing about the health hazards of toxins in garments, as grounds to develop safer alternatives. Such an eco-innovative shift in production and markets needs support from political leadership.

2.2.6 List of participants

The actors/stakeholders and the Project Partners, who attended the event, are briefly described in Table 4.

Table 4: The Biella Workshop Participants

Actor/stakeholder	Agency / organisation
Anna Mello	Tintoria di Quaregna – Quaregna
Mario Mancini	Tintoria Mancini – Sandigliano
Olga Pirazzi	Cittadellarte -Biella
Eleonora Cerruti	Cittàdellarte – Biella

Enrico Slaviero	ENTSORGA – Tortona
Roberto Lesca	Geologist –Vercelli
Giuseppe Actis Grande	Politecnico Torino-Biella
Jacopo Andrea Bertolone	Università di Torino
Valerio Monteleone	Università di Torino
Project Partner	**Affiliation**
Dioniysis Assimacopoulos	NTUA, Athens
Palle Lindgaard Jørgensen	DHI, Copenhagen
Les Levidow	Open University, UK
Anna Balzarini	MITA, Biella
Michele Spagarino	MITA, Biella
Rosanna Del Signore	MITA, Biella

2.3 The Amsterdam Workshop

2.3.1 Scope of the Workshop

The energy industry EcoWater Case Study Workshop was held in Amsterdam, Netherlands on the 7th of November 2013. The main goal of the event was the introduction of the eco-efficiency analysis in the energy sector to all participants and the proposal of a set of measures or actions to upgrade the water value chain (Table 5).

The main objectives of the Workshop were the following:

- The hosting of a more structural and to the point discussion between stakeholders and actors;
- The feedback from stakeholders on technologies selection, as well as drivers and barriers for their implementation.

Table 5: The program of the Amsterdam Workshop

Thursday, 7 November 2013		
11:45	Arrival of stakeholders/registration informal welcome with coffee	
12:00	Formal welcome and opening, overview of the day, project overview	*Dionysis Assimacopoulos, Michiel Blind*
12:15	Personal introduction of the participants	
12:35	Lunch break	
13:15	System models (Presentations in English, discussions possibly in Dutch) Narrative description of the business as usual	*Hans Goossens*

Thursday, 7 November 2013		
	scenario & inventory of suggestions, possibly very short discussions on improvements Output of SEAT and EVAT (BAU) Effect of technologies (3 examples) & inventory of suggestions, possibly very short discussions on improvements	
14:00	Start Group Model Building session (oral session in Dutch, modelling in English so that it can be followed by EcoWater participants) Set up a system dynamics model in which the PESTLE-relations are defined and drawn between (f)actors/stakeholders using the input of the present participants (we also prepare a 80% version prior to the meeting to assure necessary progress in the session)	*Marcel Bruggers*
15:30	End of session and Short break	
15:45	Start Group Model Building session 2 Define a set of measures (using the model that is previously set up) that are required to realize/make feasible 1 or 2 technologies (depending on time spent)	*Marcel Bruggers*
16:30	End of session and Short break	
16:45	Wrap up/conclusions of the GMB session and definition of (joint) 'next steps' in the project (in English)	*Marcel Bruggers*
17:15	Closing	*Dionysis Assimacopoulos, Michiel Blind*
17:15	End of stakeholder workshop	

2.3.2 Discussion summary

Welcome note and presentation of the EcoWater project

Mr. Michiel Blind (DELTARES) welcomed the local stakeholders and participants to the Amsterdam Workshop event. **Prof. Dionysis Assimacopoulos** (NTUA) presented the EcoWater concept and the relevance to the Case Study of the Energy Production. At the same time, the participants of the Workshop introduced themselves during the first part of the discussion.

Systems Models presentation

The second part of the workshop focused on the presentation of the Case Study by **Hans Goossens** (DELTARES). He pointed out some general features of energy industry concerning the power plant production and the respective energy demand (households, industries etc.). Two main remarks are that: (a) the heat demand is

much higher than the actual production, and (b) a significant amount of heat is discharged as waste in the river. Changes in the production chain were thus assumed very important and the proposed technologies by the EcoWater consortium were also discussed. It was very interesting that the output from the modelling of SEAT and EVAT fed the whole session for conversation about the possible improvements to the value chain.

Start Group Model Building session

This session shifted in two sub-sessions according to the subject of each discussion. In the first sub-session the system dynamics using the PESTLE analysis for the technology uptake were discussed. In this part, participants expressed their opinion about the drivers and barriers for the technological innovations that the expert team introduced previously. The discussion was flourished and the initial list was extended and became more structured after the discussion among stakeholders and experts.

The second part of this session concerned the preliminary selection of measures which may enhance the eco-efficiency improvements across the value chain. The discussion was based on the output from the modelling of the Case Study.

2.3.3 Workshop conclusions

The workshop finished with a brief summary of the main discussion points of the workshop. The facilitator of the workshop mentioned the technologies that were proposed during the event while repeated the extended list of PESTLE factors.

2.4 The Sofia Workshop

2.4.1 Scope of the Workshop

The Workshop concerning the urban water supply system of Sofia was held in Sofia, Bulgaria on the 25th of February 2014. The aim of the workshop was to bring together actors involved in urban water and wastewater systems in Sofia and discuss on the innovative technologies for urban water management.

To specify, the main objectives of the Workshop were the following:

- The dissemination of main project results to local stakeholders;
- The hosting/organisation of a more structural and to the point discussion between stakeholders and actors;
- The feedback on:

  (a) Work done so far;

  (b) Future work – technologies selection, as well as drivers and barriers for their implementation.

The overall program of the one day Workshop is demonstrated in Table 6.

Table 6: The program of the Sofia Workshop

Tuesday, 25 February 2014		
09:00	Opening, presentation of the EcoWater Project and introduction of the participants	*Assoc. Prof. Irina Ribarova, UACEG*
9:15	Presentation of Sofia case study	*Eng. Peyo Stanchev, PhD student, UACEG*
10:10	Prioritisation of the technologies for increasing the eco-efficiency in the water and sewage system in Sofia	*All participants* *Moderator: Albena Popova*
10:30	*Coffee break*	
10:50	Identifying political, economic, social and other drivers and barriers for the technologies' implementation	*All participants, group sessions* *Moderators: Irina Ribarova and Albena Popova*
12:20	Introduction of the results from the group sessions and final discussion	*All participants*
13:00	*Lunch - End of Workshop*	

2.4.2 Discussion summary

Welcome note and introduction of participants

The workshop started with a short welcome note by **Assoc. Prof. Irina Ribarova** (UACEG). A brief introduction of the EcoWater concepts and context of the project was presented. Each participant presented himself and his role in the meso-level chain.

The EcoWater Case Study in Sofia: Premises and context

Eng. Peyo Stanchev (UACEG) described the Sofia Case Study in more detail and the interest for the specific urban water system. His presentation attempted to summarize the results of the eco-efficiency assessment in case of an urban water system.

Prioritisation of the technologies increasing the eco-efficiency in the water and sewage system in Sofia

The next session of the Workshop focused on the five technologies suggested by the EcoWater consortium to improve the eco-efficiency of Sofia Urban Water and Wastewater System. To that point participants were asked to discuss on the identified technologies as well as to suggest other possible innovative technologies that might be relevant to the Case Study.

There were three proposals for additional innovative technologies:

- Extending of one of the selected technologies; combining pressure-reducing valve - energy generation with including small hydropower plant on the pipe, feeding water treatment plant (WTP);
- Extending of another of the selected technologies; combining heat recovery from households with heat recovery from the sewerage system using heat pumps;
- Replacement of the technology for solar sludge drying with a technology for sludge incineration.

These proposals were discussed and accepted by the group. Then participants were asked to "invest" or vote for a certain technology using small "stones" (as seen on Figure 1). The technologies with the highest number of votes were: heat recovery from the sewerage system (6 votes), energy generation through hydropower plant on the feeding pipe of the WTP (3 votes), and solar sludge drying (2 votes). It should be noted that the vote distribution was influenced by the number of participants per institution.

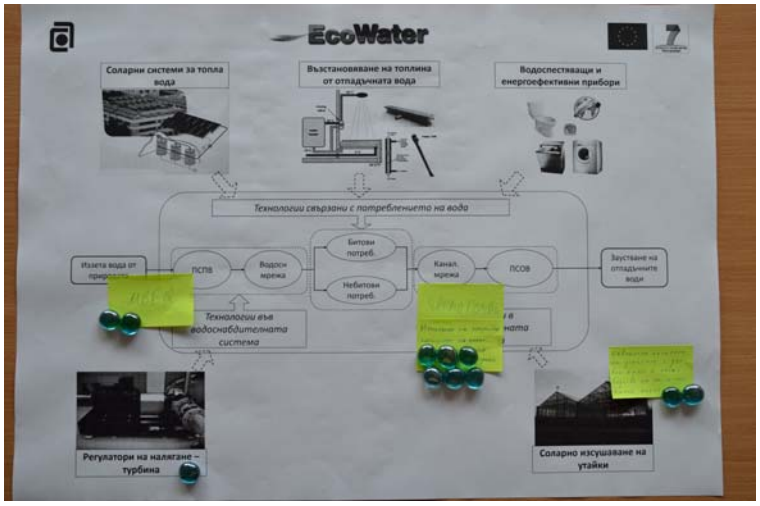

Figure 1: Votes on the technologies

Based on the votes, two technologies were chosen to be further discussed in the next Session: *Heat recovery from the sewerage system* and *Energy generation through hydropower plant on the feeding pipe of the WTP*. The participants (Table 7) were divided into two groups as follows:

- *Energy generation through hydropower plant on the feeding pipe of the WTP*: Stanislav Stanev; Emilia Georgieva; Nikolay Nalbantov; Nona Georgieva;
- *Heat recovery from the sewerage system:* Zhelyaz Rangelov, Georgi Terzov, Antoni Popov, Zdravko Georgiev, Daniel Zarev, Vera Petrova[1]

[1] Vera Petrova came when the group was already in the middle of the PESTLE table and as the technology was quite specific she was not able to participate equally with the others.

Identifying political, economic, social and other drivers [D.] and barriers [B.] for the technologies' implementation – Mapping with PESTLE

The facilitators of the groups made a short introduction of PESTLE analysis. Then the two groups were divided into two different rooms. The members of each group were chosen by Albena Popova and Irina Ribarova based on the following principles:

- *People from the same institution to be in different groups;*
- *Participant to be familiar with the technology or the part of the system. From the Ministry of Economy and Energy finally there was one representative left so the energy sector was presented only in Group 1.*

The first part of this exercise asked for individual work; each participant thought about drivers and barriers for all factors (as many as one is able to create based on his background). They were asked to fill their own PESTLE table writing driver or barrier. Afterwards the participants of each group filled together the PESTLE table factor by factor (Figure 2). Each driver or barrier was discussed within the group. The results of the PESTLE tables are presented in Annex I. The frequency of certain driver or barrier mentioned by the participants is also marked.


Figure 2: ***Individual and group works on PESTLE***

The main problem identified in both groups was the distribution of the costs and benefits of the new technologies. The roles and relations between all stakeholders were described as 'unclear'. Most of the Political and Legal drivers are linked to the future; they are marked mainly as "wish" or "need" more than the existing legal or policy framework.

Introduction of the results from the group sessions and final discussion

During the final session, all participants were brought together. The time was reserved for rising questions which appeared throughout the PESTLE Analysis. However, the initial plan was changed, because the representative from the MEE presented the Program on energy efficiency. It was decided that this financial opportunity for real eco-efficiency investments could be of common interest for all actors.

All participants gave their oral feedback for the Workshop expressing their positive evaluation of the event.

2.4.3 Workshop conclusions

The “physical” outcomes of the Workshop are PESTLE tables on two technologies. An interesting outcome was that both technologies, which were selected by the participants, were not proposed by the project team. Three of the eco-efficient technologies of the UACEG team were for households, but there were not enough representatives of citizens, so, this fact influenced the choice and the following discussion. For the Urban Water System of Sofia it was critical that property managers were involved in such meetings. This was a difficult procedure because this role was quite new for the Bulgarian context. The other option was to involve domestic water users that would change the idea of meso-scale of the Project.

The participants were interested in the Project and the proposed exercise, so they were deeply involved in the analysis. The dynamic of the groups was very helpful for the goals of the Workshop. The stakeholders were asked for feedback from the Workshop, and they shared the presentations from the Project introduction.

It was remarkable that the discussion about technologies led to an extended list of proposed technologies differentiated by the initial list by UACEG team. To that end the identified drivers and barriers are relevant for the newly proposed technologies. Simultaneously, it was very interesting that drivers and barriers for Political and Legal factors are almost the same for the context of implementation for all technologies. The lack of clear legal national framework on water management and long-term strategies to improve eco-efficiency of Urban Water Systems were the main barriers for the technology uptake. Another important and common barrier was the high economical investment. The other problem was also the ambiguity of distribution of costs and benefits between the involved actors and their responsibilities in the network.

The added value of the Workshop was the meeting between main stakeholders in the Urban Water and Wastewater System in Sofia. They recognized that it was a good chance to communicate information, discuss on common problems and share of ideas.

2.4.4 List of participants

Both Project Partners and local stakeholders participated in the first EcoWater Workshop (Table 7).

Table 7: The Sofia Workshop participants

Actor/stakeholder	Agency / Institution
Stanislav Stanev	Water operator, Sofiyska voda
Zhelyaz Rangelov	Water operator, Sofiyska voda (WWTP)
Georgi Terzov	Ministry of Environment and Water (MEW)
Emilia Georgieva	Ministry of Environment and Water (MEW)
Nikolay Nalbantov	Ministry of Economy and Energy (MEE)
Svetlana Yordanova	Ministry of Economy and Energy (MEE)

Valentina Ilieva	Ministry of Economy and Energy (MEE)
Nona Georgieva	Ministry of Investment Planning (MIP)
Antoni Popov	Sofia Municipality (SM)
Zdravko Georgiev	Sofia Energy Agency-SOFENA
Vera Petrova	Property management
Daniel Zarev	ACO, water sector engineering decisions
Project Partner	**Affiliation**
Assoc. prof. Irina Ribarova	Case Study Coordinator, UACEG
Galina Dimova	UACEG
Peyo Stanchev	UACEG
Ralitsa Lambeva	UACEG
Albena Popova	Facilitator of the Workshop
Olga Steiger	FHNW

2.5 The Zurich Workshop

2.5.1 Scope of the Workshop

The Waedenswil Urban Case Study Workshop took place on 19th of March 2014 in the Countryside Hotel on the Peninsula Au form 9 a.m. until 3.30 p.m. The aim of the Workshop was to discuss on the baseline eco-efficiency assessment of the case study and also propose technologies and options for the improvement of eco-efficiency on meso-level.

The overall program of the one day Workshop is presented in Table 8.

Table 8: The agenda of the Zurich Workshop

Saturday, 19 March 2014		
09:00	*Arrival of stakeholders and project partners*	
09:15	Welcome note	*Christoph Hugi, FHNW*
09:20	Introduction of participants	*All*
09:30	Introducing the EcoWater concepts: Relevance and research relating to urban case studies	*Christoph Hugi, FHNW*
09:45	Presentation of eco-efficiency assessment for the baseline scenario	*Olga Steiger, FHNW*
10:30	*Coffee break*	
11:00	Challenges of enhancing meso-level eco-efficiency:	*Dionysis Assimacopoulos,*

	closing the urban water cycle	*NTUA*
11:30	Discussion on following questions: *Is the introduced concept relevant for Waedenswil?* *Which aspects could become more relevant in the future?* *Which are possible areas for improvement, technologies or measures?*	*All participants*
12:30	*Lunch with stakeholders and project partners*	
13:30	Presentation of potential technologies to be discussed	*Claudia Niewersch, FHNW*
13:50	*Discussion of eco-efficient measures for water supply stage and distribution stag – Drivers and barriers, cost and benefits* *Discussion of eco-efficient measures for water use stage – Drivers and barriers, cost and benefits* *Discussion of eco-efficient measures for wastewater treatment stage – Drivers and barriers, cost and benefits*	*All participants*
15:15	Wrap up	*Christoph Hugi, FHNW*
16:00	*End of workshop*	

2.5.2 Discussion summary

Welcome note and presentation of the EcoWater project

Christoph Hugi (FHNW) welcomed the participants of the Workshop, followed by an introductory round of all the participants. Afterwards, he presented the EcoWater Project including general information, the meso-level perspective of the case study and also the connection to the river basin management framework, which was proposed in Switzerland. The presentation continued with the goals of the Workshop and the evaluation of the meso-level eco-efficiency results of the Waedenswil case study.

Presentation of the baseline eco-efficiency assessment

Olga Steiger (FHNW) presented the assessment of the baseline of the Waedenswil case study, which included the following:

- Definition of eco-efficiency;
- Methodology and state of work and progress made in the project;
- System boundaries of Waedenswil Case Study;
- Eco-efficiency indicators;
- Assessment of the total value added;
- Assessment of environmental impacts;
- Results of the eco-efficiency assessment;

- Next steps and conclusions.

The presentation was followed by a short discussion on the application of the eco-efficiency methodology in the Case Study area. One participant (AWEL) mentioned that the application of technologies and measures will take place on the micro-level in contrast to the meso-level eco-efficiency assessment.

Presentation on challenges of enhancing meso-level eco-efficiency: closing the urban water cycle

Dionysis Assimacopoulos (NTUA) presented some of the challenges of enhancing meso-level eco-efficiency e.g. closing the urban water cycle. In the light of current challenges in the water sector, the possible and necessary change from traditional urban water management, to a new management paradigm with alternative approaches, was shown. He also mentioned the suitable tools for that change, namely multi-sourcing, cascading, recycling and reuse, and finally closing loops. Afterwards, a cross-comparison of the eco-efficiency assessments of both urban case studies was presented in terms of resource efficiency, pollution prevention and promoting circular economy. The presentation ended with the description of knowledge gaps, transitional, technical and political factors

Discussion on the eco-efficiency concept

The discussion on the eco-efficiency concept consisted of two parts. In the first one, the key points concerning the methodology of the eco-efficiency analysis and the options/improvements, which can be implemented, were discussed. In the second one, the potential of new ideas were examined, such as the incentives for water saving measures.

The following key-points were discussed during the first part of presentations:

- It was suggested that the eco-efficiency methodology is useful mainly for politicians. **Christoph Hugi** (FHNW) agreed that mainly administrative institutions would apply this concept, but actors, such as operators of plants, should also be included in this study as they are the ones putting the options into action.
- The operator of the WWTP gave feedback for the recovery of heat from the biological wastewater treatment and the usage for heating of the houses close to the WWTP. This option had already been applied.
- It was pointed out that the project should aim at an overall concept, and not at a single point option for the Case Study, as these options could not be a value added Project output for the municipality of Waedenswil.
- Furthermore, participants asked about examples of barriers to the improvement of the Case Study eco-efficiency, and what the efficiency of water usage was, at that given moment. **Dionysis Assimacopoulos** (NTUA) answered that it is still under investigation in the project and a clear answer cannot yet be given.
- It was highlighted that the cross-comparison of the water cycles in different places in Europe was a very interesting procedure for the actors in

Waedenswil. Eco-efficiency was estimated to be significant higher in Switzerland and central Europe than in other European regions. Yet a transfer of knowledge and experience could be beneficial for all.

- Although comparisons are important, **Olga Steiger** (FHNW) mentioned that the main objective of the Workshop was to discuss the Case Study Wädenswil. It was expected that the environmental impact of Waedenswil would be quite high in comparison to Sofia, as the water is pumped in Waedenswil. But this was not the case, mainly due to the fact that the energy mix in Switzerland is based on hydropower compared to Bulgaria. In conclusion, the application of this systemic approach could be useful and misleading at the same time, compared to the specific energy consumption. Subsequently, the eco-efficiency in Switzerland could be improved by the installation of separated sewer systems (rainwater / wastewater).
- It is relevant to notice that Switzerland already mainly produces/uses "clean" electricity. Hence it could not seem that important to save electricity comparing to other countries, as far as environmental impacts are concerned. However, it should be also taken into consideration that part of the used electricity in Switzerland is imported from other countries, which produce electricity from coal, for example. These imports take place especially during the night.
- Two levels should be distinguished:
    - Point options of individual decision makers;
    - Concepts and methods for a holistic approach.
- It is very crucial to investigate if the proposed indicators are useful instruments, and if they give plausible results.
- Switzerland has geographical advantages so there is potential for improvement or investigation of options. For example, it could be more beneficial to build a separate line from Frutarom to WWTP instead of building own WWTP in Frutarom.
- It would be also interesting to get information about the experiences in Greece, for example, as it is a very dry country. Drinking water is transported over large distances, which leads to high energy consumption. Some mistakes/non-systemic solutions were adopted in the past, such as the fact that WWTP was built on an island and sludge was discharged into the sea. Obviously, improvements were required into the past years and nowadays discussion about water reuse starts.

Presentation of potential technologies to improve the eco-efficiency

Claudia Niewersch (FHNW) presented a list of technologies, which have the potential to improve the eco-efficiency on meso-level, if implemented to the stages of water supply and distribution, water use, and wastewater treatment. Among these technologies were:

- Energy efficiency in drinking water distribution network;
- Water saving appliances for households;

- Cleaning in Place (CIP) for companies;
- Heat recovery from wastewater;
- Phosphorus recover;
- Removal of micropollutants.

The following points were discussed about technologies:

- **Heinz Koller** (AWEL) does not see any potential of improvement of the process, and in his point of view the amortisation period should be taken into account. He noted that the project should focus on the methods rather than options.
- A turbine was suggested for the WWTP effluent head to the lake surface in order to recover energy as a non-point option on meso-level, as it addresses directly to more than one actor. Benefits from energy recovery should be transferred to the drinking water sector.
- The main issue raised by the participants from Wädenswil was the synergies that could be useful from their point of view:
    - Separate networks for rain water and wastewater;
    - Using wastewater from SMEs (indoor swimming pool, Frutarom);
    - Individual wastewater lines for some SMEs.
- It was also highlighted that the options are known, and the main restriction is payback time of less than two and a half years, required for industry. All options, which are efficient and fulfil the financial requirements, are implemented. Ideas for supporting implementation of eco-efficient measures were mentioned, such as building up of transfer instruments similar to CO_2-certificates (environmental reduction units) and financial incentives based on these instruments instead of fees. Another important point was the implementation of incentives for water saving measures. Without them, water savings will not lead to any benefit since the drinking water production is mainly driven by fix costs and increased tariffs, which as a result, reduce the financial benefit.
- It was pointed out that the WWTP can now cover already 40% of its energy consumption using the biogas production from sludge. The WWTP is now more cost efficient (prices could be reduced by 20% over the last few years). Simultaneously, the incentives for water savings were very low and not driven by WWTP. The technological level is very high, but there is no concept to save water usage on a long-term horizon. The meso-level approach could help to implement a system of incentives in order to reach a lower level of drinking water consumption on a long-term perspective. The problem is whether this is well accommodated by the existing system.

2.5.3 Workshop conclusions

The Zurich Workshop provided significant information as far as the Case Study development process is concerned. The most important conclusions reached at the event included the following:

- The individual stages of the water system in Waedenswil have already a high standard, and operate eco-efficient to a large extent. Costs are continuously declining and the latest technologies are known and implemented on a regular basis. The question is whether the system as a whole could be improved. Such aspects are not addressed currently.
- The actors and stakeholders in Waedenswil are already interlinked in order to ensure an efficient function of the system. Visions of potential future systems were not discussed.
- Driving forces or initiatives to foster innovative pilot projects are missing, as well as someone who will bring in new ideas and inputs, and will assess the different needs of different actors.
- Some actors lack of motivation to implement innovations beyond the necessary measures.
- The option of energy recovery through the turbine in the WWTP effluent should be assessed. Potential bachelor thesis as a first step is foreseen.
- Financial compensation options (in form of financial incentives) for SMEs, which aim at efficient water use by reducing fees, should be evaluated.
- Future scenarios should not start from a one-point-technology option, but from a broader vision for the whole urban water system of the case study area. Based on these water cycle scenarios with objectives, appropriate water systems and combination of technologies should be analysed.
- One possible long-term water cycle scenario for Waedenswil could be the re-dimensioning of the water system, as a consequence of efforts towards a closed loop economy with advanced water reuse and recycling in industry.

2.5.4 List of participants

Both Project Partners and local stakeholders participated in the first EcoWater Workshop. Table 9 lists the Workshop participants.

Table 9: The Zurich Workshop participants

Actor/stakeholder	Agency /Organisation
Ksenija Jurinak	Office of waste, water energy and air Canton Zurich (AWEL) *Division Environmental management in industry*
Richard Haueter	Office of waste, water energy and air Canton Zurich (AWEL) *Division water and water bodies management*
Heinz Koller	Office of waste, water energy and air Canton Zurich (AWEL) *Division Environmental management in industry*

Emmi Nemeth	Office of waste, water energy and air Canton Zurich (AWEL) *Division Environmental management in industry*
Titus Zoller	Departmental manager wastewater municipality of Waedenswil
Gian-Pietro Giacomini	Technical director WWTP Waedenswil/ Rietliau
Rolf Baumbach	Departmental manager drinking water municipality of Waedenswil
Peter Schacher	Technical director water treatment plant Hirsacker-Appital
Renato Colombi	Manager technical services Frutarom Switzerland Ltd.
Bertram Zichel	Environmental consultancy
Thomas Wintgens	University of Applied Sciences Northwestern Switzerland
Rita Hochstrat	University of Applied Sciences Northwestern Switzerland
Project Partner	**Affiliation**
Dionysis Assimacopoulos	NTUA
Thanos Angelis-Dimakis	NTUA
Michiel Blind	Deltares
Les Levidow	Open University UK
Irina Ribarova	UACEG
Peyo Stanchev	UACEG
Claudia Niewersch	FHNW
Christoph Hugi	FHNW
Olga Steiger	FHNW

3 2nd Round Events

This section presents the 2nd round events of the EcoWater Project. The Workshops are presented in a chronological order, accordingly to the dates that were held.

3.1 The Sofia Workshop

3.1.1 Introduction

The second Urban Case Study Workshop was carried out in Sofia (Bulgaria), on 3rd April in 2014 and aimed at bringing together national stakeholders with EcoWater project partners, in order to exchange views and knowledge on eco-efficiency potential improvement of urban water systems. The agenda of the Workshop is presented in Table 10.

Table 10. The Agenda of the 2nd Sofia Workshop

Session 1: Workshop		
09:00	Welcome to all	*UACEG*
09:10	**1st day - Presentation 1**: Introduction to the 3rd EcoWater Annual Meeting and welcome to local SHs	*Dionysis Assimacopoulos, NTUA*
09:30	**1st day -Presentation 2:** Innovation policy of the Sofia water operator	*Veolia*
10:00	**1st day -Presentation 3:** Summary of the WSs held in Zurich and Sofia	*Christoph Hugi, FHNW*
Session 2: Review of the Project progress **(a) Overview of the Urban Case Studies** **20 min presentations per CS and 30 min discussions with local SH**		
10:15	**1st day -Presentation 4:** Case Study 3: Sofia urban water	*Peyo Stanchev, UACEG*
10:35	**1st day -Presentation 5:** Case Study 4: Zurich urban water	*Christoph Hugi, FHNW*
10:55	*Coffee Break*	
11:10	**1st day -Presentation 6:** Discussion and cross-comparison of results from the Urban Case Studies	*Christoph Hugi, FHNW Moderator*
(b) Overview of Industrial Case Study progress **20 min presentations per CS and 30 min discussion**		
11:40	**1st day -Presentation 7:** Evaluating water footprint	*Sara Skenhall, IVL*
12:00	**1st day -Presentation 8:** Case Study 8: Volvo automotive industry, Sweden	*Sara Skenhall, IVL*
12:20	**1st day -Presentation 9:** Case Study 7: Danish Dairy sector	*Palle Lindgaard-Jørgensen, DHI*
12:40	**1st day -Presentation 10:** Case Study 6: Cogeneration of electricity and thermal energy in the Amsterdam-Rhine Channel, The Netherlands	*Michiel Blind, DELTARES*
13:00	Lunch	
14:00	**1st day -Presentation 11:** Case Study 5: The textile industry in Biella, Italy	*Anna Balzarini, MITA*

14:20	**1st day -Presentation 12:** Discussion and lessons learnt from the relevant industrial sectors	*Palle Lindgaard-Jørgensen, DHI, Moderator*
(c) Overview of Agricultural Case Study progress 20 min presentations per CS and 30 min discussion		
14:50	**1st day -Presentation 13:** Case Study 1: Sinistra Ofanto, Italy	*Mladen Todorovic, MAI B*
15:10	**1st day -Presentation 14:** Case Study 2: Monte Novo, Portugal	*Rodrigo Maia, UPORTO*
15:30	**1st day -Presentation 15:** Discussion and cross-comparison of results from the agricultural Case Studies	*Mladen Todorovic, MAI B, Moderator*
16:00	*Coffee Break*	
Session 3 - Methodological issues for the next research activities (a) Roundtable Discussions		
16:15	**1st day -Presentation 16:** Upcoming Research Activities (technology scenario assessment, cross-case study assessment, policy recommendations)	*Dionysis Assimacopoulos, NTUA*
16:45	Round table discussion – Parallel (one per sector) roundtables on upcoming research activities	*All*
18:30	End of the Workshop	

3.1.2 Discussion summary

Session 2a: Urban case studies

Christoph Hugi (FHNW) presented a preliminary cross comparison of the two urban case studies and highlighted that citizens generate nitrogen (N) and phosphorus (P). What is showed in the graphs is the dynamics of P and N through their path in the system.

Irina Ribarova (UACEG) then, replied to **Galina Dimova's** (UACEG) question whether the P entering the system with the rain due to the flush of the streets is considered, by saying that rain flows are external of the system. It is interesting to model them because of the threats of extreme events and their mitigation in the future, but it is also assumed that they will stay unchanged in all scenarios, so they were not considered in the model of the Sofia water system.

As far as the high water losses in Sofia urban system is concerned, **Teodora Todorova** (SH) explained that these are not only physical losses, but all unaccounted water quantities. **Bernard Barraque** (external advisor) mentioned that even in Paris a recent study showed that about 10% of the water meters do not work properly and mislead the analysis.

Christoph Hugi (FHNW) stated that physical losses, however, are important. Attention should be given to pipe age and to the fact that pipes actually account for 2/3 of the investment costs. Their lifetime is about 50 years and in order to avoid high physical losses, the pipes should be replaced on time.

In the end of the session 2a, **Irina Ribarova** (UACEG) mentioned that during the first Sofia workshop, local stakeholders were asked to discuss the technologies identified

in EcoWater project as well as to suggest other possible innovative technologies that might be relevant for the Case Study. Three proposals were made:

- Extending of one of the selected technology, pressure reducing valve, which is energy generator with considering of small hydropower plant on the pipe, feeding water treatment plant.
- Extending of the technology “heat recovery from households” with “heat recovery from the sewerage system using heat pumps”.
- Replacement of the technology for solar sludge drying with a technology for sludge incineration.

3.1.3 Workshop conclusions

This workshop gave the opportunity to the local stakeholders to get a better overview of the entire project. They have participated actively in the formal discussions, as well as in the informal talks during the breaks. The representative of the water operator presented the practices and the vision of the company with regard to environmental protection. This enabled project partners to understand better the local situation and to assess the eco-efficiency potential of the urban system of Sofia.

The second EcoWater urban case study (Zurich) was introduced to the local stakeholders. Comparison of the two case studies was useful for them, which could be used when decisions on improvements are to be taken.

3.1.4 List of participants

Table 11. The 2nd Sofia Workshop Participants

Actor/Stakeholder	**Organization**
Teodora Todorova	Sofiyska voda
Jelyaz Rangelov	Sofiyska voda
Gerge Terzov	Ministry of Environment and Water
Emilija Georgieva	Ministry of Environment and Water
Svetlana Yordanova	Ministry of Economics and energetics
Valentina Ilieva	Ministry of Economics and energetics
Zdravko Georgiev	NGO Sofena, energy efficiency
Irina Ribarova	UACEG
Peyo Stanchev	UACEG
Ralitsa Lambeva	UACEG
Galina Dimova	UACEG
Albena Popova	UACEG
Project Partner	**Affiliation**
Palle Lindgaard-Jørgensen	DHI

Les Levidow	Open University UK
Sara Alongi Skenhall	IVL
Michiel Blind	Deltares
Mladen Todorovic	CIHEAM-IAMB
Andi Mehmeti	CIHEAM-IAMB
Christoph Hugi	FHNW
Dionysis Assimacopoulos	NTUA
George Arampatzis	NTUA
Thanos Angelis-Dimakis	NTUA
Anna Balzarini	MITA - Biella
Bernard Barraque	Member of the EcoWater Advisory Board
Cristina Silva	UPORTO
Rodrigo Maia	UPORTO

3.2 The Gothenburg Workshop

The second Automotive Industry Workshop took place on the 6th of May 2014. It was organized by IVL at the office of IVL, Aschebergsgatan 44, Gothenburg, Sweden. The workshop was held in Swedish to promote fruitful and open discussions between the participants.

3.2.1 Scope of the Workshop

The aim of the Workshop was to show project development and results achieved after the first workshop, which was held in April 2013. Another aim was to continue the dialogue between the EcoWater project partners and the actors/stakeholders of the Volvo water value chain, getting their views on policies to promote the implementation of eco-efficient technologies. In particular the Workshop focused on:

- Presenting results from the baseline eco-efficiency assessment and the technology scenarios.
- Revisiting the results of the PESTLE analysis from the first workshop and make any necessary updates.
- Framing future scenarios using a step-by-step methodology which was under development in EcoWater.

The Workshop agenda (Table 12), covered half a day of group discussion and activities ending with a joint lunch.

Table 12. The Agenda of the Gothenburg Workshop

Tuesday, 6 May 2014		
08.15	*Arrival and registration*	
08.30	Welcome note and agenda of the day.	*Åsa Nilsson, IVL*
	Around the table presentation of participants.	*All*
08.40	Brief overview of EcoWater methodology and tools.	*Åsa Nilsson, IVL*
	Presentation of baseline results and modelled technology scenarios.	*Åsa Nilsson and Sara Alongi Skenhall, IVL*
	Questions and discussion. Interactive session: Ranking of the most important PESTLE factors, estimation of their future states and mapping of interactions.	*All participants*
10.00	*Coffee break*	
10.10	Interactive session: Formulation of plausible future scenarios based on most important PESTLE factors. Interactive session: Scoring of technologies in light of selected future scenarios. Discussion topic: What policies are needed to promote implementation of eco-efficient technologies? Discussion topic: How can the methods and tools from EcoWater increase the cooperation between local actors?	*All participants*
11.20	End of Workshop - Summing up.	*Åsa Nilsson, IVL*
11:30	*Joint lunch*	

3.2.2 Discussion summary

Welcome note and presentation of participants

The Workshop started with a welcome by **Åsa Nilsson** (IVL), followed by a round the table introduction of participants, information about the Workshop agenda and the scope of the Workshop.

Brief overview of EcoWater methodology and tools

Åsa Nilsson (IVL) presented the context of EcoWater as a reminder to the local actors. This was followed by the 3 minute animated movie about EcoWater and an overview of the project methodology and its modelling tools. The feedback from Workshop participants was that their understanding of what the project is about was really enhanced by viewing the movie.

Presentation of baseline results and modelled technology scenarios

Åsa Nilsson and **Sara Alongi Skenhall** jointly presented the baseline results and assessment of technology scenarios for Case Study 8 (Automotive Industry). It was highlighted that:

- The case study includes two separate water value chains.

- The freshwater resource depletion indicator is currently evaluated only for the foreground system. Absolute water use in the background system can also be visualized, although not shown in the presentation. Since it is not always possible to know the geographical location of water withdrawal, the freshwater depletion indicator cannot be calculated for the background system in the same way as for the foreground system (using water exploitation index).
- The breakdown of environmental impact per stage shows that the potential for improvements is largest if technology is implemented by Volvo Trucks, either in the water use stage or in Volvo's own water and/or wastewater treatment. Thus the investigation of new technologies has focused on technology implementation at Volvo Trucks.
- Spider charts of environmental impact and eco-efficiency show slight improvement in most indicators but in the same time a few indicators deteriorate slightly.

In discussion about results:

- **Tomas Rydberg** (IVL) pointed out that the improvements to be made by a new technology seem small when looking at the whole system. It could be interesting to complement the report with results broken down for each water value chain of CS8, looking at the technologies implemented in the respective parts of the whole system.
- Wastewater composition will change if Volvo replaces the phosphating with a silane-based corrosion process. **Christina Öjersson** (Stena Recycling) noted that the recycling company would appreciate being early informed from Volvo when they do test runs of such technology and get samples of wastewater. It is of high importance that Stena Recycling gets to know what kind of wastewater to expect from Volvo, so that they can plan for this well in advance before it happens. Depending on the change in composition, it could affect the cost for treatment.

Interactive session: Ranking of the most important PESTLE factors, estimation of their future states and mapping of interactions.

The PESTLE factors that had been identified at the first CS8 Workshop were revisited. The Workshop participants jointly ranked them category by category, according to their importance for implementation of a new technology. Additional factors were proposed by the participants, in case these were missing from the initial list and were considered important. The top two factors for each category are presented in Table 13.

Verified product quality ranked as the highest of the Technological factors. In relation to this, and after a discussion about the value of corrosion protection to the final product of Volvo Trucks, **Anders Axell** (Stena Recycling) reminded about an historical incident at Volvo Trucks in the seventies. Back then, the majority of a production line had to be withdrawn from the market, when it turned out that changes in the process for corrosion protection did not result in sufficient quality.

Table 13. Top 2 ranked PESTLE factors per category

Category	Rank	Factor
Political	1	Innovation climate in EU, and access to innovation agenda
	2	Concern for scarce resources (P, metals..)
Economic	1	Competitive advantage
	2	Business models for longer pay-back time of investments
Social	1	Safety, work environment and knowledge of personnel
	2	Cooperation among the actors in the supply chain
Technological	1	Verification of product quality with new technology
	2	Profitability from new technology
Legal	1	BAT
	2	Water directive
Environmental	1	Use of persistent chemicals
	2	Climate change

Interactive session: Formulation of plausible future scenarios based on most important PESTLE factors.

As an example of how to construct the future technology scenarios, three of the most important factors from the PESTLE ranking were selected. The plausible future states of those were identified. Each factor and its states were then systematically compared with all the others in order to map the effect it would have on the other factors and states. This resulted in a relation matrix which can be used to withdraw all possible combinations of plausible future scenarios for the selected factors.

Interactive session: Scoring of technologies in light of selected future scenarios.

The scoring of eco-efficient technologies is based on the assessment of how the states of each factor affect the implementation of the respective technology. A score of -3 to 3 is assigned depending on whether the state of a factor is a barrier (negative value) or a driver (positive value) for implementation. The scoring of technologies for a specific combination of factors (a set making up a plausible future) reveals the possible need for policies. Technologies with high scores are likely to be implemented while those with comparatively low scores may need policy instruments in order to reach implementation.

Due to lack of time, this session was not fully completed, but it was briefly overviewed how the project could provide a systematic methodology for pin-pointing the need for policies, to promote implementation of eco-efficient technologies.

Discussion topic: What policies are needed to promote implementation of eco-efficient technologies?

The Workshop ended before there was a chance to address this question.

Discussion topic: How can the methods and tools from EcoWater increase the cooperation between local actors?

The Workshop ended before there was a chance to discuss this topic. However, it was discussed further during the lunch and it was noted that both Stena Recycling and Volvo Trucks view this project and its tools as a means for initiating discussions. **Christina Öjersson** (Stena Recycling) said that they are very interested in having increased collaboration with Volvo (and all Stena's customers) in order to find the best solutions to waste treatment at an early stage. Involvement, even before technology selection/implementation, is very much appreciated.

3.2.3 Summary of outcomes and next steps

The assessment of factor interdependencies, the combination of plausible future scenarios and the subsequent scoring of methodologies is a task to be completed. It is realized that this would be time consuming and not fit within the limited time of a workshop. So the Workshop simply provided the chance to test the systemic approach for a few factors. It was agreed during the Workshop that IVL shall make the rest of this assessment as an internal exercise and then communicate the results to the local actors for feedback and comments.

The systematic approach is visualized in Figure 3.

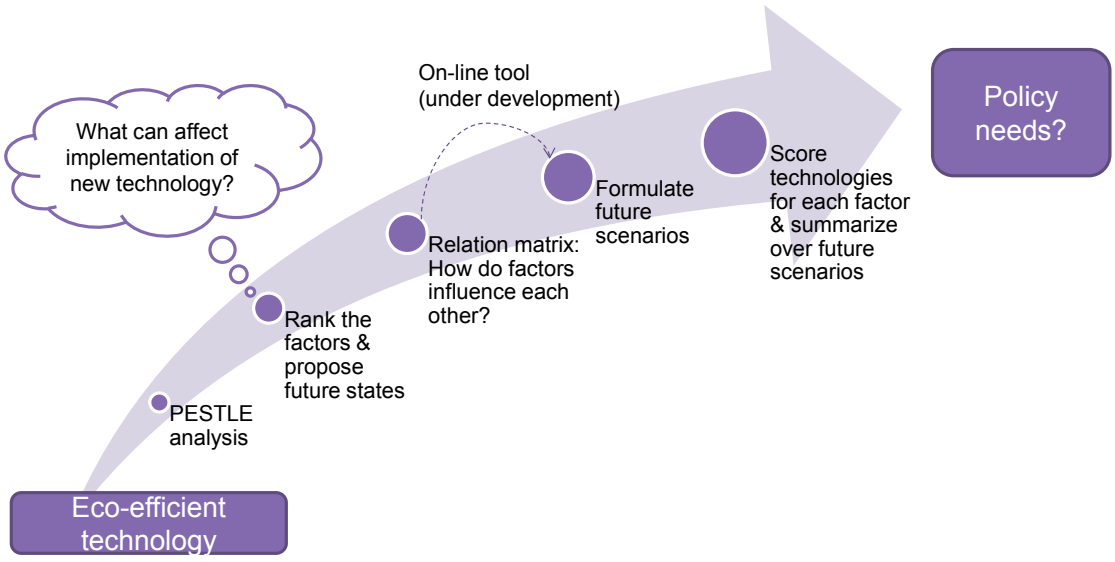

Figure 3. Systematic approach to analyse the policy need for promoting implementation of eco-efficient technology.

3.2.4 List of participants

Table 14 lists the Workshop participants.

Table 14. List of participants

Actor/stakeholder	Agency/organisation
Nils Lindskog	Project leader and senior expert at Volvo Technology, Sweden. Involved in technology development projects of Volvo Trucks.
Berndt Albinsson	Environmental and energy coordinator at Volvo Trucks, Sweden, the Gothenburg site. Industrial actor of the case study. (Had to make a last minute cancellation of planned attendance. Not present at the workshop.)
Katarina Hoflund	Technical expert at Volvo Trucks, Sweden, the Gothenburg site. Industrial actor of the case study.
Anders Axell	Hazardous waste treatment, Account manager at Stena Recycling, Sweden. Stena Recycling is the contractor for treatment of process wastewater from Volvo Trucks, Gothenburg.
Christina Öjersson	Coordinator, hazardous waste, at Stena Recycling, Sweden.
Project Partner	**Affiliation**
Åsa Nilsson	IVL
Sara Alongi Skenhall	IVL
Tomas Rydberg	IVL
Uwe Fortkamp	IVL

3.3 The Vejle Workshop

The EcoWater Workshop took place in Vejle (Denmark) on the 23th of June 2014 and concerned the dairy industry. The objective of the Workshop was to present to the participants the concept of eco-efficiency and the ongoing project "Water Efficient Dairies". The overall program of the one day Workshop is presented in Table 15.

Table 15: Agenda of the Vejle Workshop

Monday, 23 June 2014		
09.00	Arrival and start of workshop	
09.15	Welcome note and introduction to the agenda	*Palle Lindgaard-Jørgensen, DHI*
09.30	Introduction of participants	*All*
09.45	Innovative regulation of dairy production	*Claus Heggum, Agriculture and Food Association and Jeppe Boel, Danish Technological University-Food*
10.15	Result of water audit and status for water reuse in the dairies participating in the project " Water Efficient Dairies"	*Martin Andersen, DHI and Finn Skov Nielsen, Krüger*

10.45	Technologies to increase water efficiency and reuse in the dairy industry- discussion among stakeholders on potential technologies	*Gert Holm Kristensen, DHI and Martin Rygaard, Danish Technological University- Environment and Resources*
11.45	Status of work on EU BREF work on dairies	*Henrik Borg Kristensen,*
12:00	*Lunch break*	
14:00	Presentation of system level eco-efficiency assessment and scenario tools and methods for the dairy industry	*Palle Lindgaard-Jørgensen, DHI*
14.30	Summary and end of workshop	*Palle Lindgaard-Jørgensen, DHI*

3.3.1 Discussion summary

Welcome note and presentation of the EcoWater project

Palle Lindgaard-Jørgensen presented the agenda of the meeting. The meeting presented the modelling and the results of the EcoWater Project and of the ongoing project "Water Efficient Dairies" as the stakeholders involved in both projects are almost the same. Most presentations and slides were in Danish.

Innovative regulation of dairy production

The EcoWater and "Water Efficient Dairies" projects attempt to assess and develop technologies in order to reduce the amount of water, which is contained in the milk (namely as Milk-Water). According to the EU regulation, it is compulsory that the water used in dairy processes meets the water quality standards of potable water and it must be proven that the use of other types of water like e.g. milk-water does not lead to any risks for the food product safety. The safety of any use of alternative water sources has to be documented in a HACCP analysis (Hazard and Critical Control Point). However, USA and Canada have developed some quality criteria for the use of Milk-Water in the dairy plant. Both USA and Canada have set up regulations for three types of milk-water use (replacement of drinking water, use for steam production, pre-treatment of equipment and heat exchange with no contact with the product). **Claus Heggum** and **Jeppe Boel** placed emphasis on the need to test for microorganism's growth in milk-water and to test relevant technologies (which could further safeguard the quality of the water- like UV, hydrogen peroxide and additional heat treatment). It was noted that the quality of the milk-water is very crucial not only at the time of its separation phase from the milk but also when it is stored for later use in the dairy.

The discussion was focused on the branch specific agreements on which type of water can be reused and the relevant technologies required to meet the standards of drinking water. To that point, the participants also mentioned the necessity for innovative monitoring technology. The food authority claimed that they are ready to look at branch specific codes where the drinking water is replaced by e.g. "Milk Water".

The dairies which participated in the workshop stated that they are ready for water saving actions as they use more milk-water in dairy processes. According to their

statement, there is no risk for the food safety of the product. Furthermore, the technology proposed is well documented and the pay-back time for the technology is acceptable.

Result of water audit and status for water reuse in the dairies participating in the project "Water Efficient Dairies"

EcoWater and "Water Efficient Dairies" projects map the water uses in dairy industry. In EcoWater project, the water use is split into two categories only:

i) Technical utility water, which after conditioning is used for heating, cooling and other uses where it is in no contact with the product, and
ii) Process water, which is either groundwater or surface water, separated from the milk – the so-called "Milk-Water".

Innovative technologies which may be able to improve the resource efficiency were proposed and it was also highlighted the need to have more detailed information on the water use in each specific process of the dairies. **Martin Rygaard** (DTU) and **Finn Skov Nielsen** (Krüger) presented both the overall water uses and a more detailed spilt of water uses in HOCO dairy plant (the 7th Dairy EcoWater Case Study) and other dairies involved in the project "Water Efficient Dairies".

The HOCO dairy plant produces milk powder, while other dairies produce cheese or a mix of dairy products. Overall water efficiencies in dairies vary according to:

i) Product (powder, cheese or milk or mixed dairy products),
ii) Technology used in the production and the age of the production equipment, and
iii) Efforts to reduce water use (the main driver has been company environmental policies (like in Arla dairies)) or price for discharge of waste water (which is substantially higher than the price of purchasing the production water).

The share of water used for technical utility and production also varies. The technical utility water use accounts for 10-15% of total water use, the production water, including CIP, for 70-80%, while other water uses varies from 6-8 %. It should be noted that in a dairy company the water use is as high as 34%, which may be caused by lack of water meters or by inadequate work.

The expected outcomes of the water mapping activities is a better benchmark of water uses and the identification of options' implementation points to reduce the water use. Some water streams in the production chain contain valuable product and other reusable chemicals and heat, which may be reused in the production.

To sum up, the discussion was focused on the data availability and the need to both introduce more water meters in the production and to utilize water meter data better. Another issue was the lack of data on water quality (data availability is limited to the temperature of the process water and in some cases also turbidity) and the different water streams (which for some process streams is available as on-line data while other data is only monitored daily of weekly).

Technologies which promote water efficiency and reuse in the dairy industry

The discussion in this session centered on innovative technologies for dairy industry to increase water resource efficiency. In particular, both aforementioned projects had

identified a number of technologies improving water, resource and economic efficiency while the environmental impact from processes can be controlled. Table 16 provides a summary of technologies and the project which explores the potential of the technology.

The discussion focused also on the technical, economic and environmental feasibility of the proposed technologies. Most of them have been applied and tested in full or lab scale. However, the documentation of actual water reduction and energy use, may be limited or in some cases lacking. These technologies also need local adaptation to the conditions of each dairy. As far as the water meter installation is concerned, the key question was about the best location, in order to meter the water flow, and the software that supports metering processes and shows data.

One of the options discussed was monitoring the actual present water use and use a benchmark in e.g. the canteen or the production hall with the aim to optimize the water use and stop wastage. Optimizing water use often requires additional energy usage and use of additional processes and chemicals. Therefore, there is a need to assess the economic and environmental feasibility of such investments with a standardized manner. A methodology for doing so was presented and discussed in the last presentation of the workshop.

Table 16: List of proposed technologies

Type of technology application	*Technology to be assessed*	*Assessed in EcoWater Project*	*To be assessed in "Water Efficient Dairies" Project*
Water use mapping	Water meter installation		X
	Use of water meter data	X	X
Production optimization of water use and reuse	Anaerobic treatment of waste water	X	
	Advanced oxidation of RO permeate	X	
	Product and water recovery from CIP	X	X
	Cleaning and reuse of condensate	X	
	On-line bacteria monitoring		X
Testing of feasibility of technology	Advanced oxidation of RO permeate		X

EU´s work on BAT/BREF for the dairy industry and Directive for Water Reuse

This part of one day workshop focused on issues to related EU´s work on BAT/BREF for the dairy industry. The EU Commission works on the development of BAT Reference Documents for the Dairy industry. For that reason, a questionnaire had been sent to the EU Member Countries and distributed to dairies and projects (a.o.

EcoWater and “Water Efficient dairies) to collect basic data on water use and waste water discharges. Based on this survey, the EU Commission will take its next step and look at technologies that may be considered as best practice. **Henrik Borg Kristensen** stated that the organization, in which he works, collaborated with Arla and they were going to use the results from the project as an input to the EU BREF work. He also informed the workshop participants that the work on the EU Directive on Water Reuse had been delayed and that further work will be undertaken by the EU Commission. Right now it is not known whether and how water reuse in the industrial sector will be addressed.

Eco-efficiency of water use and reuse in dairies

The EcoWater model (SEAT and EVAT) which was developed in cooperation between DHI and the National Technical University of Athens was presented by **Palle Lindgaard-Jørgensen** (DHI). The model was set up for the Arla dairy in Holstebro (HOCO) which produces milk powder as its main product, and is focusing on water and energy use. The model compares a baseline model representing the production, water and energy use in 2012, including a number of different technologies and a combination of technologies (Table 16). The economic performance of the production is measured using the Total Value Added to the product (product value minus inputs needed to produce the product) due to water use.

The selection of water and energy use as the main parameters to focus on, is based on an assessment, which uses a PESTLE analysis (PESTLE comprises of political, economic, social, technological, legal and environmental aspects). The PESTLE analysis looks both at the situation as it is today and in 10-15 years in the future. By using this approach, the focus areas of technology interventions were identified, as well as scenarios for the assessment of eco-efficiency.

In summary, the **discussion** on this topic focused on the applicability of technologies to dairies in general and on the model set-up. It was assessed that both economic and environmental impacts and resource use are relevant to dairies in general and that the model comprises the right elements (water supply, production stage, waste water treatment, biogas production and transport). As mentioned above in the discussion of technologies, there may be a need to split the production into sub-processes like CIP etc. The specific scenarios and the assessment of the eco-efficiency of the technologies are being discussed in separate meetings with HOCO. Most likely the assessment of eco-efficiency of technologies will be one aspect which will be taken into account in the decision of choice of technologies. Discussions with the municipal water company are also ongoing.

3.3.2 List of participants

The Workshop participants are listed in Table 17.

Table 17: The Vejle Workshop Participants

Actor/stakeholder	Agency/organisation
Jeppe Boel	DTU Danish Technical University Food
Zanne Dittlau	Food Agency, Ministry of Food
Lars Houborg	Ecolab
Claus Heggum	Agriculture and Food Association
Finn Skov Nielsen	Krüger
Niels H. Staunsbæk	Mammen Cheese
Helle Nielsen	Arla Foods
Henrik Borg Kristensen	Agriculture and Food Association
Ingermarie Jensen (DSS)	Tetrapak
Steen Schelle Jensen	Kamstrup
Jens Møibæk	Thise Dairy
Hans-Jørgen Andersen	Danish Technical University TU Environment and Resources
Martin Rygaard	DTU Danish Technical University Environment and Resources
Niels Malling Laursen	Nordex-Food
Søren Nøhr Bak	Grundfos
Esben Rahbek Gjerdum Pedersen	Copenhagen Business School
Niels Jacob Nyborg	Danish Dairy Association
Gert Holm Kristensen	DHI
Peter Askglæde Ellegaard	DHI
Karsten Lauritzen	DSS
Ditte Holse	Danish Nature Agency, Ministry of Environment
Søren Balling Engelsen	Copenhagen University
Project Partner	**Affiliation**
Palle Lindgaard-Jørgensen	DHI
Martin Andersen	DHI

3.4 The Biella Workshop

The second EcoWater Workshop for the textile industry took place in Biella, Italy on the 4th of November 2014. The agenda of the Workshop is presented in Table 18.

Table 18: Agenda of the 2nd Biella Workshop

09:30	Welcome (with coffee)	
10:00	Resume of the Slovenia conference	*Anna Balzarini, MITA(Biella)*
10:15	Where are we after 3 years project	*Anna Balzarini, Rosanna Spagarino, MITA (Biella)*
10:45	Stakeholder feedback (technical, socio-economic, political, and legal aspects) (Unit A) (Unit B)	*Mario Mancini (Tintoria Mancini),* *Anna Mello (Tintoria di Quaregna*
11:45	Looking forward to new ideas/opportunities	*Rosanna Spagarino, MITA (Biella)*
12:15	How to take advantage of the EcoWater results	*Anna Balzarini, MITA(Biella)*
12:45	End of the meeting	

3.4.1 Discussion summary

Slovenia's conference resume and discussion

Anna Balzarini (MITA–Biella) presented the experience from the 17th ERSCP (European Roundtable on Sustainable Consumption and Production 2014) "The Europe we want". The themes of the conference were presented and a copy of the paper focused on the Biella Case Study was given to the participants.

All participants looked through the paper, and especially the owners of the two textile industries which were used as a Case Study. **Mr. Mancini** and **Mrs. Mello** have shown special interest on the spider diagrams and asked questions in particular concerning the Human Toxicity. **Mrs. Mello** of Tintoria di Quaregna, said that the general feeling about the toxicity is not acknowledged by the consumers. The common knowledge does not consider the toxicity "by contact", but only in food; this is a lack of knowledge that can be filled only after education.

Mr. Mancini commented that considering the resource efficiency, it was not taken into account that one of the biggest problem for the dyeing industry is the impending scarcity of some chemical component resources, which will induce an increase of prices and of course also the need to look forward toward new systems of dyeing. Otherwise in the future the textile industry will most probably go back to natural colors (same as is the animal coats).

The stakeholders also commented on the presentation that was made during the conference. All the technology scenarios are interesting, but in particular those towards pollution prevention, and of course especially the use of Natural Dyes.

Mrs. Mello underlined that natural dyeing processes are highly sustainable for the environment, but at large scale it won't be sufficient for the global textile needs, where the human clothes are just a minimal part of the entire textile market.

Where are we after three years project

Overview of comments

Anna Balzarini (MITA) pointed out that the project is close to its completion and the collaboration with the Biella's stakeholder was extremely difficult. The satisfaction of the work was strongly affected by this reluctance, not only at the project level but also at the personal level. Therefore it was decided to continue the collaboration with those who have effectively interacted during the project. Of course limited participation is not good for the area of Biella and neither for Mancini and Quaregna dyeing industries. However, this cannot be altered in case counterparties have clearly expressed a preference for the isolated actions, individually and privately managed.

Anna Mello (Tintoria di Quaregna) mentioned that after 3 years of collaboration, she feels very sorry for the Industrial Union committee, where she was also active member until one year ago. She admitted that this type of institutions are complicated and have hierarchic decision processes, which create never ending decision making processes. Therefore, under these circumstances,` she believes that it is very difficult and unlikely to promote eco-innovation uptake.

Mario Mancini (Tintoria di Mancini) added that after 3 years of contacts with the EcoWater consortium, he has learned several things about eco-innovative technologies, and he would like to be able to implement some into his unit. So he would like to keep in contact with MITA and to be updated in case of new opportunities.

Specific questions

The following questions for **Mrs. Anna Mello** (Tintoria di Quaregna) were prepared in agreement with **Les Levidow** (OU), due to the fact that this company is the clearest example of product upgrading among the 8 case studies.

1) - How their grant application proposed to communicate its "Naturale" process to consumers, e.g. as benefiting human health and the environment?

> Answer: The company received a grant for upgrading the research inside their laboratory, and the customers have been informed about the human health benefits.

2) - How this strategy would change relationships in the post-production value chain (garment manufacturers, retailers, etc.)?

> Answer: The aim is to create a domino effect on other links in the chain. The results are not visible yet, but are expected soon.

3) - How this could counter the market-competition from low-priced allergenic fabric?

> Answer: Prices are high, and positive opportunities are not expected in the short-term in the field of market competition

4) - How this effort could increase income from the “Naturale” process, perhaps allowing the company to expand the process beyond the current one-fifth?

Answer: For the moment the situation is positive since it remains stable.

Stakeholder feedback (technical, socio-economic, political, and legal aspects)

(Unit A) The follow-up of the PESTLE exercise did not produce any result, partly because it was not accompanied by a comparison with other industries or even with members of the industrial union. Also the general economic conditions have further deteriorated in recent months. The industrial unit, for example, currently has the tanks for dyeing, which for the sake of eco-efficiency should be replaced, but the change is not feasible, as a new tank costs exactly as much as the company profit of one year. The banks are prepared to partially fund new technologies, so it is not a banking problem, but the textile industry’s problem. In fact, as sales are getting progressively worse, the industry may come to barely break even. In such a scenario it would be a disaster to create bank debts without being certain of being able to pay due fees. Local institutions do not help, because they do not have funds available, and most importantly, even if they had, the bureaucratic procedures are so long that the technologies are already obsolete at the time of use.

(Unit B) The company has continued working fairly but with extreme fatigue, both to obtain work and to keep customers satisfied. The textile industries frequently prefer to send their goods to be dyed in areas where costs are lower, particularly in countries where the labour cost is low and the usage of chemicals not controlled. These end products bear the label "made in Italy", resulting in deception on commercial quality and safety for the consumer.

Looking forward to new ideas/opportunities

1. Great interest is placed in the association “Tessile e Salute” (Textile and Health - http://tessileesalute.it/). The Textile and Health Association, founded in 2001, is at the side of consumers, producers, agencies and organizations who care about the safety of textile products and footwear and protection of the label “Made in Italy”. It works in collaboration with the Ministry of Health, the NAS (great interest is placed in the association), the ASL (local health board) and the Office of Attorney to prevent and control the spread of harmful products on the market to the health of users. Several units are member of this association (among those interviewed during Ecowater project are: Botto Poala, Città Studi, Filidea, Finelvo, Cerruti, Marchi&Fildi, Successori Reda, Mancini, Unione Industriali Biellese)
2. There is another association which is working towards the sustainable use of resources. “The wool company”.

It is a brand that distinguishes the products manufactured in the Biella supply chain (Biella wool) on behalf of farmers in Europe and internationally. The most popular products are those made with environmentally friendly natural raw material, with the lowest environmental impact in the production phase and the utmost respect for human rights.

3. MITA personnel, following other projects experience, suggests to explore different possibilities for unusual opportunities, in an area that has to be developed. The example shown to the stakeholders is Puy du Fou (http://www.puydufou.com/). It is a thematic amusement park. In that case, the theme is historical, and the area is vast. In the area of Biella the scope is different, but there is an area available (much more limited) and in any case it is noted that at the beginning even of the Park Puy du Fou, the area was extremely smaller than the current one. The idea would be to create an environment of rediscovering Biella's textile, where one can see from the sheep up to the thread creation, then fabric and clothes etc.; creating a sequence of playgrounds where the production are as real, ending with a little store for sales. Having also a little place where people can really try to create fabric! In addition to the amusement park, this can be considered as an educational area and most likely could work as a catalyst for the revival of the textile industry. In any case, it would be essential to environmental education and innovation in the area, resulting in dissemination of knowledge on the use of resources, particularly water.

3.4.2 Workshop conclusions

All participants agree that any exchange of documents, information, conversations, meetings, including the two EcoWater Workshops were very helpful. Even though it

was obvious that the Biella textile industry does not promote eco innovative technologies, those who attended the workshop are aware that some of the ideas that came up during the last three years have been prosecuted and many other tips will be held in high consideration in the near future.

3.4.3 List of participants

The people who attended the event are briefly described in Table 19.

Table 19: The 2nd Biella Workshop Participants

Actor/stakeholder	**Agency/Organisation**
Anna Mello	Tintoria di Quaregna – Quaregna
Mario Mancini	Tintoria di Quaregna – Quaregna
Project Partner	**Affiliation**
Anna Balzarini	MITA – Biella
Martin Andersen	MITA – Biella
Rosanna Del Signore	MITA – Biella

3.5 The Sinistra Orfanto Workshop

3.5.1 Introduction

The Workshop was held in San Ferdinando di Puglia (at the Operational Center of Consortium per la Bonifica della Capitanata) on December 1st 2014. The scope of the event was to discuss with the farmers and other relevant stakeholders from the Case Study area the methodology and results obtained by the EcoWater project. The agenda of the Workshop is presented in Table 20. The meeting was followed by 20 farmers, managers of small cooperatives, agronomists and extension service staff of the Consortium (Table 21).

Table 20: The Agenda of the Sinistra Orfanto Workshop

	Monday, 1 December 2014	
10.30	Registration	
11.00	Welcome	*Mladen Todorovic* *Cammimo Mateo (CBC)* *Moro Osvaldo (CBC)*
11.10	Presentation of participants	*All*
11.20	EcoWater: Concepts, Research Framework and Case Studies.	*Mladen Todorovic*

11.40	Overview of the Sinistra Ofanto System**.** Methodology applied and data input for eco-efficiency assessment. Baseline eco-efficiency, new technologies and alternative scenarios.	*Mehmeti Andi*
12.00	Stakeholder feedback and discussion	*All*
13.15	Concluding remarks	*Mladen Todorovic*
13.30	End of Meeting	

3.5.2 Discussion summary

- The farmers were willing to participate in the Workshop and to discuss about the uptake of new technologies in agricultural water management. They have confirmed that they need such type of support and also the dissemination of knowledge about the latest technological solutions. Therefore, the concept of eco-efficiency is highly recognized by the farmers as a means to improve the sustainability of agricultural production.
- Farmers highlighted the lack of water availability for agricultural production and urged for increased water supply from the Consortium. They are ready to implement water saving technologies but they need more water to increase the economic benefits and to be competitive in the market.
- Most of farmers already implemented water saving methods and shifted from micro-sprinklers to drip irrigation. The farmers confirmed that this irrigation method supports more efficient watering and allows saving water, energy and fertilizers.
- Actually, some farmers are thinking to shift to subsurface drip irrigation. However, this step depends on many other issues and further investments not only in the irrigation system but also in the adoption of new (more profitable) crops and varieties.
- Farmers recognized they do not know when to irrigate and how much water to apply. In fact, they are applying water occasionally, following other farmers and empirical methods. Thus, they indicated that the use of smart technologies to improve on-farm irrigation scheduling is of primary importance.
- The overall perception of farmers is that they over-irrigate in many cases. They recognized that it causes several eco-efficiency problems such as: non rational use of water, overall reduction of water availability for other farms, lowering of the groundwater level, leaching of fertilizers and the reduction of their efficiency (which means additional application of fertilizers), pollution of groundwater, creation of pre-conditions for diseases and weeds, reduction of yield, reduction of added value and overall eco-efficiency.
- Farmers acknowledged that the precipitation is very variable in time and space in the last seasons and that they need a rain-gauge almost for each farm. They believe that the political will is fundamental for the implementation of new technologies in agriculture.

- The farmers do not know that a web-based irrigation support (IRRI-FRAME) is already available on the Consortium web site. After a discussion with the staff of the Consortium it was recognized that the tool is not yet at the level for adoption. Additional training is needed as well as the assistance of professional staff to implement and use the smart technologies for irrigation management on the ground. Both, the farmers and consortium staff, confirmed the lack of financial resources for the effective implementation of this tool. The farmers confirmed they are ready to cover the expenses of the implementation provided that the benefits of its use are clear, evident and immediate. Therefore, they expect that the initial funding during the implementation process should be provided by the regional/national/EU funds.
- Most of farmers use diesel pumps with power 10-15 kW to withdraw water from 40-100 m depth. They know that the electricity pumps are better in term of environmental impacts but there are many bureaucratic and economic constraints for the uptake of this technology. The farmers referred especially to the lack of electricity network in the fields and the high costs imposed by electricity provider company (ENEL) to connect to the system. Farmers claimed that for 300 m length of electricity line and connection they have to pay about 2700€ which is too much in respect to the cost of a new pump (about 5000€). Moreover, the contracts imposed by ENEL are not convenient to farmers; they have to pay 112 € for every 2 months as a fixed quota for the contract and they cannot interrupt the contract during the winter season (due to very high costs/taxes). So, they are willing to move to the use of electricity pumps but they are discouraged by the behaviour of other actors who do not support this initiative. Farmers believe that the government should impose some incentives and better tariffs to those willing to adopt the eco-efficient technological solutions.
- The farmers do not plan to adopt the solar engine pumps because they think that this methodology is not enough mature, solar panels are still very big, need maintenance and can be easily stolen.
- Farmers pay already for the agronomic consultancy between 1000 and 3000 € per season. However, this consultancy includes only marginally irrigation management which should be personalized for each farm and specific soil-plant-atmosphere conditions. Farmers are willing to pay up to 40-50 € per month per ha for technical assistance related to the efficient irrigation management support based on smart technologies.
- Farmer's perception is that the society does not care enough about them and that they should be united in the farmers associations in order to get greater benefits from agricultural production.
- Farmers do not produce the products only for the local markets but also for export because it is more profitable.
- In the study area, the cultivation of intensive crops is increasing which means the shifting to more efficient irrigation methods (like sub-surface irrigation) to increase the efficiency and to have more water available. According to market

signals, the farmers are trying to adjust the cropping pattern, to increase the quality of products and to be more competitive in the market. They believe that this is the way to increase the exports of products in EU and America. To ensure the long term sustainability of their farms the main message that they want to transmit to CBC, private and public sector and local and regional agencies is to “Increase the Water Availability for Agriculture, increase the support of institutions and funds and stronger Human Resources Development”.

3.5.3 Workshop conclusions

The participants of the Workshop recognized the importance of the eco-efficiency concept and the methodology adopted by the project. They underlined that the uptake of new technological solutions to increase the revenue and improve resources use efficiency is of their primary interest. A number of issues was addressed for eco-efficiency assessment and eco-innovation in the Sinistra Ofanto agricultural water system. Farmers felt that the available water is insufficient to cover their requirements and to guarantee the revenues. Water saving is a priority but the saved water should remain within the agricultural sector. Based on discussions, the system has relevant potential for eco-efficiency improvement; however, many obstacles and problems still persist. They mainly referred to the lack of political will and funds. Water availability, initial costs of new technologies and increasing cost of production were the main concern. Despite this, another major problem preventing farmer’s to invest in eco-efficient technologies in the study area is the on-going economic crisis and social (in)security. The farmers are among the main actors of the system, they found very productive the results of the project and stated that more support should be given in the future. However, the willingness of the institutions (local, national and regional policies) and availability of funds for initial implementation phase are considered of primary importance for the adoption of the latest technological solutions in order to ensure the sustainability of Sinistra Ofanto agricultural water system.

3.5.4 List of participants

Table 21 lists those participated in the event.

Table 21. Workshop Participants

Actor/Stakeholder	Organization
Ricco Savino	Agriculture Expert
Fiota Cosimo	Farmer
Dr. De Martino Raffaele	Agricultural Company
Lopez Michele	Farmer
Dr. Nunzella Maria	Agronomist
Damato Michele	Farmer
Cavaliere Giuseppe	Agricultural Company
Rizzitiello Angelo	Farmer

Mazilli Ferdinando	Agricultural Company
Pimmelli Pio	Farmer
Stella Salvatore	Agronomist
Perchimelli Nunzio	Agricultural Company
Cicolella Ferdinando	Agricultural Company
Vitobello Vincenzo	Farmer
Musciola Vito	Agricultural Company
Moro Osvaldo	Technical staff - Consortium “Bonifica della Capitanata”
Cammimo Mateo	Agronomist - Consortium “Bonifica della Capitanata”
Soldo Pietro	Agronomist - Consortium “Bonifica della Capitanata”
Filannino Saverio	Farmer
Lamonaca Giuseppe	Farmer
Project Partner	**Affiliation**
Todorovic Mladen	CIHEAM IAM Bari
Mehmeti Andi	CIHEAM IAM Bari
Ranieri Carlo	CIHEAM IAM Bari

3.6 The Zurich Workshops

In the Zurich urban case study, local stakeholders were involved early and actively in the case study building and analysis process. Several meetings between FHNW and several key stakeholders took place between 2012 and 2014. The individual meetings are described below, while the joint Workshop has already been described (section 2.5). A next meeting with the regulator (AWEL) is planned for early in 2015 in order to present the final results, discuss challenges for implementation and next steps.

3.6.1 Preparation Meeting for the Zurich Urban Case Study

Introduction

A preparation workshop took place on 19th February 2012 in Zurich with representatives of the cantonal regulator, the Office of waste, water energy and air of Canton Zurich (AWEL).

Discussion summary

- Introduction to the EcoWater project: project goals, tasks of FHNW
- Cooperation between AWEL and FHNW in the frame of the EcoWater project
- Discussion for selecting a suitable region for the urban case study
- Discussion for identifying suitable small and medium enterprises for the urban case study
- Communication issues
- Time plan and steps forward

Workshop conclusions

EcoWater project is relevant for the work of AWEL and the representatives are very keen to participate in the project. More staff of AWEL will be introduced to the project and involved actively in the case study.

List of participants

Table 22. List of participants

Actor	**Organization**
Peter Dell`Ava	AWEL
Christian Marfurt	AWEL
Project Partner	**Affiliation**
Christoph Hugi	FHNW
Olga Steiger	FHNW
Dirk Hengevoss	FHNW

3.6.2 Workshop in cosmetics production

Introduction

An individual workshop on drinking water use and wastewater treatment and discharge in small and medium enterprises took place on 21st of May 2012 at the cosmetics production plant “Cosmeto Lab AG” in Waedenswil.

Discussion summary

- The company has a high interest to improve the eco-efficiency of its processes.
- During the workshop, the following processes were defined as having environmental impacts: water desalination plant as well as the heating and cooling processes.
- The plant is officially controlled by the hygienic and food inspectorate of the Canton Zurich and the AWEL.

Workshop conclusions

The following ideas were elaborated during the workshop and should be checked for implementation:

- Cleaning process: purchase of a high pressure cleaning device.
- Stirring and homogenizing process: decalcification of the boiler, purchase of a more automated device.
- Energy management (especially of heating and cooling processes): time series recording of energy consumption of the individual processes and machines.

List of participants

Table 23. List of participants

Actor	**Organization**
Patrick Kamer	Cosmeto Lab AG
Marcel Gabriel	AWEL
Project Partner	**Affiliation**
Olga Steiger	FHNW
Claudia Niewersch	FHNW
Dirk Hengevoss	FHNW

3.6.3 Workshop in Surface Processing and Heat Treatment

Introduction

An individual workshop on drinking water use and wastewater treatment and discharge in small and medium enterprises took place on 30th of May 2012 at the surface processing and heat treatment plant “Galvanic Wädenswil Feusi + Federer AG” in Waedenswil.

Discussion summary

- The company has a high interest to improve the eco-efficiency of its processes.
- The company has a special interest in energy management and expects the most eco-efficiency improvements in the energy use.
- There is also some improvement potential in the wastewater treatment process, especially in the elimination of cyanide which is applied in the silver galvanization processes.

Workshop conclusions

The following measures elaborated during the workshop can improve the eco-efficiency and therefore should be checked for implementation:

- Better cyanide elimination through UV treatment,
- Measurements and documentation of energy consumption of the individual processes and machines,
- Better insulation of heated galvanizing pools, for example with floating elements,
- Application of a heat exchanger instead of electric heating elements,
- Adjusting of ventilation according to requirements,
- Use excess heat for drying processes.

List of participants

Table 24. List of participants

Actor	Organization
Peter Feusi	Director of Galvanic Wädenswil Feusi + Federer AG
Heinz Koller	AWEL
Project Partner	**Affiliation**
Claudia Niewersch	FHNW
Antje Langbein	FHNW

3.6.4 Workshop in Sport Facilities

Introduction

An individual workshop on drinking water use and wastewater treatment and discharge in small and medium enterprises took place on 03rd of July 2012 at the indoor swimming pool “Sportanlage Untermosen” in Waedenswil.

Discussion summary

During the discussion, the following points were made:

- The company has a high interest to improve the eco-efficiency of its processes.
- The problematic area of the swimming pool is the energy and heat consumption.
- An energetic analysis has already been conducted.
- On the mid-term rehabilitation measures are planned including insulation of the building.

Workshop conclusions

The following measures elaborated during the workshop can improve the eco-efficiency and therefore should be checked for implementation:

- Use of excess heat from waste water
- Check the possibility of the direct discharge of wastewater into a nearby water ditch
- Check and optimize the dosing of disinfection medium
- Measure and record the consumption of cleaning agents
- Check and optimize the intervals between disinfection and cleaning processes

List of participants

Table 25. List of participants

Actor	Organization
Willi Fegble	Director of Sportanlage Untermosen, indoor swimming pool
Horst Schreier	Vice-director of Sportanlage Untermosen, indoor swimming pool
Heinz Koller	AWEL
Project Partner	**Affiliation**
Olga Steiger	FHNW
Dirk Hengevoss	FHNW

3.6.5 Workshop in Food and Beverage Production

Introduction

An individual workshop on drinking water use and wastewater treatment and discharge in small and medium enterprises took place on 12th of June 2012 at the food and beverage production plant "Frutarom Switzerland Ltd." in Waedenswil.

Discussion summary

- The company has a high interest to improve the eco-efficiency of its processes.
- The company has already implemented several measures to reduce its environmental impacts.
- Since 1998 the company has its own wastewater treatment plant and a biogas plant to process its organic waste.
- Efficient cleaning processes have been already implemented.
- Energy-efficient free-cooling system is in operation.

Workshop conclusions

Although the processes of the company fulfill already high standards, the following potential fields for improvement have been identified:

- Investigation of the exact water saving, cleaning material saving and energy saving potentials through comprehensive introduction of CIP (cleaning in place) devices.
- Analysis of energy saving potential for the aeration technology used in the aeration basin of the wastewater treatment.
- Check the possibility of the direct discharge of wastewater into a nearby water ditch.

List of participants

Table 26. List of participants

Actor	Organization
Renato Colombi	Technical Services and Logistics, Frutarom Switzerland Ltd.
Thomas Thurn	Site & Operations Director, Frutarom Switzerland Ltd.
Emmi Nemeth	AWEL
Project Partner	**Affiliation**
Olga Steiger	FHNW
Claudia Niewersch	FHNW

3.6.6 Workshop at the Wastewater Treatment Plant

Introduction

An individual workshop on wastewater treatment and discharge took place on 3rd of September 2012 at the wastewater treatment plant "Waedenswil/ Rietliau" in Waedenswil.

Discussion summary

Wastewater treatment processes and technologies at the WWTP "Waedenswil/ Rietliau" were clarified and the following data gathered:

- Discharge values/ concentration of micropollutants;
- Amount and disposal of sludge and other waste;
- Chemicals and material consumption;
- Energy production in the internal biogas and CHP plants;
- Energy distribution to the district heating network;
- Costs and benefits.

Workshop conclusions

- The WWTP "Waedenswil/ Rietliau" operates on a high technological level.
- Additionally energy is produced: electricity is used on site and the surplus heat distributed to the nearby district heating network.
- There are plans of merging with a neighbouring WWTP which otherwise would have to be rebuilt soon.
- In the case of merging, the WWTP would have to install an additional treatment step of micropollutants removal.

List of participants

Table 27. List of participants

Actor	Organization
Gian-Pietro Giacomini	WWTP Waedenswil/ Rietliau
Andrea Weder	AWEL
Project Partner	**Affiliation**
Olga Steiger	FHNW
Claudia Niewersch	FHNW

3.6.7 Workshop at the Drinking Water Treatment Plant

Introduction

An individual workshop on drinking water treatment took place on 27th of September 2012 at the drinking water treatment plant “Hirsacker-Appital” in Horgen.

Discussion summary

The main points that were raised during the discussion are the following:

- Existing processes and technologies of the water treatment plant;
- Products and prices;
- Customers besides the municipality of Waedenswil;
- Amount of companies and households supplied;
- Amount of water processed;
- Hydraulics/ leakages;
- Water quality;
- Material and chemicals consumption;
- Costs and benefits.

Workshop conclusions

The water treatment plant ”Hirsacker-Appital” was newly rebuilt in September 2012 with a total investment of 31 Mio. Swiss Francs and therefore is now equipped with the best available technologies (BAT):

- Two equivalent water treatment lines;
- 3-steps treatment: membrane filtration, ozonation, activated carbon treatment;
- Disinfection and cleaning with Natriumhypochlorite (NaOCl);
- Efficient pumping systems for water distribution to the main networks of the municipalities.

List of participants

Table 28. List of participants

Actor	Organization
Herr Marti	Water treatment plant Hirsacker-Appital
NN	AWEL
Project Partner	**Affiliation**
Olga Steiger	FHNW
Claudia Niewersch	FHNW

3.6.8 Workshop with AWEL

Introduction

After the conduction of the individual workshops with the SMEs in the case study area, a workshop was organized at AWEL in order to present the preliminary results and to discuss the next steps. This workshop took place on 1st of July 2013 at the office of waste, water energy and air Canton Zurich (AWEL) .

Discussion summary

The main discussion points during the workshop were the following:

- Introduction of the project and case study goals;
- The methodology of eco-efficiency assessment;
- Results of the individual workshops with SMEs;
- Preliminary results of the eco-efficiency assessment in the case study area;
- Introduction and discussion of potential technologies;
- Next steps.

Workshop conclusions

The work done so far in the case study was considered as relevant by the workshop participants.

List of participants

Table 29. List of participants

Actor	Organization
Peter Dell`Ava	AWEL
Ksenija Jurinak	AWEL
Daniela Brunner	AWEL
Marcel Gabriel	AWEL
Emmi Nemeth	AWEL
Heinz Koller	AWEL

Project Partner	Affiliation
Olga Steiger	FHNW
Christoph Hugi	FHNW

3.7 2nd Workshop for Case Study 6: Energy Industry

A formal second workshop of Case Study 6 has not been carried out within the EcoWater project duration. This was due to new insights gained during the final project year, resulting in a major change in the case study. Due to this change, the key stakeholders were the energy company (NUON), the municipality of Amsterdam and to a lesser extend the water company (WaterNet), Rijkswaterstaat and the municipality of Woerden. Also the CS leader had several discussions with experts.

CS6 leader engaged in closer discussion with the stakeholder NUON, visiting on August 20th and also on Octber 22th, 2014. Besides face to face meetings several other communications by telephone and email took place. During the cause of the final project year it became evident that the use of higher temperature water was according to the key stakeholder, NUON, not a viable option unless industry would be closer to the plants, which is currently not the case. It was concluded that it could be useful to discuss with relevant authorities but not pursued any further.

Following, the main outcome of these communications was a verification of the setup of the NUON plants' models and global input data for the model, which were subsequently used to develop detailed input data. Extending the district heat network was identified as one of the more promising options for achieving higher systemic eco-efficiency. Furthermore it became evident that a higher, monthly resolution in the model was required to make the study useful, resulting in additional data collection and upgrading of the EcoWater toolbox.

Other options for further use of thermal energy were discussed. Several of these options, such as use in public buildings, are already implemented. Other potential options such as use in greenhouse horticulture, sports fields were briefly discussed but did not lead to further modelling exercises.

The Municipality of Amsterdam was visited on September 25th, 2014. The main point of discussion was the possibility of extending the district heating network. This would fall within the ambition of the municipality. The main bottlenecks identified during the first workshop, namely the need for long-term stable policy and the ownership (and hence investment) of the thermal energy grid were discussed. The discussions confirmed that within the current legal framework households can request natural gas connections even if they are in a district heating district. This further undermines the possibility to optimize district heating systems. The meeting concluded that data from a district within Amsterdam could be used to simulate the effect of increasing connections to district heating. Furthermore, the effect of micro CHP (household level) would be an interesting subject to analyse: current economic structure is that the electricity is sold to the grid by consumers has the same price than the consumers pay. This implies that when heating is required, CHP owners export electricity to the grid, potentially lowering electricity wholesale prices even further and

rendering large scale CHP plants less effective, as they remain responsible to deliver thermal energy, but have less use for electricity.

In a telephone conversation with Waternet the idea of pre-heating potable water was discussed. This option has been included in the case study.

Some communications with Rijkswaterstaat led to the conclusion that using residual heat for sludge and sediment drying, reducing transport costs and time to develop a useful product would not be a promising option.

The municipality of Woerden was contacted to discuss results of a test of road-heating. However, the experiments have not yet been concluded.

Based on these discussions and the Case Study results, the CS leader concludes that a systemic view on a large scale is an important way forward to enhance eco-efficiency. Single promising energy technologies may have overall negative eco-efficiency repercussions.

3.8 2nd Workshop for Case Study 2: Monte Novo Irrigation Scheme

The last year of the EcoWater project was mostly dedicated to the technology assessment, through the implementation of innovative technologies at the different stages of the water value chain. The selection of the different technologies to be assessed and the different parameters to be considered was based on the stakeholders' consultation and perception, keeping the involvement of the stakeholders active in the project.

However, due to the timing and quantity of work undertaken in the last year of the project, no formal stakeholders' workshop was organized. Instead, some smaller meetings and conference calls were made, emphasizing the specific role and interest of the different stakeholders in specific technologies and results.

The last phase of the project also focused on the definition of some policy recommendations. Once more, the stakeholders were involved, summarizing the ideas and topics already cited and discussed along the project development.

Finally, it should be emphasized that the wrap-up of the Monte Novo case study was performed with the involvement of Ing. Isaurindo Oliveira, consultant in irrigated agriculture, former responsible of COTR, a recognized specialist in irrigation practices in the Alentejo region in general and in the Monte Novo area in particular. His inputs were very valuable to allow summarizing the results, focusing on important and specific aspects of the Monte Novo case study and formulating some broader policy recommendations based on the stakeholders' consultations performed.

The realization of a second workshop would have been potentially less fruitful for the development of the case study as, in the last year, very specific and different technologies were tested, with different conditions depending on the crops considered. UPORTO believes that the approach followed allowed a more cohesive and complete work, closer to the region reality.

Annex I. PESTLE analysis-results from Sofia and Holstebro Workshops 1st Round Events

Table 30. PESTLE Analysis of Group 1 for Sofia urban System

GROUP 1: Energy generation through hydropower plant on the feeding pipe of the WTP		
Factor	**Drivers**	**Barriers**
Political	National and EU policies for increasing the proportion for renewable energy and utilization of the potential Would be: Development of clear legal framework and predictability of investments Would be: Long-term strategies to increase the systems' eco-efficiency	Changeable policy: 1) unclear perspective for implementation of renewable energy from Hydropower plants; 2) Imputing social function of the operator by the municipality
Economical	Additional income for the water operators and increasing their economical effectiveness [x2] Using the produced energy reducing energy expenses Reduce repair taxes, because of reducing network breakdowns due to high pressure Create preferential conditions for the use of renewable energy	High initial investment [x3] Additional tax for the water abstraction (for energy needs) Lack of economical drivers for achieved ecological effect Undeveloped energy market and unclear pricing of energy services Difficulties to provide financing with the frequent changes in the regulated price for renewable energy
Social	Improving the quality of water service Reduce pressure to consumers up to the needed levels, thus reduce breakdowns in the system	Temporary increase of the price for water supply service [?] Expected drastic reduction of the price for water service Low solvency of the population and lack of consumer culture

GROUP 1: Energy generation through hydropower plant on the feeding pipe of the WTP		
Technological	Modernization of the system Implementation of new technology in the process of exploitation of the water supplying system Engineering solution Building of infrastructure by energy distributors Positive vision of the investment; awareness	Additional maintenance Unsatisfactory condition or lack of infrastructure [x2] Necessity of space for building the small hydropower plants and compliance with the requirements for exploitation of the technology
Legal	A new legislation on the use of energy from hydropower plants is need Reduce the bureaucracy – simplifying the procedure for accession	Complicated relations in the water sector Unclear legislation on the investment Complicated procedure to register new energy capacity Facilities should be built within the sanitary protection zones (or water supply facilities)
Ecological	Reduce emissions Reduce pollution from non-renewable energy sources Water and wastewater operators should aim to implement such measures Lessen the Q at the water catchment stage Effective usage of water and energy source	

Table 31. . PESTLE Analysis of Group 2 for Sofia urban System

GROUP 2: Heat recovery from the sewerage system		
Factor	**Drivers**	**Barriers**
Political	Existing policy on energy efficiency /20/20/20 principle/ Existing EU and national policies, plans and programs Reform in the water and wastewater system in Sofia	Lack of Energy Strategy [as far as we know; to be commented by the colleagues from the MEE] Not enough political drivers; lack of funding scheme
Economical	Reduction of taxes for users of "green" energy is needed [x3] Economic benefits of trading of allowances Producing energy [x2] Existing funding for innovative technologies Premium income for the operator of the system Better financial indicators for Sofiyska voda	High investment for the technology itself and the infrastructure needed [x3; marked as very important barrier in the whole table] Limited market for the produced energy Used only by the owner of the wastewater system which in Sofia is the municipality What is the role of the Water and Energy Regulator?
Social	Reducing the service costs [x2] Reducing the price of heat energy [potential future benefit]	Lack of legal frame for distribution the costs and benefits which also influence the social factor
Technological	Available technological solutions Implementation of innovative technology in Bulgaria Applicability to existing installations	Expensive technology as first investment [high priority, see Economical barriers] Lack of infrastructure for heat transfer Lack of experience of the maintenance of such technology in BG [x2]

GROUP 2: Heat recovery from the sewerage system		
Legal	Legislation [changes are expected] [see Political factor]	Different owners which will make difficult to share of benefits of technology Difficulties in relationships between owner and concessionaire Lack of legislation about planning, exploitation and maintenance [x2] Necessary permits and licensing regimes The role of National Water and Energy Regulator and Sofia Municipality is unclear
Ecological	Reduce emissions Energy Recovery/ Use of renewable energy Improve the efficiency of the wastewater treatment plant	

Table 32. PESTLE Analysis of Dairy Industry

Dairy Industry		
Factor	**Drivers**	**Barriers**
Political	Arla company policy and strategy to decrease water and energy use by 3% annually Draft EC directive on Best Available Technology- BREF documents to be revised in 2014 EU agriculture regulation (milk Quota and price regulations) Environmental policies and strategies	Food safety and hygiene policies Costumer policies Consumer policies
Economical	Resource costs (energy, water and chemicals) WWT discharge costs Green taxes Production time- cleaning Eco efficiency of the technology	Market price of milk and milk products Equipment costs Production stopping time to install new technology
Social	Corporate social responsibility	
Technological	Water and energy audits Benchmarks Utility water (cooling)- technology developments CIP technologies – development Better sensors	

Dairy Industry		
Legal	Water fit for use combined with risk assessment(driver Environmental regulations	Food safety and hygiene regulations Compulsory use of groundwater due to food safety regulations (other water use requires risk assessment)
Ecological		Restrictions of discharge of clean treated process water (directly to surface water or injected to groundwater)