



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

Collaborative project, Grant Agreement No: 282882

Deliverable 5.10 Finalised guidelines for the use of the EcoWater Toolbox

August 2014

DOCUMENT INFORMATION

Project	
Project acronym:	EcoWater
Project full title:	Meso-level eco-efficiency indicators to assess tech- nologies and their uptake in water use sectors
Grant agreement no .:	282882
Funding scheme:	Collaborative Project
Project start date:	01/11/2011
Project duration:	38 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:	5.10
Deliverable title:	Finalised guidelines for the use of the EcoWater Toolbox
Due date of deliverable:	30/04/2014
Actual submission date:	31/08/2014
Editor(s):	Michiel Blind
Author(s):	Michiel Blind
Reviewer(s):	George Arampatzis, Thanos Angelis-Dimakis
Work Package no.:	5
Work Package title:	Integration and Synthesis
Work Package Leader:	National Technical University of Athens
Dissemination level:	Public
Version:	1.0
Draft/Final:	Final
No of pages (including cover):	55
Keywords:	Toolbox, meso-level, eco-efficiency assessment

Abstract

Based on the developed methods and tools from EcoWater WP1, 'Framework and tools for meso-level eco-efficiency analysis and technology assessment', an integrated (suite of) online, web-based tools and resources has been built for the assessment and comparison of the eco-efficiency of innovative technologies. The purpose is amongst others to facilitate technology benchmarks in water systems. The suite of tools will thus provide a mechanism for developers of new technologies to demonstrate the effect of their technology on mesolevel eco-efficiency and allow policy-makers to assess possible impacts of regulations.

Deliverable 5.10 provides the step-by step guidelines for the web-based toolbox which can be found on <u>http://environ.chemeng.ntua.gr/ewtoolbox/</u>. Each functionality for case study collaborators is presented via figures and explanations.

Contents

Contents

DO	CUM	ENT	INFORMATION	2
Abs	stract			5
Cor	ntents	s		7
List	of Fi	gure	S	8
1	Intro	duct	tion	.10
1	.1	Gen	eral introduction	.10
1	.2	Terr	ns and conditions for using the web-based toolbox	.11
1	.3	SEA	AT and EVAT	.12
	1.3.	1	SEAT	.12
	1.3.2	2	EVAT	.13
1	.4	Rea	ding guide	.13
2	Use	r gui	de	.15
2	.1	Gett	ting started	.15
	2.1.	1	About the toolbox	.16
	2.1.2	2	Creating a new account	.16
	2.1.	1	Editing your profile, profile information	.20
	2.1.2	2	Signing in	.22
	2.1.3	3	Retrieving sign-in information (password)	.23
	2.1.4	4	Deleting an account	.23
2	.2	The	functions of the main tabs on the home screen	.23
2	.3	Step	b-by step: Developing and analyzing a case study	.25
	2.3.	1	The overall case-study process	.25
	2.3.2	2	Creating a new case study	.26
	2.3.3	3	Adding and editing details of the case study	.30
	2.3.4	4	Developing (the business as usual) scenario's	.33
	2.3.	5	Evaluating (the business as usual) scenario's	.37
	2.3.0	6	Comparing multiple scenario's.	.43
2	.4	Step	o-by step: Adding and editing new technologies	.47
2	.5	Step	b-by step: Adding and editing new Indicators	.49
3	Coll	abor	ators, Administrators, Owner and Stakeholders	.53
4	Trou	ubles	hooting – Frequently asked questions	.54
5	Liter	atur	e	.55

List of Figures

Figure 1: Opening screen of the EWT, not logged in.	
Figure 2: "About" the toolbox button	
Figure 3: Registration / Account drop-down	
Figure 4: "Register for a new account" screen.	
Figure 5: Entering profile information	
Figure 6: Verifying your account.	.18
Figure 7: Registration completed screen.	.18
Figure 8: Verification e-mail.	.19
Figure 9: Final activation step	.19
Figure 10: Final activation step: Confirmation screen.	.19
Figure 11: Profile dropdown menu	
Figure 12: Profile information tabs	
Figure 13: Editing personal information.	
Figure 14: Uploading an avatar	
Figure 15: Access right overview.	
Figure 16: Sign in to the toolbox.	
Figure 17: Retrieving your password.	
Figure 18: Available tabs once signed in to the toolbox. The red circles emphasize the ta	ahs
and are not visible on screen	
Figure 19: Phases and steps in the Case Study development (Kourentzis, 2012)	
Figure 20: Case studies opening screen, showing the table of contents and the button	
request a new case study	
Figure 21: Response on requesting a new case study'	
Figure 22: Notification sample after access has been granted	
Figure 23: Create New Case Study.	
Figure 24: Entering basic information about a new case study.	
Figure 25: Schematisation of the demonstration case study 'DEWOT'.	
Figure 26: Case study immediately after creation.	
Figure 27: Case study details screen	
Figure 28: First time use of 'related technologies' tab.	
Figure 29: Selecting a related technology	
Figure 30: Technology list related to the case study.	
Figure 31: Editing a Case Study Technology	22
Figure 32: Details on a selected technology.	
Figure 33: Opening screen to create a new scenario.	
Figure 34: Case study overview, showing the general information (top) and the (BAU) f	
scenario Figure 35: Editing scenario details	.35
<u> </u>	
Figure 36: Scenario details - Environmental analysis (numerical data not editable)	
Figure 37: Scenario details - Economic Analysis (numerical data not editable)	
Figure 38: Specifying decimal points.	
Figure 39: Visualisation of the EVAT model within the scenario section.	
Figure 40: The steps of scenario evaluation.	
Figure 41: Expanded ' Select Relevant Indicator tab'	
Figure 42: Select an indicator to assign values to	
Figure 43: Selecting a parameter associated to an indicator	
Figure 44: Selecting all flows of CO2 to the air.	
Figure 45: BAU results: Eco-Efficiency Assessment.	.41
Figure 46: BAU results: Environmental Performance Assessment	
Figure 47: Environmental Impact Breakdown.	
Figure 48: Contribution of Foreground and Background Systems in the environmental imp	
categories	.42

Figure 49: Net Economic Output of Actors	43
Figure 50: Numerical results of the scenario including a more efficient pump	44
Figure 51: Numerical results of both scenario's.	45
Figure 52: Comparison of the net economic output of the system per actor	45
Figure 53: Comparison of the eco-efficiency performance	46
Figure 54: Direction of innovation for specific indicators.	46
Figure 55: Eco-efficiency effect of an individual actor.	46
Figure 56: Technology overview screen with request new technology button	47
Figure 57: Notification that your Technology request is sent to the administrator	47
Figure 58: Technology creation pop-up screen	47
Figure 59: Editing and adding information on technology tabulated screen	48
Figure 60: Environmental Impact Indicator overview screen with request ne	ew Indicator
button	50
Figure 61: Notification that your Indicator request is sent to the administrator.	The window
can be closed using the 'x' in the right hand corner.	50
Figure 62: Indicator description pop-up screen	50
Figure 63: Editing and adding information concerning an indicator (A).	51
Figure 64: Editing and adding information concerning an indicator (B)	51
Figure 65: Weighted sum of parameters evaluation rule - opening screen	51
Figure 66: Weighted sum of parameters evaluation rule - parameter definition	52
Figure 67: Weighted sum of parameters evaluation rule - overview of formula	
Figure 68: Editing and adding information concerning a fixed formula indicator	
Figure 69: Case study users	

1 Introduction

1.1 General introduction

The overall aim of Work Package (WP) 5 is to integrate the developed analytical framework, indicators and Case Study results, into different outputs to ensure their application beyond the EcoWater Project, in terms of analysing the dynamics of water systems and sectors of water use. More specifically, WP5 is tasked amongst others with the development of a publicly available suite of tools and resources for meso-level eco-efficiency assessments in different systems, and technology benchmarking, providing access to an integrated environment for the undertaking of similar analyses. The main output from this WP will be an integrated, web-based toolbox, which will contain the resources and tools necessary for developing meso-scale eco-efficiency assessments of different technologies. In addition, the WP will produce consolidated, step-wise guidelines for future assessments, as well as policy recommendations, based on Case Study results and cross-case comparison (EcoWater Description of Work, 2011). Table 1 below provides information stated in the EcoWater Description of Work, with respect to the toolbox-task.

Table 1: The description of Task 5.3: Development of toolbox for meso-level eco-efficiency of systems/products (EcoWater Description of Work, 2011, Part A, p. 22)

Based on the developed methods and tools from WP1, an integrated (suite of) on-line, webbased tools and resources will be built for the assessment of the eco-efficiency of innovative technologies, to facilitate technology benchmarks in water systems.

The indicator computational tools will be fed amongst others by an information database on eco-efficiency of technologies and materials, as developed through the WP 1.2 Technology Inventory. The suite of tools will thus provide a mechanism for developers of new technologies to demonstrate the effect of their technology on eco-efficiency and allow policy-makers to assess impacts of regulations.

Where applicable, integration will be performed in such a way that potential extensions (post-EcoWater) to other systems and products are supported. The task will be based on a functional requirements analysis (all partners), followed by a technical design (Deltares, NTUA), preliminary integration of the tools developed within the framework of T1.3 (Deltares, NTUA), followed by testing by all participants. Two testing iterations and subsequent improvements of the toolbox will be carried out. Guidelines for use and future adaptation will also be developed.

The development of the Toolbox will start in parallel to the activities of T1.3-2 and T1.3-3, with the definition of its functional design. Throughout the course of the Project, the Toolbox will be constantly fed with information, data and resources from T1.2 and from the Case Studies of WPs 2, 3 and 4, and will be tested and adapted according to feedback received (in addition to the two "formal" testing processes foreseen). The final version, including guide-lines for use, will be released in M30.

This report concerns the Deliverable 5.10 Finalized guidelines for the use of the EcoWater Toolbox which can be found on <u>http://environ.chemeng.ntua.gr/ewtoolbox/</u>. Each functionality for case study collaborators is presented via figures and explanations.

1.2 Terms and conditions for using the web-based toolbox

The use of the EcoWater toolbox is ruled by the following terms and conditions, to which you must subscribe when creating a user account. At the time of authoring this manual these conditions are as written in the grey box below (Box 1: Terms and Conditions). In case of future changes, the conditions stated in the toolbox overrule the conditions in this document.

(1) Introduction

These terms and conditions govern your use of this website; by using this website, you accept these terms and conditions in full. If you disagree with these terms and conditions or any part of these terms and conditions, you must not use this website.

(2) Acceptable use

You must not use this website in any way that causes, or may cause, damage to the website or impairment of the availability or accessibility of the website; or in any way which is unlawful, illegal, fraudulent or harmful, or in connection with any unlawful, illegal, fraudulent or harmful purpose or activity.

You must not use this website to copy, store, host, transmit, send, use, publish or distribute any material which consists of (or is linked to) any spyware, computer virus, Trojan horse, worm, keystroke logger, rootkit or other malicious computer software.

You must not conduct any systematic or automated data collection activities (including without limitation scraping, data mining, data extraction and data harvesting) on or in relation to our website without our express written consent.

You must not use this website to transmit or send unsolicited commercial communications.

You must not use this website for any purposes related to marketing without our express written consent.

(3) Licence to use website

Unless otherwise stated, we or our licensors own the intellectual property rights in the website and material on the website. Subject to the licence below, all these intellectual property rights are reserved.

You may view, download for caching purposes only, and print pages or other content from the website for your own personal use, subject to the restrictions set out below and elsewhere in these terms and conditions.

You must not:

(a) republish material from this website (including republication on another website);

(b) sell, rent or sub-license material from the website;

(c) reproduce, duplicate, copy or otherwise exploit material on our website for a commercial purpose;

(4) User generated content

In these terms and conditions, "your user content" means material (including without limitation text, images, audio material, video material and audio-visual material) that you submit to our website, for whatever purpose.

Your user content must not be illegal or unlawful, must not infringe any third party's legal rights, and must not be capable of giving rise to legal action whether against you or us or a third party (in each case under any applicable law).

You must not submit any user content to the website that is or has ever been the subject of any threatened or actual legal proceedings or other similar complaint.

We reserve the right to edit or remove any material submitted to our website, or stored on our servers, or hosted or published upon our website.

(5) Restricted access

Access to certain areas of our website is restricted. We reserve the right to restrict access to other areas of our website, at our discretion.

We provide you with a user name and a password to enable you to access restricted areas of our website or other content or services, you must ensure that that user name and password is kept confidential.

(6) Limited warranties

We do not warrant the completeness or accuracy of the information published on this website; nor do we commit to ensuring that the website remains available or that the material on the website is kept up-to-date.

(7) Breaches of these terms and conditions

Without prejudice to our other rights under these terms and conditions, if you breach these terms and conditions in any way, we may take such action as we deem appropriate to deal with the breach, including suspending your access to the website, prohibiting you from accessing the website, blocking computers using your IP address from accessing the website, contacting your internet service provider to request that they block your access to the website and/or bringing court proceedings against you.

(8) Variation

We may revise these terms and conditions from time-to-time. Revised terms and conditions will apply to the use of our website from the date of the publication of the revised terms and conditions on our website. Please check this page regularly to ensure you are familiar with the current version.

(9) Our details

The full name of our organization is: Environmental & Energy Management Research Unit (EEMRU) School of Chemical Engineering National Technical University of Athens (NTUA) You can contact us by email to: assim@chemeng.ntua.gr. Box 1: Terms and Conditions

1.3 SEAT and EVAT

The web-based toolbox is connected to two stand-alone modelling tools: The "Systemic Environmental Analysis Tool" SEAT and the "Economic Value chain Analysis Tool" EVAT. Once logged in, both tools can be downloaded from the web-based toolbox in the section 'Resources' (http://environ.chemeng.ntua.gr/EWToolbox/Toolbox/Resources.aspx). Alternatively they can be downloaded from the project website:

(http://environ.chemeng.ntua.gr/ecoWater/Default.aspx?t=299)

1.3.1 SEAT

"SEAT is the core model building tool of the EcoWater project and supports the assessment of the environmental impacts of alternative technological configurations of a meso-level water use system. It provides the flows of the materials (water, resources, products, etc.) that can be used for estimating the environmental components of the eco-efficiency indicators.

SEAT allows the development of a model representation of the corresponding supply chain, its components, processes & interactions. The supply chain is the physical representation of

the various processes that are involved in producing goods (and services), starting with raw materials and ending with the delivered product. In the current concept, the water supply chain consists of various processes which modify the quality and/or the quantity of the water flow. It follows the actual flow of the water resource and can be described using physical quantities (i.e. kg, m3)."

(Source: Thanos Angelis-Dimakis, 2013. *Deliverable 1.5 Finalized Systemic Environmental Analysis Tool – SEAT*. EcoWater Project Deliverable, retrievable here: <u>http://environ.chemeng.ntua.gr/ecoWater/Default.aspx?t=238</u>)

It should be noted that both SEAT and EVAT store results in a single output file.

1.3.2 EVAT

"The Economic Value chain Analysis Tool (EVAT) is a tool which extends the information included in a SEAT model incorporating economic data. It supports the assessment of the economic performance of alternative technological configurations of a meso-level water use system and provides the monetary flows that can be used for estimating the economic performance of the system.

EVAT allows the development of a representation of the value chain, the various actors involved and their interactions. The actors are divided into directly and indirectly involved, and emphasis is placed on their role/function. Each directly involved actor is responsible for the operation, maintenance and investment decisions for at least one stage, whereas indirectly involved actors (e.g. river basin management authorities, government agencies etc.), intervene through the setting of rules/standards, the offer of incentives, etc. The value chain monitors the added value to the final product due to water use from stage to stage and can be described using monetary quantities (i.e. \in).

(Source: Thanos Angelis-Dimakis, 2013. *Deliverable 1.6 Economic Value chain Analysis Tool – EVAT*. EcoWater Project Deliverable, retrievable here: <u>http://environ.chemeng.ntua.gr/ecoWater/Default.aspx?t=238</u>)

1.4 Reading guide

The main section of this user guide concerns chapter 2 which has 5 main sub-headers:

- 2.1 Getting started In this section the procedure to register and customize the user profile is explained.
- 2.2 The functions of the main tabs on the home screen

In this section the main resources of the toolbox are explained.

2.3 Step-by step: Developing and analyzing a case study

This section provides step by step guidance to develop a case study and assess results of individual 'technology scenarios'. Technology scenarios are sets of alternative technologies and processes which alter a system's eco-efficiency.

2.4 Step-by step: Adding and editing new technologies

Generic information about new technologies and processes can be stored for use in different case studies. Adding this information hence is independent of a case study.

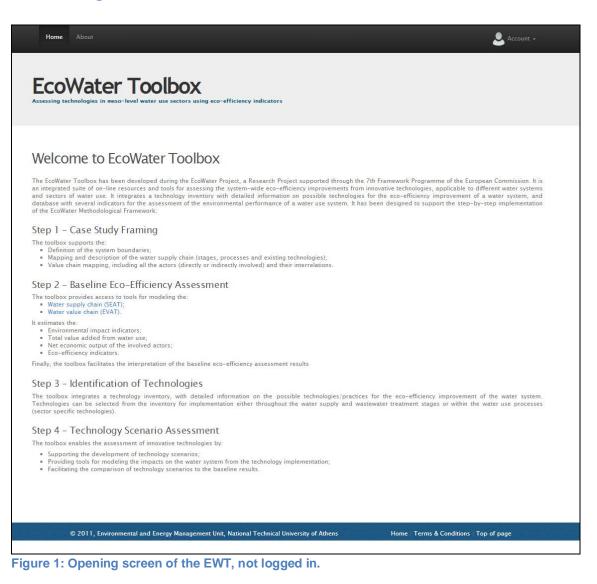
2.5 Step-by step: Adding and editing new Indicators

Generic information about new environmental indicators and processes can be stored for use in different case studies. Adding this information hence is independent of a case study.

Chapter 3 "Collaborators, Administrators, Owner and Stakeholders" explain the different roles of the toolbox users, and the ways different individuals can add to a case study. Chapter 4 "Troubleshooting – " provides a short list of issues which can help the user in case the problems. Some references are included in chapter 5 "Literature".

2 User guide

2.1 Getting started



2.1.1 About the toolbox



Figure 2: "About" the toolbox button

2.1.2 Creating a new account

In order to create an account, use the dropdown menu at the top right-hand corner, which has the options "Sign-In", "Register for a new account" and "Can't access your account" (Figure 3)

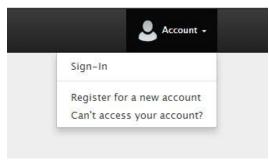


Figure 3: Registration / Account drop-down

Upon selecting "Register for a new account" Figure 4 will appear. After inserting your e-mail address, enter a password: Be aware that this password will be sent to you by mail as well, so you may want to choose a novel password.

Home About			
EcoWater Toolbox Assessing technologies in meso-level water use sectors using eco-efficiency indicators			
Register for a new account Registering to "EcoWater Toolbox" means creating an Account that you can use to access the services provided. Please follow the three steps bellow; it takes only a few seconds.			
Enter your acco	unt information		
Email (*)	max.ecoefficient@gmail.com		
Password (*)			
Confirm Password (*)			
« Previous Step N	« Previous Step »		

Figure 4: "Register for a new account" screen.

Pressing "Next step" will lead to a screen requiring some additional profile information (Figure 5).

Home Ab				
	EcoWater Toolbox Assessing technologies in meso-level water use sectors using eco-efficiency indicators			
Registering to "Ecc Please follow the t Account	Register for a new account Registering to "EcoWater Toolbox" means creating an Account that you can use to access the services provided. Please follow the three steps bellow; it takes only a few seconds.			
Enter your	profile information			
Title	Dr. 🔻			
First name (*)	Maximilian			
Last name (*)	EcoEfficient			
Country	Netherlands •			
« Previous Step	Next Step »			



Pressing "Next step" will lead you to Figure 6, which prompts you to accept the "terms and conditions" (see Box 1, page12), and inserting a verification code. Pressing "Finish" will lead to Figure 7.

Home About COWater Toolbox essing technologies in meso-level water use sectors using eco-efficiency indicators	
essing technologies in meso-level water use sectors using eco-efficiency indicators	
egister for a new account	
istering to "EcoWater Toolbox" means creating an Account that you can use to access the services provided. use follow the three steps bellow; it takes only a few seconds.	
Account Profile Verify	
gree and verify	
l agree to the following terms and conditions	
1) Introduction	-
These terms and conditions govern your use of this website; by using this website, you accept these terms and conditions in full. If you disagree with these terms and onditions or any part of these terms and conditions, you must not use this website.	
2) Acceptable use	
or our nust not use this website in any way that causes, or may cause, damage to the website or impairment of the availability or accessibility of the website; or in any way which is unlawful, illegal, fraudulent or harmful purpose or activity.	
ou must not use this website to copy, store, host, transmit, send, use, publish or distribute any material which consists of (or is linked to) any spyware, computer virus,	¥
ype the code from the image below	
829290	
829290 Change image	
x Previous Step Finish	

Figure 6: Verifying your account.

Home About	
EcoWater Toolbox Assessing technologies in meso-level water use sectors using eco-efficiency indicators	
Register for a new account	
Registration Completed	
Thank you for applying for registration to the EcoWater Toolbox. An email has been sent to verify your email address. Please check your inbox and follow the instructions to activate your account Welcome to our growing community.	

Figure 7: Registration completed screen.

You will now need to the mailbox used when registering. An e-mail should arrive as depicted in Figure 8. The red circle in this figure hides the password of "Max EcoEfficient": in your case it should show the password you selected for future reference. Following the instruc-

tions in the email should finalize your registration, via Figure 9 to the confirmation of successful registration (Figure 10).

Ecol	EcoWater Toolbox Email Confirmation		
0	EcoWater Toolbox <no-reply@chemeng.ntua.gr> to me 🖃</no-reply@chemeng.ntua.gr>		
	Thank you for applying for registration to the EcoWater Toolbox.		
	Your password is		
	Click here to confirm your email address and activate your account.		
	You will be asked to sign-in to your account to confirm this email address. Be sure to log in with your email and password.		
	If the above link does not work, you can paste the following address into your browser:		
	http://environ.chemeng.ntua.gr/EWToolbox/Membership/ActivateAccount.aspx?g=f9bad3e8-8183-4e3b-9de9-4f086278f6fb		
	Enjoy the web site.		
	The EcoWater Toolbox team.		

Figure 8: Verification e-mail.

Home About
EcoWater Toolbox Assessing technologies in meso-level water use sectors using eco-efficiency indicators
Activate your Account Please enter your email and password and press the Sign-In button to activate your account.
Email
Max.EcoEfficient@gmail.com
Password
Sign-In

Figure 9: Final activation step.

Home About
EcoWater Toolbox Assessing technologies in meso-level water use sectors using eco-efficiency indicators
Activate your Account
Activation Completed Your account to EcoWater Toolbox has been activated. Now you can use our site.

Figure 10: Final activation step: Confirmation screen.

2.1.1 Editing your profile, profile information

In the upper right corner, you can use the drop down menu to select editing your profile (Figure 11).

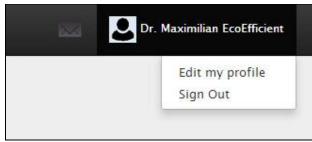


Figure 11: Profile dropdown menu.



Figure 12: Profile information tabs.

A new screen appears (Figure 12), providing (editable) information. Any field with the pencil icon (\checkmark) can be edited.

Tab	Options
Account	Account Personal Contact Short CV
	Account information
	Email 💉 max.ecoefficient@gmail.com
	Password 💉 *****
Personal	Account Personal Contact Short CV
	Personal information
	Full Name 💉 Dr. Maximilian EcoEfficient
	Occupation 💉 Scientific collaborator at EcoWater
	Figure 13 shows that when using the pencil-button (\checkmark), a pop-up will appear allowing editing information.
Contact	Account Personal Contact Short CV
	Contact information
	Address 💉 Netherlands
	Phone e - Numbers

Short CV	Account Personal Contact Short CV
	Short CV
Avatar	Figure 14 shows the screen to upload a picture which can serve as a personal avatar. When logged in, this avatar will be visible in the right hand corner, as is emphasized by the circle and arrow.
My access rights	Figure 15 shows the access rights associated with the account. Access rights are discussed in chapter 3.

Construct of the second state of the	Occupation	Zexources Heln About	Dr. Maximilian EcoEfficient
EcoWater To Assessing technologies in meso-level war	Organization Position	EcoWater Scientific collaborator	
My Profile		Cancel Change	
Account Personal Contact Personal information Full Name Cocupation Cocupation		vatar My Access Rights	

Figure 13: Editing personal information.

Home Case Studies Technologies Indicators Resources Help About	
EcoWater Toolbox Assessing technologies in meso-level water use sectors using eco-efficiency indicators	
My Profile Account Personal Contact mort CV Avatar My Access Rights	
Avatar	

Figure 14: Uploading an avatar

y pro	ofile					
ccount	Personal	Contact	Short CV	Avatar	My Access Rights	
y Acce	ss Rights					
Case S	Study Roles					
Crea	ator are not a Creato	r on any case s	study			
Coll	laborator are not a Collabo					
Adn	ninistrator are not an Admin					
Stak	keholder are not a Stakeh					
	ologies	ology creator				
	onmental Im		ators			
		inact indic				
Your	are not an Indica					
	are not an Indica					
Reque	are not an Indica ests ding Reques	ator creator				
Reque Peno There	are not an Indica ests ding Reques e are no pending	ator creator Sts g requests				
Reque Peno There Una	are not an Indica ests ding Reques	sts g requests Requests				
Reque Pene There Una There	are not an Indica ests ding Reques e are no pending uuthorised R	ator creator Sts g requests Requests rised requests				

Figure 15: Access right overview.

2.1.2 Signing in

The process of signing in is visualized in Figure 16: Using the top right hand drop down menu will result in a pop-up shown in the lower part of the figure. Checking "Keep me signed in" will keep you signed in depending on the security setting of your computer.

		Account -
Login		Sign-in Register for a new account Can't access your account?
Sign-in to you		
Password		
Keep me sig	ned-in 🗹	
	Close Login	

Figure 16: Sign in to the toolbox.

2.1.3 Retrieving sign-in information (password)

The process of retrieving your password is visualized in Figure 17: Using the top right hand drop down menu will result in a new window shown in the lower part of the figure. Your password will be send to you by email.

	Le Account 🗸
	Sign-In
Forgot your password?	Register for a new account Can't access your account?
To reset your password, type the email you use to sign in to your EcoWater Toolbox Account.	
Email	
Type the code from the image below	
847269 Change image	
Submit Request	

Figure 17: Retrieving your password.

2.1.4 Deleting an account

To delete an account contact the administrator.

2.2 The functions of the main tabs on the home screen

Once logged in a number of tabs are available.



Figure 18: Available tabs once signed in to the toolbox. The red circles emphasize the tabs and are not visible on screen.

Tab	Explanation			
'Home'	Selecting this tab will get you back to the home. The information is identical to the information when not signed in, depicted in Figure 1.			
'Case studies'	Most of the intelligence to develop a case study is available behind this tab. It is explained in chapter 2.3.			
'Technologies'	A technology can only be used in a case study after generic technology information is added to the toolbox. This information is available when you select this tab. It is discussed in chapter 2.4.			
'Indicators'	An eco-efficiency indicator can only be used if it is defined a priori. How to add an indicator is explained in chapter 2.5.			
'Resources'	 Selecting 'Resources' will provide easy access to the following: Tools Demo Case Study Files Projects Documents Other Initiatives 			

'Help'	The section 'Help' contains this help document, several video-tutorials
	and download.
'About'	The section 'About' provides information on the project and the toolbox.

2.3 Step-by step: Developing and analyzing a case study

2.3.1 The overall case-study process

The development of the EcoWater Case Studies has been divided into seventeen distinct steps, grouped into four Phases (Figure 19). **Table 2** provides information on indicative functionalities that may be supported for each step. It should be highlighted that all these functionalities will be available only for the Case Study Collaborators.

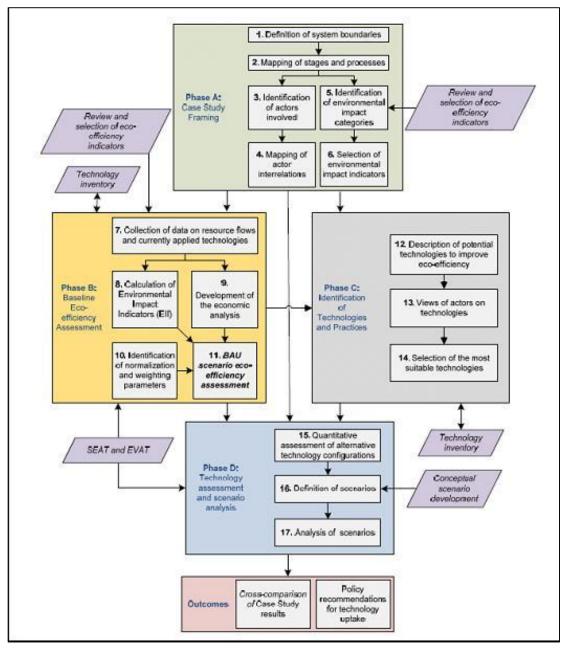


Figure 19: Phases and steps in the Case Study development (Kourentzis, 2012)

acvero	phient			
Step		Tool	box	SEAT/EVAT*
1.	Definition of System Boundaries	•	'Narrative for case study' **	
2.	Mapping of stages and processes	٠	Ditto	SEAT
3.	Definition of actors involved	٠	Ditto	EVAT
4.	Mapping of Actor Interrelations	٠	Ditto	EVAT
5.	Identification of environmental im-	٠	Ditto	
	pact indicators	٠	Defining new generic indicators	
6.	Selection of environmental impact parameters	•	Toolbox	
7.	Collection of data on resource flows and currently applied tech- nologies	•	'Narrative for case study'	SEAT
8.	Calculation of Environmental Im- pact Indicators	•	Toolbox	(SEAT***)
9.	Development of the economic analysis	•	'Narrative for case study'	EVAT
10.	Identification of normalisation and weighting parameters	•	Toolbox	
11.	. Business as usual scenario eco- efficiency-assessment	•	Toolbox	SEAT/EVAT
12.	. Description of the potential tech- nologies to improve eco-efficiency	•	'Narrative for case study'	
13.	Assessment of views of actors on technologies	•	Ditto	
14.	. Selection of the most suitable technologies	•	Ditto Defining new technologies	
15.	. Quantitative assessment of alter- native technology configurations	•	'Narrative for case study' Toolbox	SEAT/EVAT****
16.	. Definition of scenario's	٠	Ditto	SEAT/EVAT
17.	Analysis of scenario's	٠	Ditto	SEAT/EVAT
	•	1		1

Table 2: Preliminary list of functionalities that will be supported for each step of the Case Study development

*: SEAT and/or EVAT are the tools to be used.

- **: 'Narrative for case study' implies that the toolbox holds the functionality to store a narrative on this step, either by direct entry in the case study description, or by attaching relevant documents in the toolbox.
- ***: The flows of resources/pollutants are computed in SEAT, the computation of indicators based on these flows is carried out in the web-based toolbox.
- ****: The computation of the flows and economic aspects is carried out in SEAT and EVAT. The comparison is done in the toolbox.

2.3.2 Creating a new case study

When selecting the tab 'Case studies' existing case studies will be visible. A table of contents on the case studies is available on the left hand side of the screen, and a button to request to create a new case study is visible on the right hand side (Figure 20). The table of contents does not appear if your screen is not wide enough. Clicking the request will automatically send an email to the administrator, and the administrator will provide the access rights to develop a new case study (Figure 21). Using the 'X', marked in the right lover corner will close this notification. As granting access is not automatic, granting access may take some time.

	Home Case Studies	Technologies Indicators	Resources Help	About	Dr. Maximilian EcoEfficient
٥		r Toolbox eso-level water use sectors using	eco-efficiency indicator	's	
Table of Contents Agricultural systems Urban water supply systems	Case Studies				Request to create a Case Study
Industrial water systems	Sinistra Ofanto, I	taly (including Backgro	ound)		3

Figure 20: Case studies opening screen, showing the table of contents and the button to request a new case study.

	Notifications	
100	Your request to create a case study is pending a response	x

Figure 21: Response on requesting a new case study'.

Notifications		
- Your request to create a Technology was accepted by George	on Tuesday, July 29, 2014	\int_{∞}
- Your request to create an Indicator was accepted by George	on Tuesday, July 29, 2014	

Figure 22: Notification sample after access has been granted.

Figure 23 shows the position of the 'Create New Case Study' button. Selecting 'Create New Case Study' will result in a pop-up which allows inserting basic information about the case study. This result is depicted in Figure 24.

Case Studies	
	Create New Case Study
Greinen Oferen Inde Greine Bedermund	•

Figure 23: Create New Case Study.

New Case Study	×	<
Name	Reference Demonstration Case Study for the EcoWater Toolbox Manual	
Sector	Industrial water systems	
Short Description	K 心 値 値 値 ふ か Q たう 算 父 回 ● ○ 區 田 亜 Ω B I U S ×, * I, :::::::::::::::::::::::::::::::::	
Description	Image: Start Start Image: Start	
Visible	ø	1
	Cancel Create	

Figure 24: Entering basic information about a new case study.

As fields may be hard to read, this is the content of the demonstration case study:

Name: Sector:	Reference Demonstration Case Study for the EcoWater Toolbox Manual. Industrial water systems.
Short descript.:	The purpose of the case-study D-EcoWater is to feed the toolbox manual with relevant illustrations. The case study is not based on reality. To understand the basic concept of meso-level eco-efficiency analysis, please view the video on EcoWater's homepage http://environ.chemeng.ntua.gr/ecowater/. This demonstration case study
	resembles the situation described in the video.
Description:	The case study at hand concerns a system where water is abstracted (stakeholder: 'water provider'). This water is used in a production facility (Stakeholder: 'Producer') and a waste water treatment plant (Stakeholder: 'WWT-operator'). These are the three main steps in the centre of the figure in the manual (Boxes denoted: 'Water Abstraction', 'Water use' and 'WW Treatment').
	The water originates from a source (left hand side) and via the blue lines the water is disposed into an aquifer. The water-using factory requires raw materials, which are pre-processed in the plant. The plant produces some products.
	Energy is used in all stages 'Water Abstraction', 'Water use' and 'WW Treatment'. The energy is produced outside of the system, which is called 'background'. Two energy providers are involved: a diesel producer, deliv- ering the energy to 'Water abstraction' and 'WW Treatment', and a natural gas producer, delivering energy to the factory ('Water use'). The only im- portant waste stream is CO ₂ originating from all three main stages of the system and discharged into the atmosphere ('air').

Visible: If unchecked, the basic information of the case study is only visible to yourself and co-workers you select.

The figure in the manual referred to is Figure 25.

As you can the input text can be formatted. However, uploading pictures is not possible, due to limitations in the freeware licence used for this functionality.

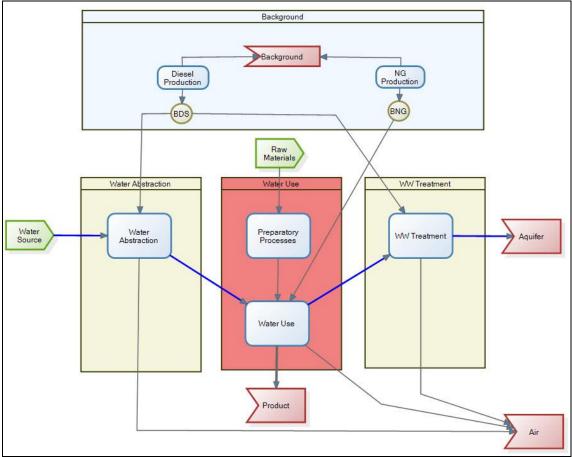


Figure 25: Schematisation of the demonstration case study 'DEWOT'.

After clicking 'Create' the case study will be among the other case studies, looking like Figure 26.

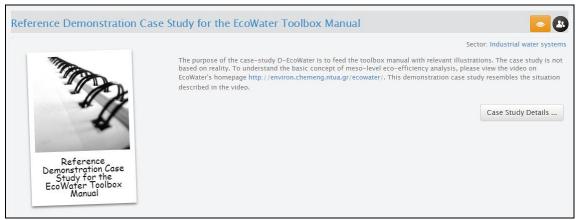


Figure 26: Case study immediately after creation.

The icon in the upper right corner of Figure 26 (²³) will provide insight in users and collaborators of the case study. This is discussed in chapter 3.

The creator of the case study can change the visibility of the case study using (hide) and, if hidden (unhide).

2.3.3 Adding and editing details of the case study

Selecting "Case Study Details" will result in Figure 27.

	O Evaluate Case Study 🔀 🗙 📀
Case Study Information	Related Technologies Related Documents Related Links Images
eference Demons	stration Case Study for the EcoWater Toolbox Manual
The second	The case study at hand concerns a system where water is abstracted (stakeholder: 'water provider'). This water is used in a production facility (Stakeholder: 'Producer') and a waste water treatment plant (Stakeholder: 'WWT- operator'). These are the three main steps in the centre of the figure in the manual (Boxes denoted: 'Water Abstraction', 'Water use' and 'WW Treatment').
	The water originates from a source (left hand side) and via the blue lines the water is disposed into an aquifer. The water-using factory requires raw materials, which are pre-processed in the plant. The plant produces some products.
*	Energy is used in all stages 'Water Abstraction', 'Water use' and 'WW Treatment'. The energy is produced outside of the system, which is called 'background'. Two energy providers are involved: a diesel producer, delivering the energy to 'Water abstraction' and 'WW Treatment', and a natural gas producer, delivering energy to the factor ('Water use'). The only important waste stream is CO2 originating from all three main stages of the system and discharged into the atmosphere ('air').

Figure 27: Case study details screen.

The following table presents the main options of this screen:

Item	Description
Case study information	This tab provides the extended case study description provided when creating the case study (or after further editing). It also allows you to add one picture which serves as case study logo, replacing the default 'folder' picture. Look out: case study images other than the logo are stored under the tab 'Images'.
Related Technologies	The related technologies field will list those relevant technologies which are used in the different scenario's,

	including in the 'Business as usual' scenario. You can add
	related technolgies <u></u> , see for more information below.
Related documents	Here you will find background information to the case study.
	You can add documents using 🗹.
Related links	Here you will links to other sources of information to the case
	study. You can add links using 🚄.
Images	Here you will find the possibility to add case study pictures. The
	first picture will become the logo picture of the case study.
• Evaluate Case Study	The evaluate case button will only function after a scenario has
	been defined.
1	Edit case study function.
×	Delete case study function
•	Administer case study function, mainly providing access rights
	to collaborators (see chapter 3)
	Hide/unhide function
8	View the access rights
Create New Scenario	You can use this button to create new scenarios. (see chapter
	2.3.4 and following)

Adding related technologies

Selecting the tab 'related technologies' will on first use reveal Figure 28. Using 🕶 will allow you to add a technology to your case study from a larger list (Figure 29) leading to a case study technology list as shown in (Figure 30). The technoliges are copied and stored with the case study, which allows to edit the basic information to match the case study specificities. Clicking on the name of the technology will allow you to make changes, but also to delete the

technology from the case study (Figure 31). The View details on Technology Inventory... button present detailed information on the technology as stored in the inventory. (Figure 32)



Figure 28: First time use of 'related technologies' tab.

Select a technology from the inventory	
Multi-User Electronic Delivery Hydrants	
Variable-Speed Pumps	
Shifting of Irrigation Methods	
Sub-Surface Drip Imigation (SDI)	
Regulated Deficit Imigation (RDI)	
On-Fam Devices for Precision Imigation	
High and Super-High Density Orchards	
Advanced Phosphorus Recovery	
Studge Drying With Renewable Energy	
Low Energy Aeration	
Producing O2 and H2 in WWTP	
	•
	Add Cance

Figure 29: Selecting a related technology

					🛛 Evaluate Case Study 📝 🗶 🔕
Case Study Information	Related Technologies	Related Documents	Related Links	Images	
Related Technologi	es				0
Home	bioreactor, and is wi A membrane biologic industrial wastewate clarifiers/filters and I responsible design conf first one is concerne and easier membrann frequent cleaning. Ir	r (MBR) is the combinat idely used for municipal cal reactor system is util r. It can operate at hig being compatible in very reparation of contaminan igurations are: the exte ed, a more direct hydroc e replacement. The mai	and industrial was lized for the treating of contaminant vo y compact layouts ints and biological ernal (side-stream) dynamic control of in disadvantages a mbranes are place	ment of organic, lumetric remova [1, 2]. An MBR reactor systems and the interna membrane fouli ure the high ene	icrofiltration or ultrafiltration with a suspended growth tent . //inorganic contaminants and microorganisms in al rates and flows, while requiring no secondary t system consists of a combination of membrane units s for the biodegradation of the waste compounds. The al (submerged/immersed) configuration. As far as the ing can be achieved, resulting in high operational fluxes rgy consumption (2-12kWh/m3) and the requirement of ked fluid; less intensive operating conditions and a
					View details on Technology Inventory
	Low Energy Aeration Changing control of	aeration systems from r	manual to automal	tic.	
					View details on Technology Inventory

Figure 30: Technology list related to the case study..

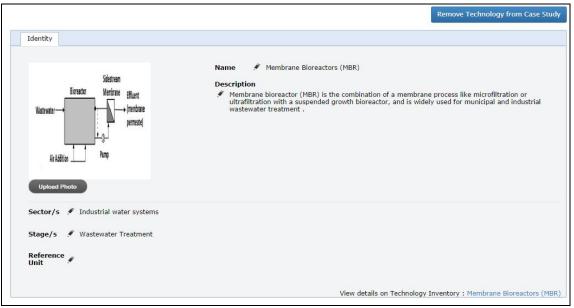


Figure 31: Editing a Case Study Technology.

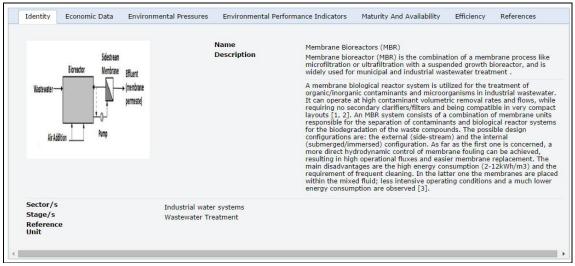


Figure 32: Details on a selected technology.

2.3.4 Developing (the business as usual) scenario's

Typically, the business as usual scenario is the first scenario developed. It serves as reference for other scenarios.

Developing a scenario is only possible if a solvable SEAT and EVAT files are available.

To develop a scenario press Create New Scenario in the edit case study field. A screen will pop-up as is shown in Figure 33. In this particular case the text entered in the scenario description is identical to the case study information, as the scenario is the business as usual scenario. Ordinarily, the BAU description would contain different narrative information.

The screen also requests uploading a SEAT model file. Once finished, the overall case study information will look similar to Figure 34. The icons in the upper section have previously been described. New icons relate to the scenario:

Item	Description
1	Edit scenario function.
×	Delete scenario function
	Hide/unhide scenario from public view function

When sececting the edit function, you can change the description, the uploaded SEAT/EVAT model file, add/edit related documents and links, as is shown in Figure 35.

When looking at the scenario details (scenario Details.), more information is available as a result of the uploading of the SEAT/EVAT model file. As shown in Figure 36, tabs exist on " Environmental Analysis, Economic Analysis, Model Preview and Images. Environmental Analysis and Economic Analysis tabs show the numerical values imported from the SEAT/EVAT model file (Figure 36 and Figure 37). The data cannot be edited, but can be printed and exported. At this point, several columns in the environmental analysis section are not populated, this will happen later in the process.

In both Figure 36 and Figure 37 the number of fractional digits can be changed using the button (Figure 38).

At last the Model Preview tab shows the schematisation of the SEAT and EVAT files. Figure 39 visualizes the EVAT model. The essential difference to the SEAT visualisation is that the actors are mentioned in the headers of the water use chain. It is possible to use different colours for different stakeholders in EVAT. This would be visible in the visualisation of the model.

Create Scenario	×
Scenario Name	Business as usual scenario (BAU-DEMO)
Description	Image: Section Control Contro Control Conterve Contecontrol Control Control Control Control Con
SEAT/EVAT File	body p
Enabled?	2
	Cancel Create

Figure 33: Opening screen to create a new scenario.

e Studies 🕨 Industrial water sy	stems ► Reference Der	nonstration Case Study for	the EcoWater Toolb	oox Manual	• Evaluate 0	Case Study	/ × 0
Case Study Information	Related Technologies	Related Documents	Related Links	Images			
Reference Demonst	ration Case Stu	dy for the EcoWa	ter Toolbox	Manual			(
	u:	ne case study at hand co sed in a production facilit perator'). These are the t pstraction', 'Water use' a	y (Stakeholder: 'Pr hree main steps in	oducer') and the centre o	a waste water treatm	ent plant (Si	takeholder: 'WWT-
	w	ne water originates from ater-using factory require oducts.					
	_i tř ≊s <mark>⊊_i</mark> to us	nergy is used in all stages the system, which is called ' Water abstraction' an se'). The only important w to the atmosphere ('air').	l 'background'. Two d ' WW Treatment' vaste stream is CC	o energy prov , and a natur	viders are involved: a al gas producer, deliv	diesel produc ering energy	er, delivering the en to the factory ('Wat
							Create New Scer
isiness as usual sc	enario (BAU-DI	EMO)					× 🔨
e case study at hand concern ste water treatment plant (Sta e' and 'WW Treatment'). e water originates from a sou cessed in the plant. The plan rgy is used in all stages 'Wat widers are involved: a diesel e'). The only important waste	keholder: 'WWT–operat rce (left hand side) and t produces some produ er Abstraction', 'Water producer, delivering the	or'). These are the three m via the blue lines the wate cts. use' and 'WW Treatment'. energy to ' Water abstract	ain steps in the cen r is disposed into a The energy is produ ion' and ' WW Trea	tre of the figu n aquifer. The ced outside of tment', and a	ire in the manual (Boxes water–using factory re f the system, which is o natural gas producer, d	s denoted: 'Wa quires raw ma alled 'backgro lelivering ener	ater Abstraction', 'Wat aterials, which are pre- ound'. Two energy
wnload File: 🦺uploaded by E	r. Maximilian EcoEffici	ent 18 seconds ago					C
							Scenario Details

Figure 34: Case study overview, showing the general information (top) and the (BAU) first scenario.

it Scenario		
Main Information	Related Documents Related Links	
Main		
Name	Business as usual scenario (BAU-DEMO)	
Description	X∿®®®≤≡≡Ω	
	B I U S X₂ X* II E I I II	
SEAT/EVAT File	+ Upload file	
Visible		
Visible 🦉		
		Cancel Update



Business as u		an and a second se	10.000						
Case Studies 🕨 Industrial wat	er systems 🕨 Reference Dem	onstration Case Study fo	or the EcoWater Too	Ibox Manual 🕨 Business a	as usual scenario (E	BAU-DEMO)			
						te Scenario	1	×	۲
Scenario Information	Environmental Analysis	Economic Analysis	Model Preview	Related Documents	Related Links	Images			
Resource Summary									
Inputs									
Resource ×									
Resource	Y From Input Node		,	Y To Process	Y	Flow	YU	nit	Y
• Resource: Water, Tot	al Flow 10000 m3								
Resource: Primary Re	esource, Total Flow 20000	kg							
Resource: Diesel, Tot	al Flow 2800 L								
Resource: Natural Ga	s, Total Flow 5000 m3								
						A	Ni		¢
Outputs									
Resource ×									
Resource	Y To Output Node		Y From	n Process	٢	Flow	YU	Init	Y
Resource: CO2, Total	Flow 16754.4 kg								
• Resource: CH4, Total	Flow 0.4706 kg								
Resource: N2O, Total	Flow 0.07562 kg								
Resource: Wastewate	er, Total Flow 8000 m3								
Resource: PO4, Total	Flow 80 kg								
• Resource: COD, Total	Flow 240 kg								
• Resource: Product, T	otal Flow 10000 item								
								N:	٠

Figure 36: Scenario details - Environmental analysis (numerical data not editable).

							🖸 Evalu	uate Scenari	× /	
Scenario Information	Environmental	Analysis	Economic Analysis	Model Previ	ew R	elated Document	Related Links	s Images		
Total Value Added from Wa Per Stage	ter Use (€) : 1190	00								
Stage	Y	Annual Eq	uivalent Investment Co	ost (€/yr) Y	Annual	O&M Cost (€/yiY	Annual Gross Inc	ome (€/yr]Y	Net Cash Flow (€/)	
Vater Abstraction		0.000			4,000.000		0.000		-4,000.000	
Vater Use		0.000			22,500.000		40,000.000		17,500.	
WW Treatment		0.000				1,600.000	0.000		-1,600.000	
Background		0.000				0.000	0.000		0.000	
er Actor	Y	Annual Eq	uivalent Investment C.	Y Annual O&	M CosY	Gross Income.Y	Revenues from W	ater Servi.Y	Net Economic Outp	
		1		1000		100 00000		2012/21202/2120	2 400	
Per Actor Actor Water System Operator			0.00	5,	600.000	0.000		9,000.000	3,400.0	

Figure 37: Scenario details - Economic Analysis (numerical data not editable).

Specify decimal points for each column	×
Annual Equivalent Investment Cost (€/yr) : Annual O&M Cost (€/yr) : Annual Gross Income (€/yr) : Net Cash Flow (€/yr) :	3 3 3
	ОК

Figure 38: Specifying decimal points.

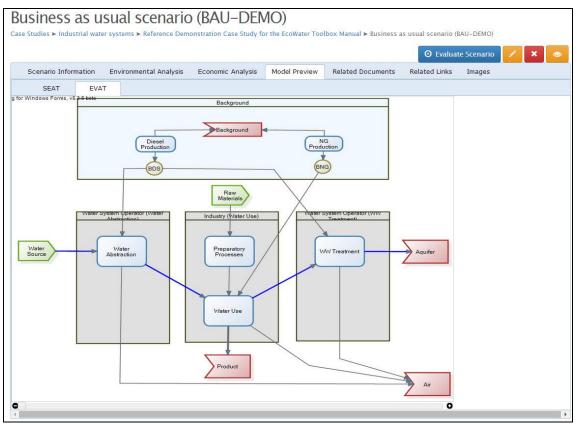


Figure 39: Visualisation of the EVAT model within the scenario section.

2.3.5 Evaluating (the business as usual) scenario's

When pressing O Evaluate Scenario Figure 40 will appear. As shown, the first step concerns the selection of the indicators, the second step the association of the model with the indicators, and as last step a review of results.

Case Studies > Industrial water systems > Reference Demonstration Case Study for the EcoWater Toolbox Manual > Business as usual scenario (BAU-DEMO) > Scenario Evalu	lation
Scenario Evaluation	
Step 1: Select Relevant Indicators	*
Step 2: Assign Values to Indicator Parameters	
Step 3: Review results	+

Figure 40: The steps of scenario evaluation.

2.3.5.1 Scenario evaluation: Step 1 – select indicators

Using the 'down-arrow' on the right hand side allows expanding the steps. In Figure 41 you see that two indicators are selected to be included in the analysis: 'Climate Change' and 'Freshwater Resource Depletion'. The majority of pre-defined indicators are international defined midpoint indicators originating from Life Cycle Assessment studies. However you can define your own indicators (chapter 2.5).

Case Studies > Industrial water systems > Reference Demonsti Scenario Evaluation		
Step 1: Select Relevant Indicators		4
Available Indicators: Aquatic Ecotoxicity Climate Charge Fossil Fuels Depletion Freshwater Resource Depletion Eutrophication Human Toxicity Terrestrial Eutrophication Addification Abiotic Resource Depletion Aquatic Ecotoxicity Stratospheric Ozone Depletion Terrestrial Ecotoxicity Respiratory Inorganics	Add Selected	
Step 2: Assign Values to Indicator Parameters		
Step 3: Review results		

Figure 41: Expanded ' Select Relevant Indicator tab'.

2.3.5.2 Scenario evaluation: Step 2 – assign values to indicators parameters

The step 'Assign values to indicator parameters' consists of several sub-steps. In step 1, the indicator is selected (Figure 42). On the right hand side you can scroll through the indicator background info. For the indicator 'Climate Change' the full information is included in 'Box 2: Details on the Climate Change indicator.' The essential part is highlighted: it provides insight in the parameters which should be combined when calculating the indicator. Figure 43 shows the selection of Carbon Dioxide (Step B of assigning values). In step 2, depicted in Figure 44, all the CO2 flows leading into the air are combined.

Climate Change Indicator

In case of Climate Change, the SEAT model includes flows Carbon Dioxide, Methane and Nitrous Oxygen. The model however also allows assessing the environmental pressures in the background, this case the CO2 flow resulting from Diesel and Natural gas production. Including this in the evaluation is done by defining:

Parameter <Background Impacts> of Indicator Climate Change is connected to all incoming Back Climate Change flows of Node Background

For the Climate Change Indicator, step 2 concerns 4 assignments of model parameters to the indicator:

P	All Connections of indicator Climate Change with flows:	
	Parameter Carbon dioxide of Indicator Climate Change is connected to all incoming CO2 flows of Node Air	8
	Parameter Methane of Indicator Climate Change is connected to all incoming CH4 flows of Node Air	8
	Parameter N2O of Indicator Climate Change is connected to all incoming N2O flows of Node Air	8
	Parameter <background impacts=""> of Indicator Climate Change is connected to all incoming Back Climate Change flows of Node Background</background>	ade

A) Select an Indicator:			
Climate Change Freshwater Resource Depletion	Name:	Climate Change	*
	Description:	Measures the impacts caused by the greenhouse effect which is induced by emission of greenhouse gases into the air.	
	*	Warming of the atmosphere due to the reduction in outgoing long wave heat radiation resulting from its absorption by greenhouse gases (GHG) such as CO ₂ N-O	-

Figure 42: Select an indicator to assign values to.

Name: Climate Change

Description:

Measures the impacts caused by the greenhouse effect which is induced by emission of greenhouse gases into the air.

Warming of the atmosphere due to the reduction in outgoing long wave heat radiation resulting from its absorption by greenhouse gases (GHG) such as CO_2 , N_2O , CH_4 and volatile organic compounds (VOCs) (JRC, glossary of terms

Symbol: GWP100

Formula: CO2 + 25 * CH4 + 298 * N2O + 14800 * HFC23 + 1430 * HFC134a + 22800 * SF6 +7390*CF4+8.7*CH2Cl2

Unit: tCO2eq

Type: Output

Source:

JRC (2010), ILCD Handbook: General Guide for Life Cycle Assessment – Detailed Guidance, First Edition, European Union.

IPPC (2007) Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007. 2007. Retrieved 2012-05-24.

Guinée, J.B. (Ed.), Gorrée, M., Heijungs, R., Huppes, G., Kleijn, R., de Koning, A., Van Oers, L., Wegener Sleeswijk, A., Suh, S.,. Udo de Haes, H.A, De Bruijn, J.A., Van Duin R., Huijbregts, M.A.J. (2002). Handbook on Life Cycle Assessment: Operational Guide to the ISO Standards. Series: Eco-efficiency in industry and science. Kluwer Academic Publishers. Dordrecht (Hardbound, ISBN 1-4020-0228-9; Paperback, ISBN 1-4020-0557-1). Box 2: Details on the Climate Change indicator.

Name:	Carbon dioxide	*
Symbol:	C02	
Unit:	tn	
* Unit Conversion		-
	Symbol: Unit:	Symbol: CO2

Figure 43: Selecting a parameter associated to an indicator.

Specify Parameter Value:			
Use a Constant Value			
Use Resource Flows			
Define Rule:			
Select Flow Direction:		Select the resource of the flow:	To Node:
All incoming All outgoing	*	Water Diasal Vatural Gas CO2 Wastewater CH4 N20 Product Primary Resource Frimary Resource Intermediate Product	Air Air
			Air

Figure 44: Selecting all flows of CO2 to the air.

Step 1 (selecting mid-point indicators) and step 2 (assigning parameters) need to be repeated until all parameters related to the indicators are properly assigned. The next sections elaborate on the assignments in this case study.

Freshwater Resource Depletion

Freshwater Resource Depletion is calculated as the product of "Water Withdrawal to Availability ratio" multiplied by the "Water Abstracted" for each basin and for each "water" involved. Here we have one basin and only freshwater. If one of the two parameters is not assigned a value then it is automatically set to 0, and the result of the product is zero, regardless the value of the other.

The "Freshwater Abstracted" is linked to an actual flow of the system (as the majority of the parameters). The selected method for specifying the parameter value is "Use Resource Flow" (which the default). However, the Water Withdrawal to Availability ratio is not linked to an actual flow of the system, but is a constant region/system-dependent value. So, in order to specify its value you should use the method "Use a constant value".

The overall assignments regarding freshwater resource depletion is:

Parameter Surface Water Abstracted of Indicator Freshwater Resource Depletion is connected to all outgoing Water flows of Node Water Source	ce🕄
Parameter Water Withdrawal to Availability of Indicator Freshwater Resource Depletion is connected to a Constant (Value 0.5)	8

The Freshwater Resource Depletion in the background can in no case be determined, as the information required is system dependent, something typically unknown for background processes.

Eutrophication

Aquatic eutrophication potential is defined as a combination of all nutrients. The following links are relevant in this

Parameter Total P Released of Indicator Eutrophication is connected to all incoming PO4 flows of Node Aquifer	•
Parameter Chemical oxygen demand of Indicator Eutrophication is connected to all incoming COD flows of Node Aquifer	8
Parameter <background impacts=""> of Indicator Eutrophication is connected to all incoming Back Eutrophication flows of Node Backgroun</background>	d🛛

Human toxicity, Aquatic Eco-toxicity, Acidification

In the case study at hand, these midpoint indicators are not considered important in the foreground system. However, these are important in the background. Hence, these three indicators should be included in "Step 1: Select Relevant Indicators", too, and values should be assigned in "Step 2: Assign Values to Indicator Parameters" as follows:

Parameter <Background Impacts> of Indicator Human Toxicity is connected to all incoming Back Human Toxicity flows of Node Background Parameter <Background Impacts> of Indicator Aquatic Ecotoxicity is connected to all incoming Back Aquatic Ecotoxicity flows of Node Background Parameter <Background Impacts> of Indicator Acidification is connected to all incoming Back Acidification flows of Node Background Parameter <Background Impacts> of Indicator Acidification is connected to all incoming Back Acidification flows of Node Background Parameter <Background Impacts> of Indicator Acidification is connected to all incoming Back Acidification flows of Node Background

2.3.5.3 Scenario evaluation: Step 3 – Evaluate results

Figure 45 provides an overall view of the eco-efficiency per indicator. The results should be read as follows: The system 'earns' $0.66 \in$ per ton CO₂-equivalent, in the period covered in the SEAT model, which typically concerns a year.

Figure 46 provides the absolute total, foreground and background values of the indicators. For example: Of about 18.100 ton CO_2 -equivalent 16.800 ton is emitted in the foreground, and 1.300 is emitted in the background. As anticipated, there is no value for the Fresh Water Resource Depletion in the background, nor values for Human toxicity, Aquatic Eco-toxicity, Acidification in the foreground.

The distribution of these Environmental Impact indicators over the stages of the system is visualized in Figure 47. As you can see, the Fresh Water Resource Depletion is fully associated with 'water abstraction' and Eutrophication with waste water treatment.

For each environmental impact indicator, Figure 48 shows distribution between background and foreground fractions of the impact.

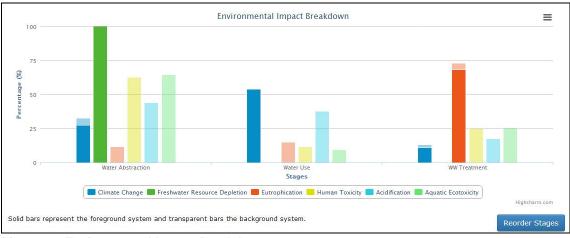
Figure 49 provides insight in the costs per actor. In this simple example, you can see that the revenues from water services are positive for the Water System Operator, and likewise negative for the industry. Still, industry has the highest overall revenue.

Indicator	Value (€/Unit)
Climate Change (tCO2eq)	0.66
Freshwater Resource Depletion (m3)	2.38
Eutrophication (kgPO4eq)	32.58
Human Toxicity (kg1,4-DBeq)	82.53
Acidification (kgSO2eq)	852.45
Aquatic Ecotoxicity (kg1,4-DBeq)	1,080.68



Indicator	Value (Unit)	Foreground Value(Unit)	Background Value(Unit)
Climate Change (tCO2eq)	18,075.85	16,788.70	1,287.15
Freshwater Resource Depletion (m3)	5,000.00	5,000.00	0
Eutrophication (kgPO4eq)	365.27	250.08	115.19
Human Toxicity (kg1,4-DBeq)	144.20	0	144.20
Acidification (kgSO2eq)	13.96	0	13.96
Aquatic Ecotoxicity (kg1,4-DBeq)	11.01	0	11.01

Figure 46: BAU results: Environmental Performance Assessment.





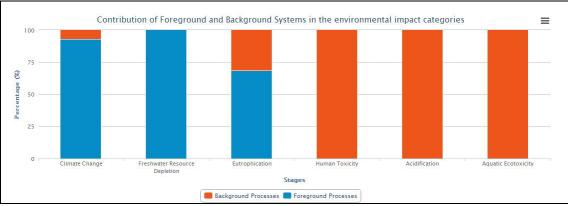


Figure 48: Contribution of Foreground and Background Systems in the environmental impact categories.

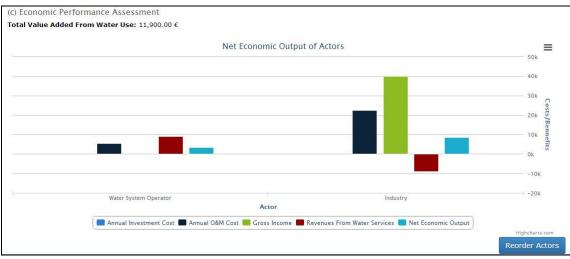


Figure 49: Net Economic Output of Actors.

2.3.6 Comparing multiple scenario's.

For the purpose of this manual a second scenario has been developed using SEAT/EVAT. In this scenario, a more energy efficient pump has been installed in the water abstraction stage.

When developing a new scenario, it is not necessary to re-create the links to indicators: these links are consistent throughout a case study.

The numerical results of this scenario are presented in Figure 50. Figure 51 provides the numerical results of both scenarios. There are clear differences all originating from using less energy to pump water, both in the foreground and in the background.

The net economic output per actor is graphically represented in Figure 52. It is evident that the water system operator increases his net revenue, mainly because of lower energy costs. Figure 53 shows that the eco-efficiency with respect to all indicators improves, meaning that installing the pump has a higher economic output/environmental impact ratio.

Figure 54 presents a type of diagram allowing positioning of a scenario in different quadrants with respect to economic output and environmental impact. Everything above the diagonal line is more eco-efficient compared to the business as usual situation. Only the right top quadrant implies both absolute economic and environmental gains.

Figure 55 shows the eco-efficiency per actor, which is selected on the top left of the figure. Such analysis can show that a technology has positive eco-efficiency effect for one actor, but negative for another.

(a) Eco-Efficiency Assessment

Indicator	Value (€/Unit)	
Climate Change (tCO2eq)	0.85	
Freshwater Resource Depletion (m3)	2.56	
Eutrophication (kgPO4eq)	37.27	
Human Toxicity (kg1,4-DBeq)	129.72	
Acidification (kgSO2eq)	1,178.22	
Aquatic Ecotoxicity (kg1,4-DBeq)	1,718.32	

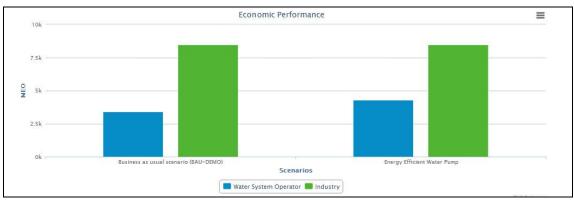
(b) Environmental Performance Assessment

Indicator	Value (Unit)	Foreground Value(Unit)	Background Value(Unit)
Climate Change (tCO2eq)	15,110.09	14,282.07	828.02
Freshwater Resource Depletion (m3)	5,000.00	5,000.00	0
Eutrophication (kgPO4eq)	343.64	250.08	93.56
Human Toxicity (kg1,4-DBeq)	98.74	0	98.74
Acidification (kgSO2eq)	10.87	0	10.87
Aquatic Ecotoxicity (kg1,4-DBeg)	7.45	0	7.45

Figure 50: Numerical results of the scenario including a more efficient pump.

Indicator	Business as usual scenario (BAU-DEMO)	E	Energy Efficient Water Pump
Climate Change (€/tCO2eq)		0.658	0.848
Freshwater Resource Depletion (€/m3)		2.380	2.562
Eutrophication (€/kgPO4eq)		32.579	37.27:
Human Toxicity (€/kg1,4-DBeq)		82.526	129.717
Acidification (€/kgSO2eq)		852.450	1,178.221
Aquatic Ecotoxicity (€/kg1,4-DBeq)	1	080.677	1,718.321
Indicator	Business as usual scenario (BAU-DEMO)	E	Energy Efficient Water Pump
Environmental Performa		10	
			chergy chiclenc water Fullip
	10	075 046	15 110 00
Climate Change (€/tCO2eq)		075.846	2
		075.846	2
(€/tCO2eq) Freshwater Resource Depletion			5,000.000
(€/tCO2eq) Freshwater Resource Depletion (€/m3) Eutrophication		000.000	5,000.000 343.636
(€/tCO2eq) Freshwater Resource Depletion (€/m3) Eutrophication (€/kgPO4eq) Human Toxicity		000.000 365.271	5,000.000 343.630 98.740
(€/tC02eq) Freshwater Resource Depletion (ε/m3) Eutrophication (ε/kgP04eq) Human Toxicity (ε/kg1,4-DBeq) Acidification		000.000 365.271 144.197	15,110.094 5,000.000 343.636 98.740 10.871 7.454
(€/tCO2eq) Freshwater Resource Depletion (€/m3) Eutrophication (€/kgP04eq) Human Toxicity (€/kg1,4-DBeq) Acidification (€/kg502eq) Aquatic Ecotoxicity		000.000 365.271 144.197 13.960	5,000.000 343.630 98.74(10.871
(€/tCO2eq) Freshwater Resource Depletion (€/m3) Eutrophication (€/kgP04eq) Human Toxicity (€/kg1-4-DBeq) Acidification (€/kg502eq) Aquatic Ecotoxicity (€/kg1,4-DBeq) Economic Performance		000.000 365.271 144.197 13.960 11.012	5,000.00(343.63) 98.74(10.87) 7.45
(€/tCO2eq) Freshwater Resource Depletion (ε/m3) Eutrophication (ε/kgPO4eq) Human Toxicity (ε/kg1.4-DBeq) Acidification (ε/kg5O2eq) Aquatic Ecotoxicity (€/kg1.4-DBeq)	Business as usual scenario (BAU-DEMO)	000.000 365.271 144.197 13.960 11.012	5,000.00 343.63 98.74 10.87 7.45 7.45 Energy Efficient Water Pump
(€/tCO2eq) E Freshwater Resource Depletion (€/m3) Eutrophication (€/kgP04eq) Human Toxicity (€/kg1.4-DBeq) Acidification (€/kg502eq) Aquatic Ecotoxicity (€/kg1.4-DBeq) Economic Performance Actor	Business as usual scenario (BAU-DEMO)	000.000 365.271 144.197 13.960 11.012	5,000.000 343.636 98.740 10.871 7.454 E M M 4







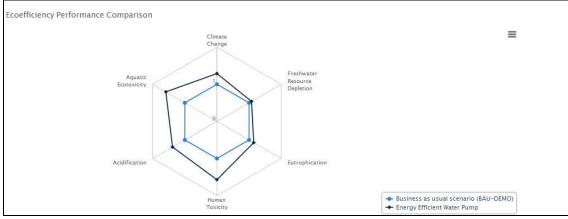


Figure 53: Comparison of the eco-efficiency performance.

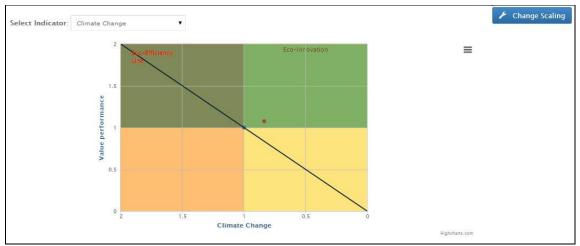


Figure 54: Direction of innovation for specific indicators.

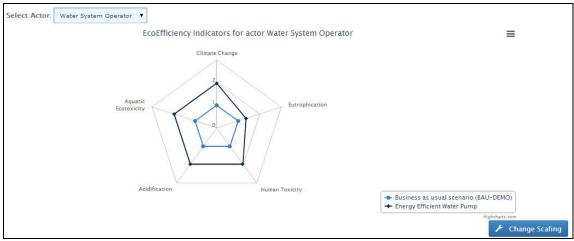


Figure 55: Eco-efficiency effect of an individual actor.

2.4 Step-by step: Adding and editing new technologies

Figure 56 depicts the opening or overview screen of technologies. Novel processes or methods can also be included. The picture reveals a 'Request adding a Technology' button. Using the button will send an e-mail to the administrator who will grant access. The notification for sending the message is shown in Figure 57. Using the 'X', marked in the right lower corner will close this notification. As granting access is not automatic, granting access may take some time.

After access has been granted the user can press Create Technology button, which will launch a pop-up for basic information of the tehcnology (Figure 58). After the new technology with basic information is created, much more information can be included, using the different tabs of the tool (Figure 59). Table 3 lists the different types of data that can be associated with a technology.

Technol	ogies					
					Request adding	a Technolo <u>c</u>
Drag a column a	nd drop it here to group by that column Name	Sectors 🔺	Stages	Investment Cost	Operation Cost	
	Biological Production Shifting from traditional agricultural production methods to modern biological production methods by using natural agricultural enhancers.	Agricultural systems	Water Use	10346/00110110020	•	
	Multi-User Electronic Delivery Hydrants An electro-mechanical device is utilized by a multi-user delivery hydrant so as to optimize the effectiveness of the water supply to authorized users.	Agricultural systems	Water Distribution	1,200 € [3]	0.022 €/m3 (assumed to be 10% of investment, 1 device is responsible for the supply of approximately 5 ha cfund(cStt) [2]	
1	Sub-Surface Drip Irrigation (SDI)	Agricultural systems	Water Use	2500€/ha	0.27 €/m3 (CS#1) [2]	

Figure 56: Technology overview screen with request new technology button.

Notifications	
- Your request to create an Indicator is pending a response	Ø

Figure 57: Notification that your Technology request is sent to the administrator.

Create Technology			×
General information	Image		
	Name	Max's Technology	
	Short Description	X 心 歯 歯 歯 ★ →) (Q 助 単) IX II) (● 弐 座 亜 亜 亜 亜 亜 亜 亜 亜 亜 亜 亜 亜 亜 亜 亜 亜 亜 亜	
		Max Ecoefficienct Technology concerns	
		jbody p	
- * -			
		Cancel Create Technology	

Figure 58: Technology creation pop-up screen.

					Dele	te Technolog
Identity Economic Da	ata Environmental Pressures	Environmental	Performance Indicators	Maturity And Availability	Efficiency	Reference
Upload Photo		lame Description	🖋 Maxs Technolo	σγ		
Sector/s Stage/s	1					
Stage/S Reference Unit						

Figure 59: Editing and adding information on technology tabulated screen.

Table 3: Technology characteristics fields.

Section/Item	Type of field	Description
Identity		
Name	Text field	Self-explanatory (s.e.)
Description	Text field	(s.e.)
Sector/s	Text field	(s.e.)
Stage/s	Text field	Stages in a water value chain
Reference Unit	Text field	It reference unit referring to the size or capacity of each technology for which the economic and envi- ronmental data are estimated. (i.e. Pump: 10kW)
Economic Data		
 Technology lifetime (number of years) 	Numeric	(s.e.)
Investment Cost (Euro)	Numeric	(s.e.)
Operation Cost (Euro/year)	Numeric	(s.e.)
Environmental Pressures		
Air Quality	Text field	Narrative description of the tech- nology pressure
Soil Quality	Text field	dito
Water Quality	Text field	dito
Water Use	Text field	dito
Resource Use	Text field	dito
Solid Waste	Text field	dito
 Indirect Impacts 	Text field	dito
Environmental Performance indica- tors		
a. Resource Depletion Potential		
i. Water Consumption (m3)	Numeric	Value per reference unit

[ii. Energy Consumption	Numeric	dito
	(kWh)		
	iii. Type of energy consumed (thermal/electrical/fuel)	Numeric	dito
	iv. Resource consumption (kg)	Numeric	dito
	v. Type of Resource con- sumption (i.e. solvents, fer- tilizers)	Numeric	dito
	Global Warming Potential (KgCO2,eq)	Numeric	dito
	Eutrophication potential (KgPo4-3,eq)	Numeric	dito
	Ecotoxicity Potential (CTUe)	Numeric	dito
	Human Toxicity Potential (CTUh)	Numeric	dito
	Acidification Potential (KgSO2-,eq)	Numeric	dito
Ū	Ozone Depletion Potential (KgC2H2,eq)	Numeric	dito
h.	Photochemical Ozone Crea- tion Potential (KgC2H2,eq)	Numeric	dito
i.	Respiratory Effects (Kg PM10,eq)	Numeric	dito
j.	Land Use (ha)	Numeric	dito
	Ionizing Radiation (Kbq U235air,eq)	Numeric	dito
Matur	ity and Availability		
•	Technical maturity	Selection field	Value between one star and five
•	Commercial maturity	Selection field	star maturity Value between one star and five star maturity
•	Reliability	Text field	Narrative
•	Applications/Innovative Char- acter	Text field	Narrative
Efficie	ency		
•	Water saving	Text field	Narrative
•	Energy Efficiency	Text field	Narrative
•	Physical Efficiency	Text field	Narrative
•	Environmental Impact	Text field	Narrative
Refere	ences		
		Text field	Field for publications etc

2.5 Step-by step: Adding and editing new Indicators

Figure 60 depicts the opening or overview screen of Environmental Impact Indicators. The picture reveals a 'Request adding an Indicator' button. Using the button will sent an e-mail to the administrator who will grant access. The notification for sending the message is shown in Figure 61. Using the 'X', marked in the right lover corner will close this notification. As granting access is not automatic, granting access may take some time.

Environmental Impact Ind	dicators	5	Request adding	a Indicator
Drag a column and drop it here to group by that co	lumn			
Name	Symbol	Unit	Sector(s)	
Climate Change Measures the impacts caused by the greenhouse effect which is induced by emission of greenhouse gases into the air.	GWP100	tCO2eq	Agricultural systems, Urban water supply systems, Industrial water systems	
Fossil Fuels Depletion Consumption of non-renewable resources thereby lowering their availability for future generations (JRC, glossary of terms)	FDP	MJ		

Figure 60: Environmental Impact Indicator overview screen with request new Indicator button.



Figure 61: Notification that your Indicator request is sent to the administrator. The window can be closed using the 'x' in the right hand corner.

Once the request is granted, a 'Create Indicator' button wil become available. Pressing this button wil start an indicator definition process. The first step is shown in Figure 62. Once this information is completed and the 'Create Indicator' button is pressed Figure 63 will appear. The fields with the pencil icon () can be edited. The evaluation rule section, and in particular the 'weighted sum of parameters' is the important part of the indicator definition. Checking the weighted sum button will reveal Figure 65. Using 'add parameter' a parameter can be added to a formula, as is shown in Figure 66. Repeating this process may result in a table of weighted parameters as is shown in Figure 67.

In case the user wants to use a fixed value he can use the 'formula' checkbox, and fill in a simple formula or fixed value (Figure 68).

Create Indicator	×
Name	MyIndicator
Description	X 心 歯 歯 歯 ◆ ク 気 厚 X ③ ● ◎ ◎ □ 田 吾 Ω B I U S X, X I X 厚 □ ◎ ◎ ◎ □ 田 吾 Ω
	MyDescription
	holy p
Symbol	MD
Unit	
	Cancel Create Indicator

Figure 62: Indicator description pop-up screen.

		Delete Indicat
Identity Ev	aluation Rule Source	
Name	🖋 MyIndicator	
Description	MyDescription	
Sector/s	*	
Symbol	🖋 MD	
Unit	ℐ [-]	

Figure 63: Editing and adding information concerning an indicator (A).

			Delete Indicato
Identity	Evaluation Rule	Source	
ormula	Formula	of parameters	
Parameters			
	e no parameters		

Figure 64: Editing and adding information concerning an indicator (B).

Environmental In	dicators 🕨 MyIndicato	pr						Delete Indicator
Identity	Evaluation Rule	Source						
Evaluation M © ® Parameters	Formula	m of parameters						
			Name	Symbol	Unit	Weight		
Add Paramet	er		There a	re no paran	neters			

Figure 65: Weighted sum of parameters evaluation rule – opening screen.

Name	myparam2
Symbol	MYP2
Unit	tn
Multiplier Value	0.3

Figure 66: Weighted sum of parameters evaluation rule – parameter definition.

invironmental In	dicators 🕨 MyIndicato	Dr							Delete Indicator
Identity	Evaluation Rule	Source							
⊖ ⊛ Parameters	Formula Weighted su	m of parameters							
			Name	Symbol	Unit	Weight			
			MyParam	MYP	tn	0.5		0	
			myparam2	MYP2	tn	0.3		0	
Add Paramete	er		(0.5	* MyParam) + (0.3	* myparam:	2)		

Figure 67: Weighted sum of parameters evaluation rule – overview of formula.

Indicator			×
Formula	3*12		
		Cancel	Change
			Formula 3*12

Figure 68: Editing and adding information concerning a fixed formula indicator.

3 Collaborators, Administrators, Owner and Stakeholders

Collaborators, administrators, owner and stakeholders are three types of persons working on a case study (see Figure 69). A case study has one creator/owner. This owner is also administrator, who on request can give administrator rights to other registered users. These administrators can give access to other registered users to collaborate on the case study. All administrators can also delete a case study. We recommend not giving administrator rights to inexperienced users, but letting these users be collaborators or stakeholders. They have the same access rights to view and edit case studies.

As one can see from the figure, giving access rights is user driven, which implies that a case study must be visible, see at the end of 2.3.2 Creating a new case study.

Case Study Users	×
Case Study Owner / Creator: Dr. Maximilian EcoEfficient	
Collaborators Administrators Stakeholders	
Case Study Collaborators The users that are able to enter and edit Case Study-specific information.	Request to become a collaborator
Dr. Maximilian EcoEfficient	
	Close

Figure 69: Case study users.

4 Troubleshooting – Frequently asked questions

Issue	Solution			
Can't log in	A facility to retrieve a lost password is incorporated in the Account - scrol down menu.			
	Forgot your password; To reset your password, type the email you use to sign in to your EcoWater Toolbox Account:			
	490617 Change image			
Accidently deleted a case study	Currently there is no repair mechanism implemented.			
Ruined a case study – would like to revert to a previous ver- sion	The user can revert to the previous scenario using the 'Scenario Information' screen.			
Can't see a case study	The case study administrator must make the case study visible, or include the user as case study collaborator.			
Can't access case study	The case study administrator must include the user as case study collaborator.			
SEAT file will not load	Most likely the model was not able to solve. Return to SEAT.			
SEAT file loaded there are no results.	A model may solve but have no flows. Return to SEAT.			
Can't change the case study logo	The image can be changed in the edit section () of case study details. The case study picture cannot be altered by adding pictures to the tab 'Images'. The latter only concerns pictures relating to the case study.			

5 Literature

- Angelis-Dimakis, Thanos. 2013. *Deliverable 1.5 Finalized Systemic Environmental Analysis Tool* – *SEAT*. EcoWater Project Deliverable, retrievable here: <u>http://environ.chemeng.ntua.gr/ecoWater/Default.aspx?t=238</u>
- Angelis-Dimakis, Thanos. 2013. *Deliverable 1.6 Economic Value chain Analysis Tool EVAT*. EcoWater Project Deliverable, retrievable here: <u>http://environ.chemeng.ntua.gr/ecoWater/Default.aspx?t=238</u>
- EcoWater Description of Work, 2011, EcoWater Project, Meso-level eco-efficiency indicators to assess technologies and their uptake in water use sectors, 7th Framework Programme, Grant Agreement No: 282882 (restricted access).
- Kourentzis, V., 2012, Roadmap for Case Study Development, Deliverable 1.8 of the Eco-Water Project, Meso-level eco-efficiency indicators to assess technologies and their uptake in water use sectors, 7th Framework Programme, Grant Agreement No: 282882 (restricted access, available on demand).
- Van Vliet, L., Levidow, L., Alongi Skenhall, S. and Blind, M., 2012, Review and selection of eco-efficiency indicators to be used in the EcoWater Case Studies, Deliverable 1.1 of the EcoWater Project, Meso-level eco-efficiency indicators to assess technologies and their uptake in water use sectors, 7th Framework Programme, Grant Agreement No: 282882.