NUMBER C 92 | MARCH 2015 | **REPORT**

EcoWater report

Synthesis report from the 1st Round of Case Study events

IVL Swedish Environmental Research Institute

Author: IVL, NTUA, UPORTO, IAMB-CIHEAM
Funded by: Collaborative Research Project of the 7th Framework Programme
Report number: C 92
Edition: Only available as PDF for individual printing

IVL Swedish Environmental Research Institute Ltd.,
P.O Box 210 60, S-100 31 Stockholm, Sweden
Phone: +46-8-598 563 00 Fax: +46-8-598 563 90
www.ivl.se

This report has been reviewed and approved in accordance with IVL's audited and approved management system.

This report is a deliverable or other report from the EU project EcoWater.

At project closure it is was also published in IVL's C-series, available from the IVL web-site.

The EcoWater project was conducted by an international consortium coordinated by NTUA (National Technical University of Athens). IVL participated in the R & D work, in addition to leading one of the industrial case studies (Volvo Trucks), represented by Volvo Technology.

EcoWater ran 2011-2014. The project is presented in more detail on http://environ.chemeng.ntua.gr/ecoWater/
The project website holds a complete repository of all public deliverables from the EcoWater project.

Persons from IVL involved in EcoWater were:

Åsa Nilsson
Sara Skenhall
Magnus Klingspor
Tomas Rydberg
Uwe Fortkamp
Felipe Oliveira
Lina Danielsson
Elisabeth Hallberg

Contact person: Åsa Nilsson asa.nilsson@ivl.se

For Deliverables, please see additional information on this specific report on the subsequent Document Information page.

EcoWater

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

Collaborative project, Grant Agreement No: 282882

Deliverable 6.1

Synthesis report from the 1st Round of Case Study events

April 2013

DOCUMENT INFORMATION

Project	
Project acronym:	EcoWater
Project full title:	Meso-level eco-efficiency indicators to assess technologies and their uptake in water use sectors
Grant agreement no.:	282882
Funding scheme:	Collaborative Project
Project start date:	01/11/2011
Project duration:	36 months
Call topic:	ENV.2011.3.1.9-2: Development of eco-efficiency meso-level indicators for technology assessment
Project web-site:	http://environ.chemeng.ntua.gr/ecowater
Document	
Deliverable number:	6.1
Deliverable title:	Synthesis report from the 1st Round of Case Study events
Due date of deliverable:	30/04/2013
Actual submission date:	30/04/2013
Editor(s):	Patricia Stathatou
Author(s):	Åsa Nilsson, Sara Alongi Skenhall, Franka Gad, Vassilis Kourentzis
Reviewer(s):	Ino Katsiardi
Work Package no.:	6
Work Package title:	Dissemination, communication and science-policy links
Work Package Leader:	DELTARES
Dissemination level:	Public
Version:	1
Draft/Final:	Final
No of pages (including cover):	47
Keywords:	Workshops, dissemination, stakeholders, technologies, indicators, meso-level

Executive summary

The Deliverable 6.1 presents the main outcomes from the 1st Round of the EcoWater Case Study events, which comprises the:

- Monte Novo Workshop (Évora, Portugal, April 2012);
- Sinistra Ofanto Workshop (Bari, Italy, October 2012); and
- Volvo Automotive Industry Workshop (Gothenburg, Sweden, March 2013).

The Case Study Workshops were aimed at introducing the EcoWater concept and objectives to local audiences and strengthen linkages and collaborations with local actors.

During the events, the EcoWater project and its anticipated results were presented and the main aspects of the specific Case Studies were analyzed. The discussions held in the Case Study events were mainly dedicated to:

- Demonstrating the relevance of the Project approach in supporting local policy decisions and actions, and obtaining feedback on work already undertaken at the Case Studies, in relation to value chain mapping and baseline eco-efficiency assessments;
- Consolidating the applicability of the employed approach, particularly with regard to economic assessments, taking into consideration the interactions among the different economic actors involved;
- Jointly deciding on the environmental aspects that should be taken into consideration and the technologies that should be assessed through the Project.

The Case Study Workshops also included field visits and joint activities for 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 1st Round of the EcoWater Case Study Workshops 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 core objective of the EcoWater Project's Dissemination Strategy is the maximization of the usefulness, impact and uptake of project results. To that end, the project seeks to involve 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 and applicable to the local context.

The stakeholder engagement process of EcoWater will take place through two series of local Workshops/Case Study events, held throughout the project, to ensure that a) all project approaches and outcomes are in line with the local context and policies, and b) outcomes are relevant and can inform actual policy decisions at the local context.

The purpose of this document is to present the main outcomes of the 1st series of the Case Study events, focusing particularly on the applicability of employed approaches and the identification of technologies for the specific Case Studies. The three local Workshops which constitute the 1st series of the Case Study events relate to Case Study #2 (Monte Novo Workshop, Portugal, April 2012), Case Study #1 (Sinistra Ofanto Workshop, Italy, October 2012), and Case Study #8 (Volvo Automotive Industry Workshop, Sweden, March 2013).

The document is structured as follows:

- Sections 2, 3, and 4 are dedicated to the Monte Novo, Sinistra Ofanto, and Volvo Automotive Industry Workshops respectively. Each Section presents the scope and schedule of the event, summarizes the discussions held during the Workshop, and describes the main outcomes of the event as well as its contribution to the Case Study development process. The event participants are also presented, including both Project Partners and local stakeholders/actors.
- Annexes I and II present the Questionnaire distributed during the Monte Novo Workshop on the Evaluation of the 1st EcoWater Case Study Workshop, and the results of the PESTLE analysis exercise held during the Volvo Case Study Workshop, respectively.

2 The Monte Novo Workshop

2.1 Scope of the Workshop

The first EcoWater Workshop was held in Évora (Portugal) on the 20th and 21st April 2012, and concerned the 2nd agricultural EcoWater Case Study: Eco-efficiency assessment in new hydro-agricultural systems – New technologies for eco-efficient water management and agricultural production. It was organized by the University of Porto (UPORTO) and combined with the 1st Interim Project Meeting. The event aimed to introduce the EcoWater concept to the local stakeholders and strengthen the linkages with local actors.

Overall, the Workshop was dedicated to:

- Presenting the Project approach and identifying its relevance to the local needs and expectations;
- Obtaining feedback on a preliminary baseline eco-efficiency assessment of the Monte Novo Irrigation Scheme;
- Identifying stakeholder perspectives regarding economic issues, environmental aspects, and technologies to be assessed; and
- Providing significant information both for the development of the Monte Novo Case Study and for the structure and content of the forthcoming events.

The Monte Novo Workshop also included field visits and discussions with local stakeholders. The former aimed at the familiarization of the Project Partners with the Study area, while the latter at the identification of the main aspects that should be included in the analysis and the possible application of Ecowater results.

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

Table 1: The program of the Workshop

Friday, 20 April 2012		
8:30	*Transfer to Monte Novo*	
9:00	Field visit to Monte Novo	
10:30	Transfer to Évora	
11:00	Welcome note	*Rodrigo Maia, UPORTO*
11:15	Introduction of participants	*All*
11:30	The EcoWater concepts: Relevance and research relating to Case Studies	*Dionysis Assimacopoulos, NTUA*
12:00	The EcoWater Case Study in Portugal: Premises and context	*Rodrigo Maia, UPORTO*
12:30	The Monte Novo Irrigation Scheme: Environmental benefits, impacts and economic issues	*José Costa Gomes, EDIA S.A.*
12:45	Structured discussion with local actors and stakeholders (Focus: Added value of the Case Study to local decision-making)	*Facilitation by Rodrigo Maia and Dionysis Assimacopoulos*
13:30	*Lunch*	
15:00	Eco-Innovations in the Monte Novo Irrigation Scheme (water, energy and agricultural management): Perspectives of farmers and decision-makers	*Jorge Maia, COTR*
15:30	A preliminary baseline eco-efficiency assessment of the Monte Novo Irrigation Scheme through the EcoWater tools – System mapping, data requirements and expected outcomes	*NTUA*
16:00	Structured discussion with local actors and stakeholders (Focus: Identification of environmental impact categories and technologies to be assessed)	*Facilitation by Rodrigo Maia and Dionysis Assimacopoulos*
16:45	*End of Workshop*	
Saturday, 21 April 2012		
09:00	Field visit to Alqueva Dam	
12:00	*End of field visit*	

2.2 Discussion summary

2.2.1 Introduction to the EcoWater Concept

Welcome note and introduction of participants

The Workshop started with a short welcome note by **Prof. Maia** (UPORTO). This included preliminary information on the Project (starting date, duration and general logistics), as well as the introduction of the Workshop participants (both Project Partners and local stakeholders).

The EcoWater concepts: Relevance and research relating to Case Studies

Prof. Assimacopoulos (Project Coordinator, NTUA), the Project Coordinator, welcomed the local stakeholders and thanked them for their interest in the EcoWater Project. His presentation provided a general description of the concepts introduced in EcoWater and their relevance to the local policy and decision makers, particularly emphasizing on the Europe 2020 targets. The presentation highlighted that the overall aim of the Workshop was to discuss the concepts in EcoWater, identify its relevance to the local needs and frame the Case Study according to the actual problems and expectations of the scheme.

The EcoWater Case Study in Portugal: Premises and context

Upon the completion of the general introduction to the Project, **Prof. Maia** (UPORTO) presented the premises and the context of the Case Study on the Monte Novo irrigation scheme. His presentation started with a general overview of the system, comprising the primary supply network and the secondary irrigation network. The presented water supply chain included the following stages:

1. Water abstraction from the Alqueva reservoir;
2. Water transportation through canals from the Álamos reservoirs (I, II and III) to the Loureiro reservoir;
3. Water diversion in the Loureiro reservoir and delivery to the secondary irrigation network; and
4. Distribution of water to the irrigation areas through five regulation reservoirs and four pumping stations.

The characteristics of the irrigation area were then presented, including the evolution of the irrigated areas since 2009 and their division into seven different blocks. Block 2 is occupied by 48 farmers owning a small-medium area for cultivation, while the rest of the blocks are occupied by a significantly smaller number of farmers, ranging from 3 to 11 (2011 data). Arable crops, horticultures, maize, olives, and vineyards are the most popular crop types cultivated in the area.

Figure 1 shows the overall supply chain of the Monte Novo irrigation scheme, as presented by **Prof. Maia**.

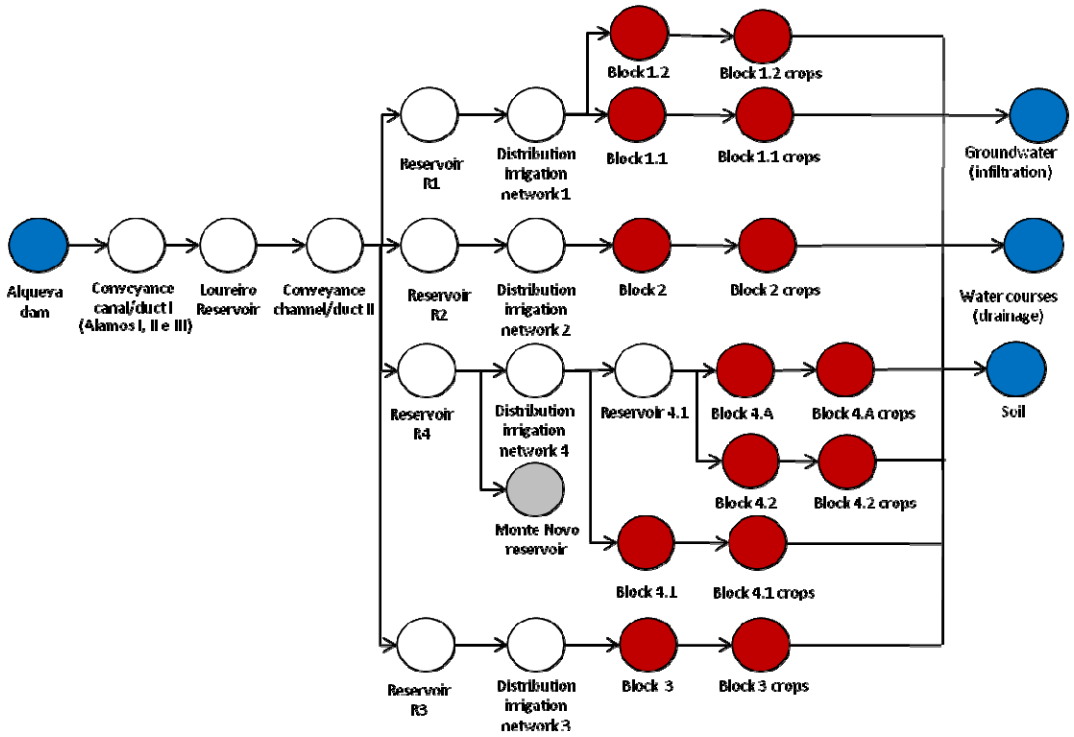

Figure 1: The supply chain of the Monte Novo irrigation area

Moreover, information on the water supply services was presented, focusing on water losses in the primary and secondary networks (about 12%, and 0.5-1% respectively). It was also stated that in the secondary network, water could be supplied either at low or high pressure; it was clarified that the latter was preferable for small-medium sized farms, as the installation of individual pumping stations is not required. Additionally, energy consumption rates and water tariffs in the primary and the secondary distribution networks were presented, highlighting that water tariffs have been set for the following 5 years.

Figure 2 illustrates the farms that will be analysed within Case Study #2 per block and the respective pressure levels.

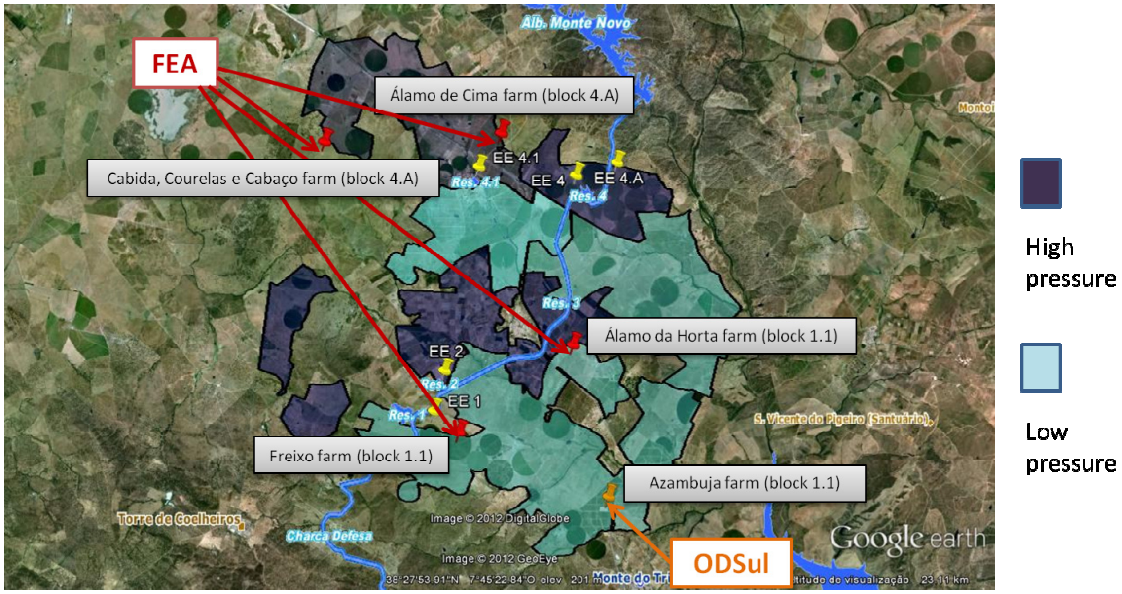

Figure 2: The farms to be analysed within Case Study #2 per block and the respective pressure levels

The presentation continued with a brief description of the types of crops cultivated in each farm, and of the relevant water consumption. Upon the completion of the description of the system, the main objectives of the Case Study were outlined. These included the assessment of:

- The overall performance of a relatively recent hydro-agricultural system;
- The impacts of the introduction of new conditions (change of crop, technology, management strategies, policies, competitive uses and economic systems) on the eco-efficiency of the system; and
- New technologies and management strategies.

The eco-efficiency assessment, which will be performed within Case Study #2, will be based on a set of indicators measuring the eco-efficiency of the system in terms of irrigation water management and use, water productivity and income from agricultural production. The presentation ended with a preliminary list of different technologies and practices that could be assessed, referring both to the water distribution and the irrigation water use stage (Table 2).

Table 2: A preliminary list of eco-innovative technologies/practices

Distribution Network	Water Use Stage
Variable tariffs of water supply (function of demand)	Drip irrigation
Variable tariffs of water supply (function of energy costs)	Sub-surface irrigation
Pressure head delivery	High and super-high density orchards
	Variable rate irrigation system
	Biological production
	Increase of organic matter
	Regulated deficit irrigation

2.2.2 Discussions concerning the Monte Novo Irrigation Scheme

The Monte Novo Irrigation Scheme: Environmental benefits, impacts and economic issues

Mr. José Costa Gomez, EDIA representative, presented the view of local stakeholders focusing on the general characteristics of the study area (including the objectives of the scheme) and the environmental benefits and economic issues related to the Monte Novo irrigation scheme.

Structured discussion with local actors and stakeholders concerning the added value of the Case Study to local decision-making

Prof. Assimacopoulos (NTUA) facilitated the discussion through a presentation on certain aspects of the Case Study. He began by examining the potential for improvements in the scheme and reiterated the dilemma between the economic benefits of intensive agriculture, which can ensure economic growth, employment and high living standards, and the environmental impacts from the extensive use of resources, which increases soil and groundwater salinity (affecting habitats as well). Stakeholders stated that soil salinity is not a major problem, and no minimum tillage is applied in the area.

Further on, **Prof. Assimacopoulos** highlighted the need to identify the main local environmental problems in order to include them in the environmental component of the eco-efficiency indicators. Local actors considered soil erosion an important problem that should be taken into account, as it affects the efficiency of crop production in the long term. **Prof. Todorovic** (CIHEAM-IAMB), leader of the other agricultural EcoWater Case Study on the Sinistra Ofanto irrigation scheme in Italy, recognized the importance of the specific problem. He further stated that the impacts of soil erosion are not visible, and thus farmers are not aware and well-informed about them. **Prof. Maia** (UPORTO) stated that the Project was in the first phase of its development, and the aim of the Workshop was to establish the essential links with the relevant stakeholders, in order to design the specific system together and take into account the actual needs of the area. All Project Partners agreed on the need to

include soil erosion in the analysis. Emissions of Carbon dioxide were also regarded as an important environmental impact that cannot be excluded from the analysis.

Prof. Assimacopoulos continued the presentation, focusing on the economic aspects of the system. Two eco-efficiency challenges were highlighted concerning interventions related to water management and local economy:

- Reducing energy consumption while at the same time ensuring that the water delivery system will operate properly and relevant costs will remain low.
- Increasing the value added while at the same time minimizing production costs.

The economic interactions of the system components, which will provide the basis for the economic analysis, were also presented.

The discussion that followed underlined the high investment cost of the scheme and the two different water tariffs, which depend on the pressure levels (low or high). It was specified that both farmers using the EDIA water services and those who individually abstract groundwater pay a compulsory maintenance fee. It was stated that EDIA designs its network to provide high pressure services, as this reduces the investment cost required by individual farmers. However, some farmers who cultivate large areas prefer to install their own pumping stations, and hence these water supply networks are of low pressure. This leads to a differentiation of water tariffs between low and high pressure water distribution services. Although during the discussion it was questioned whether this decision is accepted by all farmers, EDIA representatives clarified that this strategy is considered widely accepted, as the total cost is similar in both occasions.

The last part of the presentation concerned the calculation of the eco-efficiency indicators, focusing on the environmental component of the analysis. **Mr. Ocaña** (ODS) asked if comparisons among different alternative configurations will be made. **Prof. Assimacopoulos** replied by explaining that the technologies and practices that will be analyzed refer to a mid-term time horizon (5 to 10 years), and will be compared to the current situation (Business-As-Usual scenario). The aim of these comparisons is to examine different incentives for the farmers and suggest alternative policy measures to support technology uptake.

FEA representatives asked if the aforementioned comparisons will be based on a single, overall eco-efficiency indicator. The Project coordinator clarified that analytical information is required to identify, suggest and support relevant policy measures. In case of a single indicator, the required information could be misleading, hiding certain problems. Therefore, different individual indicators will be analyzed; an overall eco-efficiency indicator may also be identified, in order to cross-compare similar systems (e.g. the two agricultural water service systems).

Another issue raised by the Project Partners was whether local farmers conduct risk assessments to monitor the quality of water and soil in the irrigated areas. **Mr. Ocaña** informed them that farmers in the Monte Novo irrigation scheme empirically distinguish the most sensitive areas.

Eco-Innovations in the Monte Novo Irrigation Scheme (water, energy and agricultural management): Perspectives of farmers and decision-makers

Mr. Jorge Maia (COTR) presented preliminary information on the innovative technologies and practices specified in Table 2; a summary of their most important characteristics is provided in Table 3. The proposed evaluation indicators for the assessment of the described technologies and practices mainly considered operational and investment costs (economic indicators), and CO_2 emissions, water and soil quality parameters (environmental indicators).

Table 3: Brief description of the proposed technologies and practices

Description	Relevant Environmental Impact
Technologies & Practices in the Distribution Network	
Variable tariffs of water supply (function of demand)	
• Water prices range according to crop water needs. • Farmers can have access to the recommended amount of water (depending on crops, soil & technologies). Water prices increase with consumption.	Water use
Variable tariffs of water supply (function of energy costs)	
• Water prices range according to the corresponding schedule / energy price for the specific period. • Water use during periods with low energy tariffs can be promoted.	Water & energy use
Pressure head delivery	
Supply of more areas at high pressure levels, as the difference in water prices can encourage farmers to invest in their own pumping stations.	Water & energy use
Technologies & Practices in the Water Use Stage	
Drip irrigation	
• Anticipated reduction of water consumption by 10-20%, as soil evaporation losses could be significantly decreased. • In terms of energy consumption, drip irrigation systems require operating pressures lower by 10-15 bars than sprinkler systems.	Water & energy use **(maize)**
Sub-surface irrigation	
Anticipated reduction of water consumption by 5-10%, as sub-surface drip irrigation allows for the minimization of soil evaporation losses (but may increase leaching).	Water & energy use **(vineyards)**

Description	Relevant Environmental Impact
Technologies & Practices in the Water Use Stage (cont.)	
High and super-high density orchards	
• Shift between high density orchards (between 200 and 400 trees per hectare) and super-high density orchards (between 1200 and 2000 trees per hectare) could increase production. • Input resources will increase.	Water & energy use, production **(olives)**
Variable rate irrigation system (VRI)	
The use of VRI provides maximum precision in irrigation & individual sprinkler or span control of up to 30 different possible VRI zones along the pivot. It allows adapting the system water application rate to the soil infiltration rate. Also, it is possible to stop irrigation in an irregular water line inside the pivot area.	Water use & soil quality
Biological production	
• Better control of the costs of input resources, adding value to the final products. • More eco-friendly production system.	Water use & soil quality
Increase of organic matter	
• Significant improvement of the soil water content, the infiltration rates and the machinery transitability over the fields. • It can be attained through the use of organic wastewater from olive oil production, wineries and dairy cattle, organic material from pruning of orchards, etc.	Water use & soil quality
Regulated deficit irrigation	
Induction of mild to moderate plant water deficits during some specific phenological stages, by withholding irrigation or applying less water than plants would use under normal conditions (especially in olive orchards).	Water & energy use

The discussion that followed focused on the services provided to farmers, and on the environmental issues that are important for the specific area. It was underlined that the irrigation intensity must be in accordance with the carrying capacity of the soil, in order to prevent soil erosion. **Prof. Todorovic** (CIHEAM-IAMB) asked stakeholders about the method used for estimating water irrigation requirements. **Mr. Jorge Maia** (COTR) replied that, although meteorological stations already exist in the area, relevant information cannot be accessed by local farmers, as this process is still under development. **Prof. Todorovic** highlighted the importance of sharing available information with the farmers, as lack of information can lead to more intense use of resources and thus increase costs and leakages. Therefore, the provision of advisory

services to farmers through different means, e.g. through websites (which is a low cost investment) was suggested. **Mr. Jorge Maia** clarified that a website providing information to the farmers already exists.

Ms. Van Vliet (Deltares) raised a question on the information that farmers expect in order to thoroughly support their decision making. **Mr. Ocaña** (ODS) replied that farmers make decisions based on their experience and observed farm conditions. **Prof. Maia** (UPORTO) asked if hydrological conditions are measured for the identification of vulnerable areas, and **Mr. Ocaña** replied that such measurements are not available, as most farmers empirically assess the characteristics of their land.

The discussion continued with the identification of the environmental issues faced in the area. **Ms. Van Vliet** asked whether biodiversity is an important environmental aspect in the area, and **Mr. Ocaña** replied that inherent biodiversity is a significant factor affecting the operation of the irrigation scheme, as it does not allow the intense use of chemicals. It was also noted that the use of pesticides may cause important environmental impacts, and hence the analysis should not be limited to phosphorus and nitrogen use.

Although EcoWater does not focus on the social aspects of the examined systems, it was suggested that the potential benefits from the proposed interventions to the future generations should be examined. It was also suggested that alternative irrigation methods, including surface irrigation, should be considered.

Mr. Ocaña highlighted that any intervention that could even slightly increase the farmers' profits is important, since current profit margins are low. The significant cost of CO_2 emissions was given as an example of this condition. **Dr. Levidow** (OU) emphasized that a reduction of CO_2 emissions would only reduce energy costs for water delivery and not water demand. **Mr. Jorge Maia** clarified that the overall cost of water would also be decreased, as a significant portion of it is attributed to energy costs.

Minimization of the dependence on tractors and genetically modified crops were also considered possible alternative configurations.

Ms. Van Vliet asked if there were any specific parameters of high value to be reduced by the introduction of new technologies. The most significant parameters stated concerned the operation of the urban water and wastewater service system. However, **Prof. Assimacopoulos** (NTUA) clarified that these parameters are not included in the scope of the specific Case Study.

Finally, **Dr. Levidow** inquired whether the cultivation of organic crops could be considered as an alternative option and if bio-labeling could be promoted. **Mr. Ocaña** specified that farmers would cultivate organic products, if they could be convinced that their profit would increase, highlighting that owners of small farms (e.g. farms in Block 2) would not be easily convinced.

A preliminary baseline eco-efficiency assessment of the Monte Novo Irrigation Scheme through the EcoWater tools – System mapping, data requirements and expected outcomes

The Workshop continued with the presentation of a preliminary example of the EcoWater methodological approach for the estimation of eco-efficiency of the Monte

Novo irrigation scheme by **Ms. Elina Manoli** (NTUA). The system boundaries, data used and assumptions made were described, and the input and output resource flows of the system were analyzed. The environmental impact indicators and the Total Value Added (TVA) from water use were calculated. Based on the economic and environmental indicators the eco-efficiency of the system was assessed. The baseline scenario was then compared to an alternative one involving the introduction of a technology, which reduces irrigation energy requirements by 50%. The presentation concluded with the improvements of the system's performance due to the reduction of energy and CO_2 emissions.

Dr. Levidow (OU) commented that practitioners would also appreciate information on alternative technology options, to overview the distribution of the cost and benefits among these. **Ms. Manoli** further clarified that a simple example of the cross-comparisons that will be made was presented, aiming at the identification of the type of data required for the analyses. **Prof. Maia** (UPORTO) noted that the specific presentation provided useful guidance for the next steps of the Case Study development process. He also stated that the mapping of the system would be sent to all actors to redefine any stages and processes that required further clarification.

A questionnaire was distributed to stakeholders for the evaluation of the Workshop (see Annex I).

Prof. Assimacopoulos concluded the Workshop discussions highlighting the importance of establishing linkages with the local stakeholders, as their feedback is a significant factor affecting for the Project progress.

2.3 Field visits

Two field visits were organized during the Monte Novo Workshop, aiming at the familiarization of Project Partners with the area and the practices of the specific system.

The first visit was divided into two parts:

a. The visit to the local office of the EDIA S.A., which controls the water supply in the irrigation scheme (secondary network). The existing irrigation scheme, its blocks, and the water supply network were briefly described. The hardware systems which control water supply and monitor the operation of the pumping stations were also illustrated, focusing on a single station with five pumps. The discussion that was held during the visit, focused on:
   - The existing cropping patterns and the expansion of the irrigated land;
   - The distinction between high and low pressure networks, and the corresponding water tariffs;
   - The profit margin of the farmers; and
   - The possible lack of available data due to the short time period that the scheme operates.

b. The visit to one of the reservoirs that will be analyzed in the Case Study (i.e. Reservoir R4.1), including the relevant pumping station for water delivery in the high pressure networks.

During the second day of the Workshop, Project Partners visited the Alqueva dam (Figure 3), which is the main water source of the system examined.

Figure 3: The Alqueva dam [Source: www.wikipedia.org]

2.4 Workshop Conclusions

The first EcoWater Workshop provided significant information both for the development of the specific Case Study and for the structure and organization of the forthcoming events.

The most significant conclusions reached at the Monte Novo Workshop are the following:

- Local stakeholders showed significant interest in the overall concept and objectives of the EcoWater Project;
- Farmers are interested in every technological configuration (e.g. introduction of technologies that reduce CO_2 emissions) that might increase their profits, as their profit margins are low;
- The successful operation of the developed irrigation scheme is of crucial importance, as the investment costs were significant;
- All the proposed technologies could potentially add value to the scheme;
- Soil erosion is a significant environmental impact that must be taken into consideration in the analysis;
- The value chain mapping of the system was nearly finalized.

Regarding the structure of the forthcoming Workshops, Project Partners agreed the following:

- Workshops should start earlier;
- A preparation phase should be included in the program, where participants can be introduced and have face-to-face contact; and
- An example of preliminary results should be presented, highlighting the interaction among the different actors.

Concerning the next steps in the Case Study development process it was decided that Prof. Maia (UPORTO) would discuss the value chain mapping of the system with all the actors involved, in order to arrive to a final version. Additionally, the most significant environmental issues affecting the system would be specified, to be taken into account for the selection of the environmental impact indicators.

2.5 List of Participants

Both Project Partners and local stakeholders participated in the first EcoWater Workshop. Table 4 briefly describes the main characteristics/responsibilities of the actors/stakeholders and the affiliation of the Project Partners who participated in the event.

Table 4: The Monte Novo Workshop participants

Actor/stakeholder	Characteristics
André Matoso	Representatives of the **River Basin District Administration of Alentejo (ARH Alentejo)**, which is a regional public institution with responsibility in the water & agricultural sectors
Alice Fialho	
Maria João Rasga	
Gonçalo Macedo	Representative of the **Monte Novo Irrigation Scheme Users Association** (Associação de Beneficiários do Monte Novo, **ABMN**), which is responsible for the infrastructures management & water distribution of the Monte Novo public irrigation site
Jorge Maia	Representative of the **Technical and Operational Center for Irrigation** (Centro Operativo e de Tecnologias de Regadio, **COTR**), an advisory entity which is responsible for the coordination & promotion of scientific research on agricultural development
José Costa Gomez	Representatives of the **Alqueva Development and Infrastructures Company** (Empresa de Desenvolvimento e Infra-estruturas do Alqueva, **EDIA**), which is responsible for the implementation and operation of the Alqueva Multipurpose Project (EFMA)
José Rosado	
Duarte Carreira	
Gonçalo Pinheiro	Representatives of the **Fundação Eugénio de Almeida Farmers Association (FEA)**, which currently holds almost 20% of the Monte Novo Irrigation Scheme area (about 1500 ha)
Luís Rosado	
Luis Ocaña	Representative of the **Olivais do Sul Farmers Association (ODS),** which currently holds 260 ha in the Monte Novo irrigation scheme & produces olives and olive oil
Ricardo Serralheiro	Representatives of the **University of Évora**
Mário Carvalho	

Project Partner	Affiliation
Mladen Todorovic	International Centre for Advanced Mediterranean Agronomic Studies - Mediterranean Agronomic Institute of Bari (**CIHEAM-IAMB**)
Daniele Zaccaria	International Centre for Advanced Mediterranean Agronomic Studies - Mediterranean Agronomic Institute of Bari (**CIHEAM-IAMB**)
Alessandra Scardigno	International Centre for Advanced Mediterranean Agronomic Studies - Mediterranean Agronomic Institute of Bari (**CIHEAM-IAMB**)
Lija van Vliet	**Deltares**
Marcel Bruggers	**Deltares**
Palle Lindgaard-Jørgensen	**DHI**
Cristoph Hugi	University of Applied Sciences and Arts Northwestern Switzerland (**FHNW**)
Claudia Niewersch	University of Applied Sciences and Arts Northwestern Switzerland (**FHNW**)
Olga Steiger	University of Applied Sciences and Arts Northwestern Switzerland (**FHNW**)
Åsa Nilsson	Swedish Environmental Research Institute (**IVL**)
Sara Alongi Skenhall	Swedish Environmental Research Institute (**IVL**)
Dionysis Assimacopoulos	National Technical University of Athens (**NTUA**)
George Arampatzis	National Technical University of Athens (**NTUA**)
Elina Manoli	National Technical University of Athens (**NTUA**)
Vassilis Kourentzis	National Technical University of Athens (**NTUA**)
Les Levidow	The Open University (**OU**)
Irina Ribarova	University of Architecture, Civil Engineering and Geodesy (**UACEG**)
Peyo Stanchev	University of Architecture, Civil Engineering and Geodesy (**UACEG**)
Rodrigo Maia	University of Porto (**UPORTO**)
Cristina Silva	University of Porto (**UPORTO**)
Sofia Rios	University of Porto (**UPORTO**)
Eduardo Vivas	University of Porto (**UPORTO**)

3 The Sinistra Ofanto Workshop

3.1 Scope of the Workshop

The second EcoWater Workshop was held in Bari (Italy) on the 3rd and 4th October 2012 and concerned the 1st agricultural EcoWater Case Study: Meso-level assessment of eco-efficiency improvements through innovative technologies for irrigation water management and agricultural production. It was organized by the International Centre for Advanced Mediterranean Agronomic Studies - Mediterranean Agronomic Institute of Bari (CIHEAM-IAMB), and was combined with the 1st Annual Project Meeting. It was aimed to introduce the EcoWater premises and objectives to local stakeholders and involve local actors in the Case Study development process.

The event focused on:

- Demonstrating the relevance of the Project approach in supporting local policy decisions and actions;
- Obtaining feedback on work already undertaken in the Case Study;
- Presenting the results of a preliminary baseline eco-efficiency assessment; and
- Identifying the main environmental problems of the area and developing a preliminary list of innovative technologies that should be assessed through the Project.

The Sinistra Ofanto Workshop included field visits, for the familiarization of the Project Partners with the Study area, and discussions with local stakeholders regarding the applicability of the EcoWater results.

The overall program of the Workshop is presented in Table 5.

Table 5: The program of the Workshop

		Wednesday, 3 October 2012
08:30	*Transfer from Bari to Cerignola*	
10:00	Arrival in Cerignola	
10:00	Visit to the Capacciotti Dam ▪ *Illustration of operational techniques by the WUA technical staff*	*Nicola Lamaddalena, CIHEAM-IAMB & Local speaker, WUA*
11:15	Visit to the Sinistra Ofanto irrigation districts (Districts 1 and 10) ▪ *Illustration of operational criteria, main economic, environmental and eco-efficiency issues* ▪ *Innovations: Perspectives of farmers and decision makers*	*Nicola Lamaddalena, CIHEAM-IAMB and a representative, WUA*

13:30	*Lunch*	
15:00	Visit to Farmers Cooperative of San Ferdinando di Puglia ▪ *Economic and environmental aspects related to crop production, irrigation water management and innovations*	*Farmers' representatives*
16:30	*Departure to Trani*	
17:00	Short tourist walk in Trani	
19:00	*Departure to Bari*	
20:30	*Dinner in Bari*	
		Thursday, 4 October 2012
09:30	Welcome addresses	*C. Lacirignola* *N. Lamaddalena* *F. Amati*
09:50	Presentation of participants	*All*
Session 1: Introduction		
10:00	EcoWater: Concepts, Research Framework and Case Studies	*Dionysis Assimacopoulos, NTUA*
10:15	Eco-efficiency assessment in agricultural water systems	*Mladen Todorovic, CIHEAM-IAMB*
10:30	*Coffee break*	
Session 2: Eco-efficiency assessment in the Sinistra Ofanto Irrigation Scheme for a baseline scenario: Perspectives of farmers, local actors and decision-makers		
11:00	Methodology for stakeholder analysis	*D. D'Agostino, CIHEAM-IAMB*
11:10	Overview of the Sinistra Ofanto System	*D. Zaccaria, CIHEAM-IAMB*
11:25	Preliminary results on the baseline eco-efficiency assessment for the Sinistra Ofanto System	*E. Manoli, NTUA*
11:40	Stakeholder feedback and discussion	*All*
Session 3: Eco-innovations and scenarios for the Sinistra Ofanto Irrigation Scheme: Water, energy, environment and agricultural management		
12:20	Visions, new technologies and alternative scenarios	*M.Todorovic, CIHEAM-IAMB*
12:35	Preliminary results on the assessment of new technologies	*T. Angelis-Dimakis, NTUA*
12:50	Stakeholder feedback and discussion	*All*
13:30	Concluding remarks & forward planning	*Mladen Todorovic, CIHEAM-IAMB*
13:45	*End of stakeholder Workshop*	
	Lunch	

3.2 Discussion summary

3.2.1 Introduction to the EcoWater Concept

EcoWater: Concepts, Research Framework and Case Studies

Prof. Assimacopoulos (Project Coordinator, NTUA) welcomed the local stakeholders and thanked them for their interest in the EcoWater Project. The main concepts and objectives of the EcoWater Project (meso-level and eco-efficiency) were presented, and the methodological framework of the Project was described. The overall aim of the Workshop concerning the framing of the Case Study according to the local needs was also highlighted.

Eco-efficiency assessment in agricultural water systems

Prof. Todorovic (CIHEAM-IAMB) presented the scope and the objectives of assessing eco-efficiency in agricultural water systems and provided an overview of the two EcoWater agricultural Case Studies. The methodological framework for assessing the eco-efficiency of agricultural water systems was then described, including:

- The mapping of the system;
- The baseline eco-efficiency assessment;
- The selection of environmental impact indicators;
- The identification of technologies and practices for eco-efficiency improvement; and
- The technology scenario assessment.

It was noted that the improvement of the system's eco-efficiency through the introduction of innovative technologies may result from:

a. Higher economic value of products;
b. Lower resources and energy consumption; and
c. Reduced environmental impact.

3.2.2 Eco-efficiency assessment in the Sinistra Ofanto Irrigation Scheme

Analysis of stakeholders views

Dr. Daniela D'Agostino (CIHEAM-IAMB) presented a methodology for the analysis of stakeholder perspectives and inputs, which included two phases:

- The qualitative phase, in which the views of stakeholders are identified; and
- The semi-quantitative phase, in which the main views are grouped and the relations between them are identified.

The results of this process can be presented in a Cognitive Map to facilitate their use and interpretation.

Overview of the Sinistra Ofanto System

Dr. Luigi Nardella, representative of the consortium for the remediation of the Capitanata region (Consorzio per la Bonifica Della Capitanata), presented a general overview of the examined system, providing technical and economic information. Sinistra Ofanto is a very large and complex irrigation scheme; it was noted that Ofanto River, which is the main water source of the irrigation scheme, also provides water for other purposes (e.g. urban water use), and hence conflicts among different users have occurred. **Dr. Nardella** also presented economic data for the period 2010-2011 including operation costs and water tariffs.

Value chain mapping of the Sinistra Ofanto irrigation system

Mr. Daniele Zaccaria (CIHEAM-IAMB) made a presentation on the value chain of the Sinistra Ofanto irrigation system, providing information about water supply volumes, operation costs and water tariffs. It was noted that the scheme is divided into different irrigation zones according to water distribution networks (gravity or pumped). The value chains of the different irrigation zones to be analyzed were then illustrated. The presentation ended with a short list of innovative technologies that could be implemented in the different stages of the system for improving eco-efficiency.

Preliminary results on the baseline eco-efficiency assessment for the Sinistra Ofanto System

Ms. Elina Manoli (NTUA) presented a preliminary baseline eco-efficiency assessment for the Sinistra Ofanto irrigation scheme, which aimed at the illustration of the methodology to followed in the Case Study development process. The system boundaries, the data used and the assumptions made were described. The calculated resource flows of the system and Total Value Added (TVA) from water use were then presented. The presentation concluded with the calculated economic, environmental and eco-efficiency indicators.

Prof. Assimacopoulos (NTUA) noted that the aim of this presentation was to identify the weak points of the analysis, regarding the environmental and economic aspects considered, to enable the selection of relevant indicators. A prototype version of the EcoWater tools was used for the modelling of the water supply and value chains of the presented example.

The discussion that followed focused on the weak points of the analysis and the selection of appropriate indicators for measuring the performance of the system. **Prof. Vurro** (CNR) commented that although the presented approach was very interesting, groundwater overexploitation was not considered, and **Ms. Manoli** explained that relevant data were not available. **Ms. Iannarelli**, representative of Apulia regional administration, commented that the environmental cost (e.g. the cost for recovering the aquifer) was not taken into account. **Ms. Manoli** noted that this aspect is out of the scope of the analysis, which aims to assess different technology scenarios for improving the system‘s performance and to analyze the relevant economic costs.

The discussion also focused on the following issues:

- The importance of investigating new, low-cost, and water-saving irrigation methods and practices;
- The difficulty in the implementation of drip irrigation systems, which is considered the most appropriate irrigation practice; and
- The main barriers that need to be overcome towards the reuse of treated wastewater for irrigation, which concerned treatment costs and farmers' perceptions.

3.2.3 Innovative technologies & scenarios

Visions, new technologies and alternative scenarios

Prof. Mladen Todorovic (CIHEAM-IAMB) introduced the main aspects that should be accounted for defining alternative future scenarios:

- Market dynamics;
- Regulatory instruments;
- Economic instruments;
- Organizational changes;
- Structural changes.

Moreover, he suggested that the PESTLE analysis method can support the scenario definition process through the identification of drivers and barriers for technology uptake. A preliminary list of technologies and practices that can be implemented was also presented (Table 6). The primary and secondary impacts of the implementation of five of these technologies and practices have been identified (Table 7), while the acceptability of local stakeholders remains to be assessed (with the exception of variable speed pumps which are highly acceptable). It was underlined that both agronomic and engineering aspects will be integrated in the analysis.

Table 6: Technologies & practices for the Sinistra Ofanto irrigation scheme

Technologies & Practices
Abstraction stage
Solar powered irrigation pumps
Eco-friendly variable speed pumps
Remote control of irrigation water supply based on an integrated (engineering & agronomic) approach
Remote control of water withdrawals from the aquifer
Use of treated waste water
Distribution stage
Network sectoring & dynamic pressure regulation
Variable speed pumps

Technologies & Practices
Water use stage
Drip irrigation system
Sub-surface drip irrigation system
Use of electronic water delivery device (AcquaCard)
Use of biodegradable mulches to restrict soil water loss from evaporation & weeds
Application of minimum tillage technique
Change of cropping patterns
Improved irrigation scheduling/WUE/deficit irrigation
Use of sensors for monitoring weather variables and soil moisture conditions

Table 7: Impacts of selected interventions (technologies & practices) on the system

Application Level	Action	Primary effect	Secondary effect
Hydrants equipped with electronic cards			
Farm	Recording water withdrawals	Water & energy saving	Reduction of network operational cost
Variable speed pumps			
District/system	Modulating pumps frequency & speed to actual requirements	Energy saving	Reduction of network operational cost
Shifting of irrigation methods (from sprinkle to mini-sprinkle & trickle irrigation)			
Field/farm	Reduction of consumptive use & operating pressure	Water & energy saving	Reduction of operational cost for farm irrigation
Sub-surface drip irrigation (SDI) & Regulated deficit irrigation (RDI)			
Field/farm	Increase of water use efficiency (WUE) & water productivity (WP)	Water & energy saving	Reduction of irrigation cost

Preliminary results on the assessment of new technologies

Dr. Thanos Angelis-Dimakis (NTUA) highlighted that the main objectives for implementing innovative technologies are:

- Reduction of resources use;
- Reduction of environmental impacts, and
- Maintenance or enhancement of the value added from water use.

The main innovative technologies and irrigation practices proposed by CIHEAM-IAMB for improving water use and energy efficiency were presented. Two alternative technology scenarios concerning the implementation of sub-surface drip irrigation and regulated deficit irrigation were compared with the baseline. Indicative results on the environmental, economic and eco-efficiency performance of the system were presented. **Dr. Nardella** (Consorzio per la Bonifica Della Capitanata) commented that new technologies should be used to optimize water use efficiency, highlighting that the main objective of local stakeholders is cost reduction.

3.3 Field visits

During the first day of the Workshop, Project Partners visited the Sinistra Ofanto irrigation scheme. The visit was divided into two parts:

- The first part involved a field visit to the Capaccioti Dam and the irrigation districts 1 and 10, where **Dr. Nicola Lamaddalena** (CIHEAM-IAMB) welcomed the Project Partners and presented the main features of the reservoir and distribution network.
- The second part included a visit to the local office of the Consortium per la Bonifica Della Capitanata - Co.Bo.Ca, the main water management body in the Sinistra Ofanto area. **Mr. Michele Solimando** informed Project Partners on the history, the administrative structure, the scope and the responsibilities of the consortium. The different irrigation schemes managed by the consortium were then presented emphasizing on the Sinistra Ofanto irrigation scheme (Figure 4). The main features of the scheme and the water supply network were described, focusing on the existing systems and applied technologies. The presentation also included economic data related to the operation of the scheme and water tariffs.

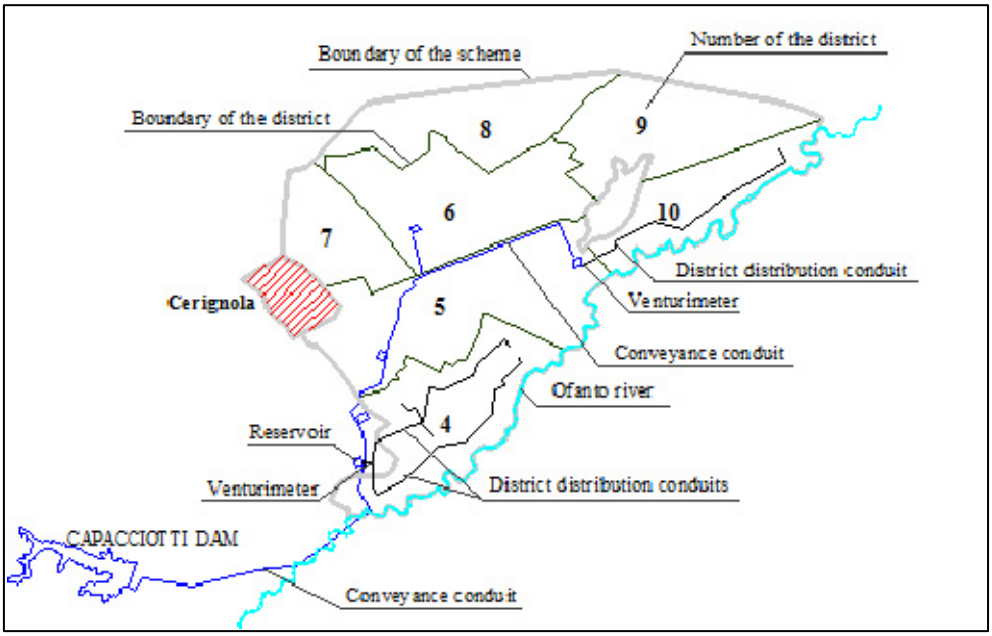

Figure 4: The Sinistra Ofanto irrigation scheme

In the discussion that followed the presentation of **Mr. Solimando** (Co.Bo.Ca), the issue of water availability was raised. **Prof. Mladen Todorovic** (CIHEAM-IAMB) noted that compared to the Monte Novo irrigation scheme, which is still under development, Sinistra Ofanto is an old scheme facing water availability issues. **Dr. Vivas** (UPORTO) added that high water prices in Monte Novo are the most significant driver for improving the efficiency of irrigation practices. **Mr. Zaccaria** (CIHEAM-IAMB) commented that in Sinistra Ofanto farmers invest on water saving techniques (drip irrigation, etc) to improve the water use efficiency. **Dr. Lindgaard-Jørgensen** (DHI) asked whether the agricultural products of the scheme are consumed domestically or exported. Stakeholders replied that the local produce is both consumed domestically and exported, highlighting that the production of the area is limited by the available amount of water for irrigation. **Dr. Levidow** (OU) enquired about local farmers' view on cultivating crops with lower water demands. **Mr. Solimando** replied that farmers would cultivate crops with lower water demands if the profits gained were significant. There are two ways to deal with the increased crop irrigation requirements, which have been doubled during the last years:

- Water abstraction through private wells; and
- Reduction of water loses.

Mr. Blind (Deltares) asked about the existing legislation concerning groundwater withdrawals, and **Mr. Solimando** responded that regional organizations are responsible for groundwater monitoring by defining the cultivated crops and imposing relevant limitations.

Prof. Assimacopoulos (NTUA) asked whether innovative technologies have been applied or are planned to be applied in the area for improving the system's efficiency. **Mr. Solimando** replied that new hydrants have already been installed to monitor water use. He noted however that, although the efficiency of the system as a whole was increased, in the farm level efficiency was decreased due to inadequate

pressure during peak periods; an even distribution of water withdrawals during the day could solve this issue. It was suggested that incentives to achieve even distribution, e.g. application of lower water tariffs during night hours, should be investigated by the Project within the assessment of alternative scenarios.

At the end of the first day of the Workshop, participants visited the Coldiretti farmers' cooperation and were apprised on the processes and technologies used for the production of olives and wine.

3.4 Workshop Conclusions

The Sinistra Ofanto Workshop provided significant information for the Case Study Development process. The most important conclusions reached at the event included the following:

- Local stakeholders are very interested in the objectives and anticipated results of the Project;
- The introduction of innovative technologies and practices to address water availability and environmental issues is extremely important for the successful operation of the scheme;
- Farmers should be informed about the new technologies and practices that will be assessed by the Project, to foster their uptake;
- Groundwater overexploitation is a major issue in the area and relevant information would be appreciated by the local stakeholders;
- Technologies regarding the monitoring of groundwater abstractions should be assessed, as groundwater is considered a scarce resource;
- The preliminary results shown were considered of significant importance by the local actors;
- Data collection regarding some aspects of the economic and environmental performance of the system might be challenging.

3.5 List of Participants

Both Project Partners and local stakeholders participated in the second EcoWater Workshop. The Workshop was also attended by two members of the External Advisory Board, Dr. Enrique Playán and Dr. Christian Remy. The main characteristics/responsibilities of the actors/stakeholders and the affiliation of the Project Partners, who participated in the event, are briefly described in Table 8.

Table 8: The Sinistra Ofanto Workshop participants

Actor/stakeholder	Characteristics
Maria Antonietta Iannarelli	Representatives of the **Apulia Regional Administration**
Antonello Antonicelli	

Michele Vurro Ivan Portoghese	Representatives of the **CNR - Water Research Institute**, the research activities of which focus in the fields of water resources management and protection and on the development of methodologies and technologies for water purification and treatment of wastewater
Luigi Nardella Michele Solimando Giusepe Dicataldo	Representatives of the consortium for the remediation of the Capitanata region (**Consorzio per la Bonifica Della Capitanata Co.Bo.Ca**), which is the main water management body in the Sinistra Ofanto area
Umberto Fratino Antonio Disanto	Representatives of the **River basins authority of Apulia region**
Vito Specchio	Representative of the **SOGESID Spa**, a company committed to protecting water resources and related infrastructures through operative interventions (e.g. environmental remediation, environmental requalification, assistance in treating urban solid waste and industrial waste, etc.)
Pietro Rubino Antonio Lonigro	Representatives of the **University of Bari - Faculty of Agriculture**
Project Partner	**Affiliation**
Nicola Lamaddalena	International Centre for Advanced Mediterranean Agronomic Studies - Mediterranean Agronomic Institute of Bari (**CIHEAM-IAMB**)
Mladen Todorovic	International Centre for Advanced Mediterranean Agronomic Studies - Mediterranean Agronomic Institute of Bari (**CIHEAM-IAMB**)
Daniele Zaccaria	International Centre for Advanced Mediterranean Agronomic Studies - Mediterranean Agronomic Institute of Bari (**CIHEAM-IAMB**)
Daniela D'Agostino	International Centre for Advanced Mediterranean Agronomic Studies - Mediterranean Agronomic Institute of Bari (**CIHEAM-IAMB**)
Lija van Vliet	**Deltares**
Michiel Blind	**Deltares**
Palle Lindgaard-Jørgensen	**DHI**

Else Okkels-Birk	**DHI**
Claudia Niewersch	University of Applied Sciences and Arts Northwestern Switzerland (**FHNW**)
Olga Steiger	University of Applied Sciences and Arts Northwestern Switzerland (**FHNW**)
Åsa Nilsson	Swedish Environmental Research Institute (**IVL**)
Sara Alongi Skenhall	Swedish Environmental Research Institute (**IVL**)
Anna Balzarini	**MITA**
Dionysis Assimacopoulos	National Technical University of Athens (**NTUA**)
George Arampatzis	National Technical University of Athens (**NTUA**)
Elina Manoli	National Technical University of Athens (**NTUA**)
Thanos Angelis-Dimakis	National Technical University of Athens (**NTUA**)
Vassilis Kourentzis	National Technical University of Athens (**NTUA**)
Les Levidow	The Open University (**OU**)
Irina Ribarova	University of Architecture, Civil Engineering and Geodesy (**UACEG**)
Peyo Stanchev	University of Architecture, Civil Engineering and Geodesy (**UACEG**)
Rodrigo Maia	University of Porto (**UPORTO**)
Eduardo Vivas	University of Porto (**UPORTO**)
External Advisory Board members (EAB)	
Dr. Enrique Playán	
Dr. Christian Remy	

4 The Volvo Automotive Industry Workshop

4.1 Scope of the Workshop

The third EcoWater Workshop was carried out in Gothenburg (Sweden) on the 20th of March 2013 and concerned the 8th industrial EcoWater Case Study: Meso-level eco-efficiency indicators for technology assessment in water use in the automotive industry. It was organized by the Swedish Environmental Research Institute (IVL), and was combined with the 2nd Interim Project Meeting. The event was aimed to introduce the EcoWater concept to stakeholders and enhance collaboration and linkages among the Project Partners and the actors involved in the Volvo production value chain.

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 technology assessment in the Case Study; and
- Identify drivers and barriers for introducing new technologies in water using processes of the automotive industry;

The Volvo Workshop lasted half a day and was concluded with a joint lunch and a reconvention in the evening for a social event and dinner. Fruitful discussions were held during the Workshop, and a joint exercise was undertaken on the application of the PESTLE analysis method, providing valuable input for the forthcoming scenario analysis (see Annex 2). The event did not include field visits; the initially organized visit to the Volvo Trucks production site was cancelled as the site was closed off for visitors due to the launching of a new model.

The overall program of the Workshop is presented in Table 9.

Table 9: The program of the Workshop

		Wednesday, 20 March 2013
08:30	*Arrival of stakeholders/registration*	
08:45	Welcome note	*Åsa Nilsson, IVL*
09:00	Introduction of participants	*All*
09:15	Introducing the EcoWater concepts: Relevance and research relating to Case Studies - *What are we doing, and why?* - *What is eco-efficiency?*	*Dionysis Assimacopoulos, NTUA*
09:30	Presentation of Volvo Trucks water consuming processes.	*Nils Lindskog, Volvo Technology*
10:00	*Coffee break*	
10:30	Eco-efficiency and eco-innovation (discussion) • *What is it? (intro)* • *Is it important and relevant?* • *Is there a benefit of a systems perspective?*	*Facilitation by Uwe Fortkamp, IVL and Palle Lindgaard-Jörgensen, DHI*
11:00	Presentation of system level eco-efficiency assessment in the case study for a few technology scenarios (Baseline assessment)	*Åsa Nilsson, IVL*
11:30	Drivers and barriers for introducing new technologies Mapping with PESTLE - *How to use the PESTLE method? (intro)* - *Mapping of drivers and barriers (group discussions)*	*Intro by Palle Lindgaard-Jörgensen, DHI*
12:30	Summary of group discussions (PESTLE mapping)	*One representative from each group*
12:50	Conclusions: What is next in the project?	*Dionysis Assimacopoulos, NTUA*
13:00 – 14:00	*End of stakeholder Workshop*	
	Lunch with stakeholders and project partners	
18:30	*Social Event for stakeholders and project partners. Guided tour of Ostindiefararen Göthenborg.*	
20:00	*Social Dinner for stakeholders and project partners.*	

4.2 Discussion summary

4.2.1 Introduction to the EcoWater Concept

Welcome note and introduction of participants

The Workshop started with a short welcome note by **Ms. Åsa Nilsson** of IVL, including preliminary information on the Workshop (the overall program of the Workshop and general logistics), and a brief introduction of the EcoWater concepts. It was followed by a short around-the-table presentation of all Workshop participants.

Introduction to the EcoWater concepts

Prof. Assimacopoulos of NTUA, the Project Coordinator, welcomed the stakeholders and thanked them for their interest in the Project. He presented the main EcoWater research framework and concept, to familiarize the external audience with the Project's objectives and anticipated results. The presentation provided an overview of the eight EcoWater Case Studies focusing on the Automotive Industry (Volvo) Case Study. Furthermore, Prof. Dionysis Assimacopoulos presented the methodological approach and the expected outcomes of the project.

4.2.2 The Volvo Case Study

Volvo Trucks water consuming processes

Upon the completion of the introduction to the Project, **Mr. Nils Lindskog**, Volvo Technology representative (VTEC), presented an overview of the water consuming processes in the production of Volvo Trucks. He provided relevant information on the production of Volvo Trucks in Sweden, emphasizing on the water and energy consuming processes of the two production facilities that will be analyzed by the Case Study, sited in Umeå and Gothenburg. The Volvo Company uses systems and methods to evaluate water use in production processes, mainly focusing on cabin production.

The presentation continued with a description of water use processes in the Umeå site. It was noted that water and energy demands at the Umeå production site depend partly on the scheduling between the different steps of the anti-corrosion surface treatment process, while water use efficiency depends on the overall process design and the selected technologies. It was highlighted that the largest water consumption is associated with the pre-treatment step (metal surface treatment before painting, including degreasing and methods for corrosion protection), and the painting processes which use liquid coatings.

Mr. Lindskog also referred to the Volvo corporate policy concerning efficient use of resources and water management, and informed the audience that the production of Volvo trucks in the Umeå site is close to CO_2 neutral, while the energy used at the site is produced from hydropower. Examples of possible applications of water efficient processes were then illustrated, indicating alternative technology scenarios that could be examined by the Project. It was pointed out that the electro dip coating (cataphoresis) step can become more efficient by recycling the paint over an

ultrafiltration unit. Furthermore, results of a pilot testing of the replacement of the phosphating technology in corrosion protection with a new technology (Oxilane) showed that there is potential to introduce new, environmentally friendly technologies in Volvo production processes. Moreover, advantages of integrated water management were presented, and the presentation ended with a reference to water saving actions.

Discussion on Eco-efficiency and eco-innovation

The next part of the Workshop was dedicated to a discussion on eco-efficient and eco-innovative technologies, their relevance to the automotive industry and the benefits of applying a systems perspective. Opening the discussion, **Mr. Uwe Fortkamp** (IVL) presented an overview of the concepts of eco-efficiency and eco-innovation. He also referred to obstacles regarding eco-innovation implementation and incentives for technology uptake.

The discussion that followed was facilitated by **Dr. Palle Lindgaard-Jørgensen** of DHI. **Dr. Palle Lindgaard-Jørgensen** asked the representatives of the Stena Recycling Company (treatment of Volvo wastewater) for their views about the system's approach that will be followed by EcoWater, highlighting that the operation of Volvo has a direct impact on the operation of the wastewater treatment company. **Mr. Anders Axell**, of the Stena Recycling Company, responded that although Stena Recycling has short-term assignments by Volvo (3 years at a time), the systems perspective interest the company. He pointed out that currently Volvo provides information on the generated wastewater thus simplifying the treatment processes, while Stena Recycling informs Volvo concerning the quality of the received wastewater, thus providing feedback on the production processes. **Mr. Anders Axell** also noted that if Volvo improved its environmental performance and generated effluents of better quality, it would be easier for Stena Recycling to comply with the regulations. **Ms. Christina Öjersson** (Stena Recycling representative) added that highly polluted effluents increase the cost of the treatment process. She also commented that the set-up of business agreements with Volvo, which would benefit both sides, can be enhanced by working more closely together as part of a common system – e.g. variable rate, flat rate, fee for extra pollution.

Prof. Mladen Todorovic (CIHEAM-IAMB) asked if charges for wastewater treatment depend on the quantity or the quality of the generated effluents, and **Mr. Anders Axell** replied that both parameters affect the water treatment cost.

Prof. Mladen Todorovic also asked if Volvo conducts analyses regarding the improvement of the environmental and economic performance of production processes, through the introduction of different technologies. **Mr. Nils Lindskog** (VTEC) replied that Volvo always performs cost-benefit analyses in the examined technologies, taking into account the relevant resources flows. He added that at the moment recycling seems a very promising option for improving both economic and environmental performance of production processes.

Finally, **Dr. Lindgaard-Jørgensen** highlighted the importance of organizing the different "players" of the system towards a common goal and assessing the entire

system as a whole, for the identification of the optimum solution for improving eco-efficiency.

Baseline eco-efficiency assessment – Results of a technology scenario

Ms. Åsa Nilsson (IVL) presented the results of the preliminary baseline eco-efficiency assessment for the Volvo Automotive Industry, and the assessment of an alternative technology scenario, based on the system modelling in the EcoWater tools (SEAT and EVAT). First, an overview of the system mapping was provided including the two production sites of Volvo Trucks (i) the Umeå site, and (ii) the Gothenburg site, as presented in Figure 5 (the truck cabins are produced in Umeå and then are sent to Gothenburg, where they are assembled for the production of the final products). A list of relevant indicators was then presented, and the results of the preliminary baseline eco-efficiency assessment of the system were provided. The comparison of eco-efficiency and environmental performance between the Business As Usual (BAU) and a technology scenario followed. In the examined technology scenario, the traditional phosphating technology used for corrosion protection of frame beams in the Gothenburg production site was replaced by a silane-based technology (Oxilane). The technology scenario was based on results from the pilot tests previously presented by Mr. Nils Lindskog (VTEC). The preliminary results indicated that, according to the selected eco-efficiency indicators, the examined technology improves the eco-efficiency of the system.

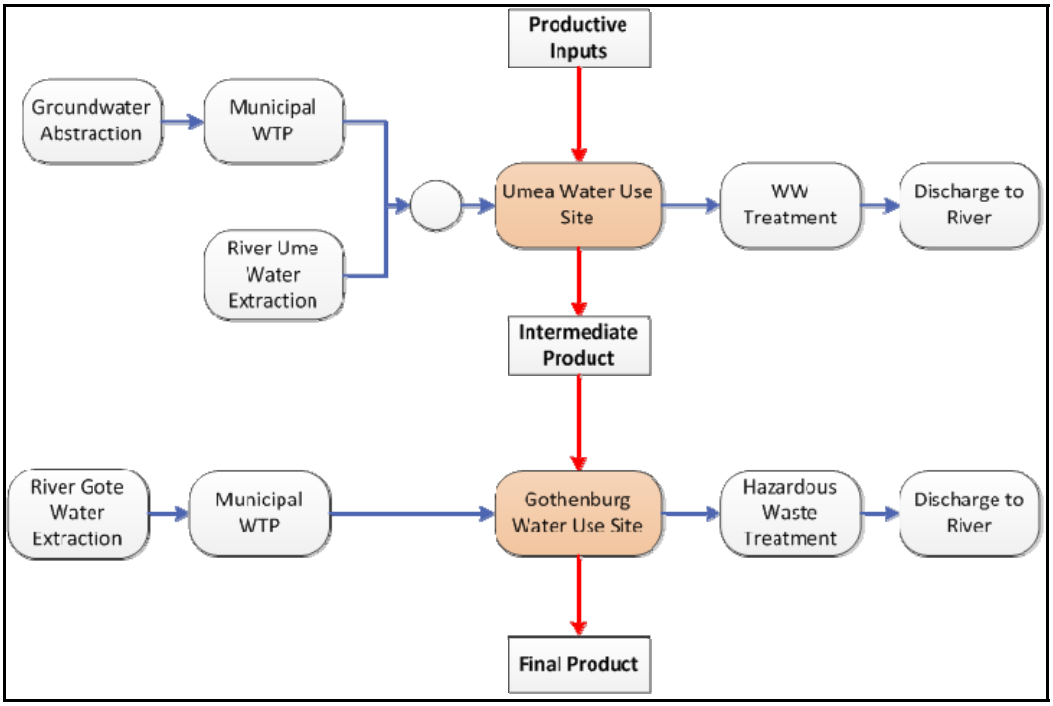

Figure 5: The overview of the examined system

During the presentation, **Mr. Nils Lindskog** (VTEC) noted that the presented alternative technology appears promising, but its introduction in the Volvo production

line is still under examination, as the corrosion protection that it provides is not considered sufficient. **Ms. Nilsson** (IVL) indicated that although the technology examined in the alternative scenario reduced the water consumption of the specific process in which it was introduce, it did not significantly reduce the water consumption of the whole system, as the contribution of the specific process to the whole water consumption is not substantial. **Ms. Sara Alongi Skenhall** (IVL) highlighted that this constitutes a serious challenge of the analysis in the meso-level, as micro improvements through the implementation of new technologies in specific processes may not significantly affect the operation of the whole system.

In the discussion that followed **Mr. Uwe Fortkamp** (IVL) commented that case-specific indicators that take into account the potential drawbacks from the implementation of a new technology should also be considered, and **Ms. Nilsson** replied that such indicators - potentially based on the LCA methodology - will be added in the analysis, in order to take into account the specific parameters that change when introducing a new technology.

Dr. Les Levidow (OU) asked Volvo representatives whether the EcoWater concept could help and improve the operation of the company, and they replied that they found the presented concept very interesting, as it is very important to consider the whole system when taking decisions or implementing technologies.

4.2.3 The PESTLE analysis exercise

Drivers and barriers for introducing new technologies – Mapping with PESTLE

Dr. Palle Lindgaard-Jørgensen (DHI) made a brief introduction to the PESTLE analysis, a structured analysis format selected to pin-point drivers and barriers for introducing new technologies. His presentation focused on the importance of:

- Understanding drivers and barriers for a technology uptake; and
- Thinking about plausible futures.

A list of PESTLE analysis factors and relevant issues (Table 10) was also presented.

Table 10: PESTLE analysis factors

Factor	Likely to include
Political	Worldwide, European and government policies, funding policies
Economic	Funding mechanisms and streams, business directives, budgetary restrictions, budget targets, markets for products
Social	What are the main societal and cultural aspects, is Corporate Social Responsibility (CSR) a driver?
Technological	Major current and emerging technologies of relevance
Legislation	European and national proposed and passed legislation
Environmental	Local, national and international environmental impacts and outcomes of political and social factors

A discussion/joint exercise followed in which local actors and members of the EcoWater consortium were organized in three groups (Figure 6). The aim of the exercise was to get the external audience's input on drivers and barriers for technology uptake in the water value chain of the automotive industry in Sweden. Two of the PESTLE factors were assigned to each group for analysis and identification of relevant drivers and barriers:

- 1st group: Political and Economic. Led by Ms. Sara Alongi Skenhall, IVL.
- 2nd group: Social and Technological. Led by Mrs. Åsa Nilsson, IVL.
- 3rd group: Legislation and Environmental. Led by Mr. Uwe Fortkamp, IVL.

Figure 6: Group of Workshop participants during the PESTLE analysis exercise

There was no time left during the meeting for a summary presentation of the group discussions, so instead it was decided that IVL would send out the summary after compilation. The resulting PESTLE analysis is included in Annex II. After circulating it among the Project Partners for comments, it was sent by e-mail to the external audience.

4.3 Workshop Conclusions

The third EcoWater Workshop was a successful forum for the dissemination of the project and its preliminary results to the local actors. The presence of Mrs. Charlotta Stadig in particular, a representative of the Swedish Agency for Marine and Water Management (HaV), enables the wider dissemination of the Project. Unfortunately however, no representative of the municipal water supplier was able to attend despite being invited to the Workshop.

The most important conclusions/outcomes of the Volvo Workshop are:

- Local stakeholders have shown significant interest in the EcoWater concept and results; colleagues of the Workshop participants also expressed their interest in being involved in similar EcoWater events;

- Further information on technologies would also be appreciated;
- The proposed silane based technology can potentially improve eco-efficiency of the Volvo water system;
- Water recycling is a promising option for improving the performance of water consuming production processes;
- The selected technologies should contribute to the improvement of the whole system and not only in the specific processes in which they are implemented;
- Case-specific indicators that take into account the potential drawbacks from the implementation of new technologies should be considered in the analysis;
- The consideration of the system as a whole and the organization of the different "players" of the system towards a common goal are of great importance.

Moreover, the participation of the local actors in the PESTLE exercise provided useful input for the EcoWater scenario analysis. This input concern drivers and barriers for technology uptake in the water value chain of the automotive industry, and will provide a basis for setting up the future scenarios related to the Volvo Case Study. The next steps for the project will be to assess the future importance and uncertainty of the listed drivers and barriers. Groups of the most important and uncertain drivers and barriers will be then used to formulate the future scenarios. Communication with the local actors during this process will be sought, as it would provide helpful feedback to the Project.

4.4 List of Participants

The main characteristics/responsibilities of the actors/stakeholders and the affiliation of the Project Partners, who attended the event, are briefly described in Table 11.

Table 11: The Volvo Workshop participants

Actor/stakeholder	Characteristics
Nils Lindskog	Project leader and senior expert at **Volvo Technology, Sweden**. Involved in technology development projects of Volvo Trucks.
Carina Ström	Manager and senior expert at **Volvo Technology, Sweden**.
Berndt Albinsson	Environmental and energy coordinator at **Volvo Trucks, Sweden**, the Gothenburg site. Industrial actor of the Case Study.
Anders Axell	Production engineer (hazardous waste treatment) at **Stena Recycling, Sweden**. Stena Recycling is the contractor for treatment of process wastewater from Volvo Trucks, Gothenburg.

Christina Öjersson	Coordinator at **Stena Recycling, Sweden**.
Charlotta Stadig	Representative of the **Swedish Agency for Marine and Water Management (HaV)**, which is the national water management authority that issues high-level policy for good environmental status.
Project Partner	Affiliation
Mladen Todorovic	International Centre for Advanced Mediterranean Agronomic Studies - Mediterranean Agronomic Institute of Bari (**CIHEAM-IAMB**)
Michiel Blind	**Deltares**
Marcel Bruggers	**Deltares**
Palle Lindgaard-Jørgensen	**DHI**
Christoph Hugi	University of Applied Sciences and Arts Northwestern Switzerland (**FHNW**)
Olga Steiger	University of Applied Sciences and Arts Northwestern Switzerland (**FHNW**)
Åsa Nilsson	Swedish Environmental Research Institute (**IVL**)
Sara Alongi Skenhall	Swedish Environmental Research Institute (**IVL**)
Tomas Rydberg	Swedish Environmental Research Institute (**IVL**)
Uwe Fortkamp	Swedish Environmental Research Institute (**IVL**)
Anna Balzarini	**MITA**
Dionysis Assimacopoulos	National Technical University of Athens (**NTUA**)
George Arampatzis	National Technical University of Athens (**NTUA**)
Patricia Stathatou	National Technical University of Athens (**NTUA**)
Franka Gad	National Technical University of Athens (**NTUA**)
Les Levidow	The Open University (**OU**)
Irina Ribarova	University of Architecture, Civil Engineering and Geodesy (**UACEG**)
Peyo Stanchev	University of Architecture, Civil Engineering and Geodesy (**UACEG**)
Rodrigo Maia	University of Porto (**UPORTO**)

Annex I: Questionnaire on the Evaluation of the 1st EcoWater CS Workshop

This questionnaire aims to assist us in evaluating the processes and context of the 1st EcoWater Case Study Workshop on "Improving eco-efficiency of water use in the Monte Novo Irrigation Scheme". It will further communicate to us your views on the expected impact of the EcoWater project, both within the local context (Monte Novo Irrigation Scheme) and from a wider research and policy development perspective.
Thus, through a series of simple questions, we would like to have your opinion on:

- The structure, content and processes of this 1st Workshop so that we may improve our subsequent events;
- The potential contribution of EcoWater in addressing local issues and fostering capacity for eco-innovation and enhanced eco-efficiency in water use.

This questionnaire is structured in 2 parts and has a total of 10 questions; **we would appreciate if you could complete all questions;** this should not take more than 10-15 minutes of your time.
The results from this questionnaire will be processed anonymously and will be taken into account for the organisation of subsequent Case Study Workshops in EcoWater. They will further be consulted for improving project processes, where and when this is feasible.

Thank you

The NTUA team

Please complete your name and affiliation

Full Name: ……

Affiliation (Institution and position):……

PART A: Evaluation of Workshop processes

The following questions (1 – 4) concern the evaluation of processes followed during the Workshop.

Question 1

On a scale from 1-5 (1: the lowest mark; 5: the highest mark) please rate the level of efficiency of the processes followed during the Workshop.

	1	2	3	4	5
Introduction of project objectives, framework and expected impacts	❑	❑	❑	❑	❑
Presentation of the main issues of relevance to the project (eco-innovation, eco-efficiency and value chain analysis)	❑	❑	❑	❑	❑
Discussion on eco-efficiency indicators	❑	❑	❑	❑	❑
Discussion on currently applied eco-innovations and technologies to enhance eco-efficiency in water use	❑	❑	❑	❑	❑

Please give us your opinion on how the related processes could have been improved.

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Question 2

On a scale from 1-5 (1: the lowest mark; 5: the highest mark) please rate the information provided during the Workshop on the following issues:

	1	2	3	4	5
Eco-efficiency	❑	❑	❑	❑	❑
Eco-innovation	❑	❑	❑	❑	❑
Innovative technologies & practices	❑	❑	❑	❑	❑
Eco-efficiency indicators	❑	❑	❑	❑	❑

Question 3

Please indicate the topic(s) on which you would have liked to received more information.

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Question 4

Please list the relevant topic(s), which have not been addressed in the Workshop, and that you consider essential to the Monte Novo Irrigation Scheme & the Alqueva system in general.

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PART B: Expected Project Impact

With questions 5 – 10, we would like to have your view on the potential impacts of EcoWater project.

Question 5

On a scale of 1-5 (1: the lowest mark; 5: the highest mark) please rate the feasibility of achieving the project objectives:

	1	2	3	4	5
Development of an analytical framework for eco-efficiency assessment across water service systems	❑	❑	❑	❑	❑
Improved understanding of dynamics for technology implementation	❑	❑	❑	❑	❑
Identification of policy instruments to foster technology implementation & uptake	❑	❑	❑	❑	❑
Building of an operational science-policy – industry interface	❑	❑	❑	❑	❑

Question 6

On a scale of 1-5 (1: the lowest mark; 5: the highest mark) please rate the foreseen/planned project activities with regard to the following:

	1	2	3	4	5
Bringing together actors and researchers	❑	❑	❑	❑	❑
Disseminating research results	❑	❑	❑	❑	❑
Achieving a better understanding of eco-efficiency challenges in the Case Studies	❑	❑	❑	❑	❑
Providing insight on policy instruments for technology uptake	❑	❑	❑	❑	❑

Question 7

On a scale of 1-5 (1: the lowest mark; 5: the highest mark), please rate the level of planned engagement of project processes, activities and outputs, with different actors in the Monte Novo Irrigation Scheme.

	1	2	3	4	5
Decision makers	❑	❑	❑	❑	❑
Technical community/Water professionals	❑	❑	❑	❑	❑
Local users	❑	❑	❑	❑	❑
Local authorities	❑	❑	❑	❑	❑

Question 8

In your opinion, which are the strong points or innovations of the EcoWater project in comparison to other, similar projects and initiatives dealing with eco-efficiency and eco-innovation?

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Question 9

In your opinion, which are the main weaknesses of the EcoWater project?

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Question 10

Please give us your comments and suggestions in relation to EcoWater, focusing particularly on our Case Study for the Monte Novo Irrigation Scheme.

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Thank you very much for your time & input

Annex II: Outcomes of the PESTLE analysis exercise

Factor	Drivers	Barriers
Political	Environmental concern	Duration of political terms (3-4 years) - lack of long term perspective
	Awareness of & research agenda on environmental technologies and innovation	Lack of awareness of environment and innovation
	EU innovation agenda	Loss of employment opportunities
	Potential export opportunities	Obsolete regulation/BAT or inadequate regulation for innovation (hinder ideas and implementation)
	Green Growth agenda	Too much regulation, hard to catch up
	Respect for EU legislation	Funds and rules for funds, or availability
	Concern for scarce resources (water, P, metals, etc)	Innovation climate in EU
	Funds for Research & Development (R&D)	
	Best Available Technologies (BAT) documents	
	BLUEPRINT document on future water management	
	Innovation climate in EU	

Factor	Drivers	Barriers
Economic	Globalisation of sector, world market	Different legislation/standardisation for different markets (challenge to respect regional legislation on a global market)
	EU vs. world market	Cost of investment, payback time
	Business opportunity - quality, treatment cost	Availability of funds, how to get funding (application process etc)
	Profits of new technologies	Business model suitability in the value chain (e.g. volume vs. components in fee for waste treatment)
	Competitive advantage	Economic risk for an immature technology
	Find business models for longer pay-back time	Different budget posts for cost and investments (cash flow within company)
	Cost savings, lower fees	"local" cost - "global" profit
	Environmental taxations	
Social	Safer work environment	Means of communication (internal in company)
	Simplified operation	Requirement of education/experience
	Corporate Social Responsibility (CSR)	Unknown risks
Technological	Quality	Size of equipment
	Simplified operation	Quality of product is not verified
	Use of reclaimed water (save water use, relooping of water)	Takes time to verify improvements
	Reduced water footprint	Too concentrated wastewater (difficult treatment)
		Profitability

Factor	Drivers	Barriers
Legislation	BAT under the Industrial Emissions Directive (IED)	BAT (IED) standard can become a ceiling
	Water Framework Directive (WFD) - national regulation	Individual permits
	WFD - local thresholds	State aid (restrictions on financial support)
	Marine Water Directive	
	Hazardous waste	
	Waste directive	
Environmental	Awareness	Focus on benefits in product use (e.g. fuel efficiency) rather than process design
	Climate change	Eco-innovation can substitute one environmental problem for another, thus encountering new barriers
	Company image (environmental profile)	Less focus on environment (economic crisis)
	CSR	
	Nano materials (Or other new materials)	
	Children (future generations)	
	Public health	
	Persistent chemicals	
	Environmental taxes	

IVL Swedish Environmental Research Institute

IVL Swedish Environmental Research Institute Ltd., P.O. Box 210 60,
S-100 31 Stockholm, Sweden
Phone: +46-8-598 563 00 Fax: +46-8-598 563 90
www.ivl.se