H2020-EE-2015-3-MarketUptake

WaterWatt

Improvement of energy efficiency in industrial water circuits
by online self-assessment, benchmarking and economic decision support

Project Title: Improvement of energy efficiency in industrial water circuits using gamification for online self-assessment, benchmarking and economic decision support

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1. Executive Publishable Summary

The mission of the project WaterWatt is to remove market barriers for energy efficiency solutions, to provide information transfer to the stakeholders and motivate them to implement energy efficient solutions in water circuits. The WaterWatt E^3 Platform will provide according tools facilitating the information exchange and implementation.

This document presents the concept, the use cases and the requirements definition for the WaterWatt E^3 Platform. In continuity with the approach applied since the initial stages of the WaterWatt project, the requirements come from an iterative and participative process. It involves discussion with researchers as well as with engineers and operators of cooling circuits and further stakeholders from various industrial sectors (steel and non-steel-metals; pulp and paper; gas and oil; food and beverages; chemical).

The first part of the document (section 3) provides an overview of the E^3 Platform concept and its tools, such as decision guidance matrix, energy efficiency database, water circuit simulation software, e-learning and forum. The tools will facilitate information transfer and help infrastructural managers to take decisions on investment in energy efficiency and on efficient operation of existing systems. This will result in overall reduction of energy demand in water intensive industrial branches.

Section 4 describes some significant usage scenarios, in order to show how users can interact with the E^3 Platform, and summarizes the list of requirements produced. The main scenarios are the following:

1. User wants to assess information on energy efficiency of industrial water circuits
2. User wants to evaluate energy efficiency of their water circuit
3. User wants to improve energy efficiency of their water circuit
4. User wants to design a new water circuit
5. User wants to share their experience
6. User wants to obtain recognition for energy efficient circuits.

Furthermore, this report outlines the use cases collected, providing information for each use case like: actors of the use case; goal to reach; any preconditions; trigger of the use case; any post-conditions; steps to follow.

This document provides a solid basis for the development of E^3 Platform. During the platform implementation and development this basis will be enhanced and widened according to user feedback.

2. Introduction

The main goal of this deliverable is to define requirements and use cases as an initial activity of WP4 to provide a solid basis for the implementation of the E^3 Platform that will be realized in the subsequent WP4 tasks. Specifically, this deliverable aims to:

1. Provide an overall E^3 Platform concept, highlighting its main tools and functionalities;
2. Define the lists of requirements and use cases.

The requirements come from an iterative process, involving also outputs from WP2 (Modelling and Optimization of Industrial Water Circuits) and WP3 (Human and Organisational Changes).

The document is organized as in the following:

- Chapter 1 outlines the executive summary;
- Chapter 2 is this introduction and description of the document itself;
- Chapter 3 shows the E^3 Platform Concept;
- Chapter 4 lists scenarios, requirements and use cases.

2.1. Acronyms list

E3	Energy Efficiency Evaluation
EE	Energy Efficiency
KPI	Key Performance Indicator
HCI	Human Computer Interaction
IWC	Industrial Water Circuit

3. E3 Concept

3.1. E^3 Platform Goals

The project WaterWatt aims to remove market barriers for energy efficiency solutions, in particular the lack of expertise and information on energy management and saving potential in industrial water circuits. In fact, industrial water circuits are often considered as auxiliary systems and have not been in the focus of energy efficiency measures. For this reason the potential for improvement is high.

There are definitely technical solutions to tap this potential, but there are also market barriers for the implementation of these solutions.

The main market barriers are:

- Low awareness of the existing energy saving potential
- Uncertainty of the positive economic effects

Currently, there is neither a benchmark on the energy consumption in industrial water circuits, nor tools for its systematic reduction, nor awareness of the saving potential. The WaterWatt project wants therefore fill this gap by providing an **Energy Efficiency Evaluation** Platform (E^3 Platform) for online self-assessment, benchmarking and economic decision support on the improvement of industrial water circuits (**Figure 1**).

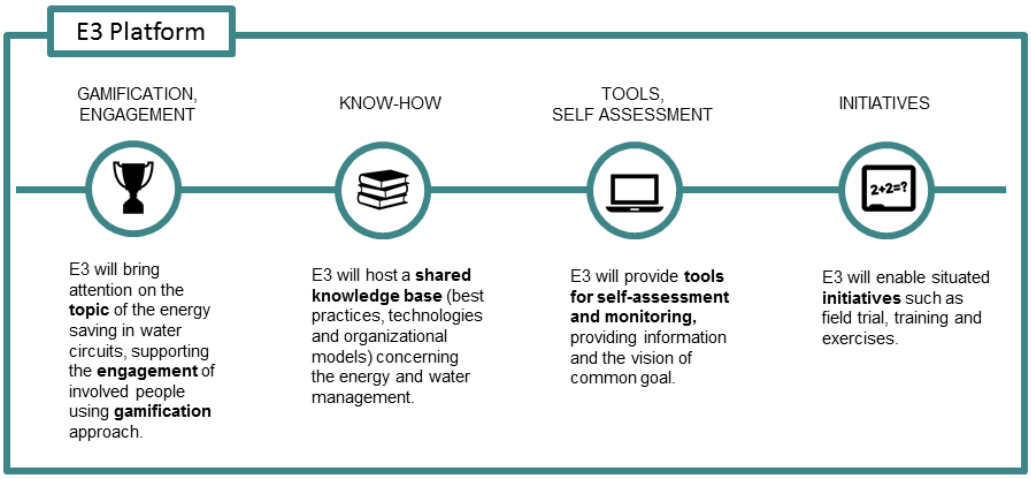

Figure 1: Objectives of E^3 Platform

The main objectives of the E^3 Platform are the following:

- To increase the awareness of the possible reduction of energy consumption in industrial water circuits and support the engagement of involved people using gamification approach.

- To provide a shared knowledge base of best practices, technologies and organizational models concerning the energy and water management.
- To provide advanced tools for self-assessment and monitoring.
- To enable situated initiative such as field trial training and exercises.

3.2. E^3 Platform Logical Tools

To achieve the aforementioned objectives, E^3 Platform will provide several tools that allow stakeholders to play an active role in reducing the energy consumption in industrial water circuits (IWC).

The main sets of E^3 Platform tools are the following (**Figure 2**):

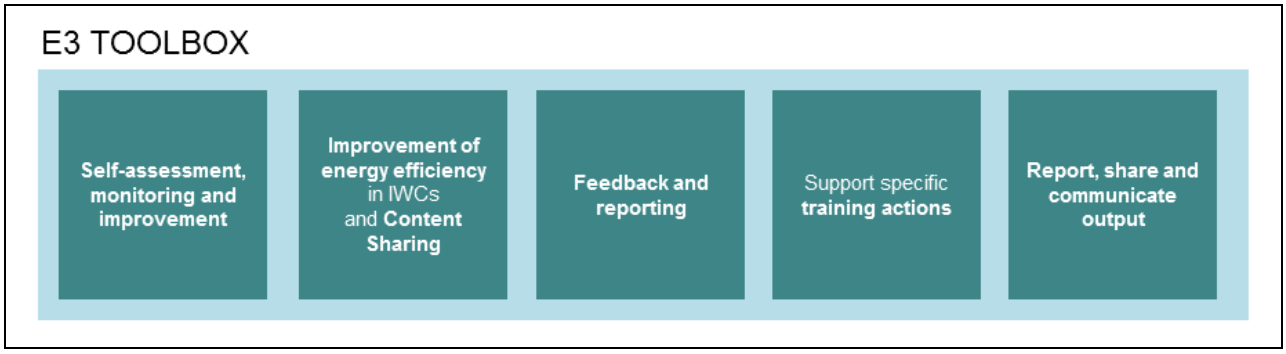

Figure 2: E^3 Platform Toolbox

- Tools for the self-assessment, monitoring and improvement of the energy efficiency of IWCs.
- Informational tools for improvement of energy efficiency in IWC and content sharing.
- Feedback and reporting tools.
- Tools to support specific training actions.
- Tools to report, share and communicate output and outcomes.

In the following sections each set of tools is described in more detail.

3.2.1. Tools for self-assessment, monitoring and improvement of the energy efficiency of industrial water circuits

This category includes a set of tools (**Figure 3**) helping the user to assess energy efficiency of their IWC and choose according improvement measures. It is therefore required to take into account the data of the specific circuit, through a self-assessment procedure.

This set of tools is designed for an industrial user, typically an infrastructure or a maintenance manager working with water circuits and responsible for energy efficiency and investment decisions at industrial plant. Using these tools the user can:

- Access an interactive step-by-step guideline for the analysis of energy efficiency in a certain IWC.
- Get information on important water circuit parameters and techniques to monitor them.
- Use an interactive interface for the calculation of Key Performance Indicator (KPI) on basis of the data from the certain circuit.
- Access an integrated KPI benchmark value to compare efficiency of particular circuit to those in other companies and branches.
- Get the maximal technically achievable savings to evaluate the energy saving potential.
- Simulate certain circuit with various modifications e.g. to determine optimal number of pumps, their size, automation mode, pressure levels, etc.
- Estimate energy savings, costs and payback time for the alteration of particular circuit.
- Design a new energy efficient circuit on basis of existing water demand.

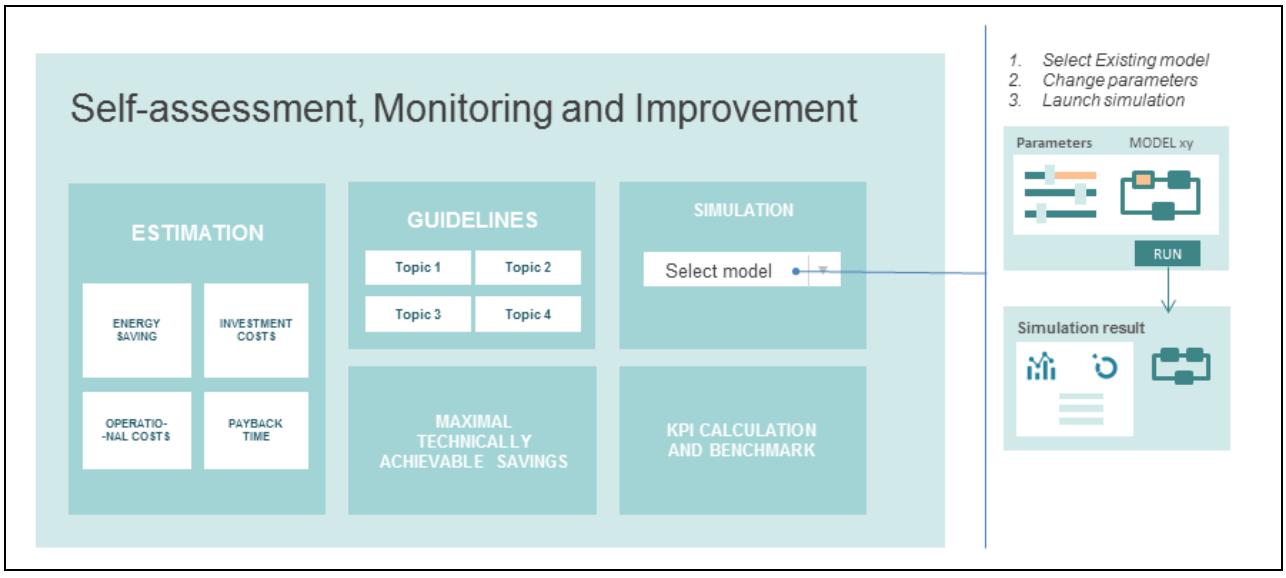

Figure 3: Tools for self-assessment, monitoring and improvement of energy efficiency of IWCs

3.2.2. Informational tools for improvement of energy efficiency in IWC and content sharing

This category includes a set of tools (**Figure 4**) providing information on general measures for improvement of energy efficiency in IWC and ways to facilitate their implementation. These tools will increase awareness on potential reduction of energy consumption in IWCs and its economic and environmental effects.

These tools are meant to provide general information applicable to the most IWC not referring to particular circuits directly (self-assessment of user' circuits is managed by another set of tools mentioned in the previous chapter).

Informational tools are designed for any user who seeks information on energy efficiency in water circuits. Besides maintenance engineers these could be lawyers, EU representatives, journalists, public representatives as well as researchers. Using this set of tools the user can:

- Access a comprehensive database of solutions for the improvement of energy efficiency in IWCs. Database will include the most energy efficient technologies and solutions available with estimated energy savings, specific costs and payback times.
- Access the decision guidance matrix for the implementation of energy saving measures in IWCs.
- Get access to the project case study histories.
- Get access to best practices.
- Get access to laws and regulations.
- Learn about impacts of the energy savings.

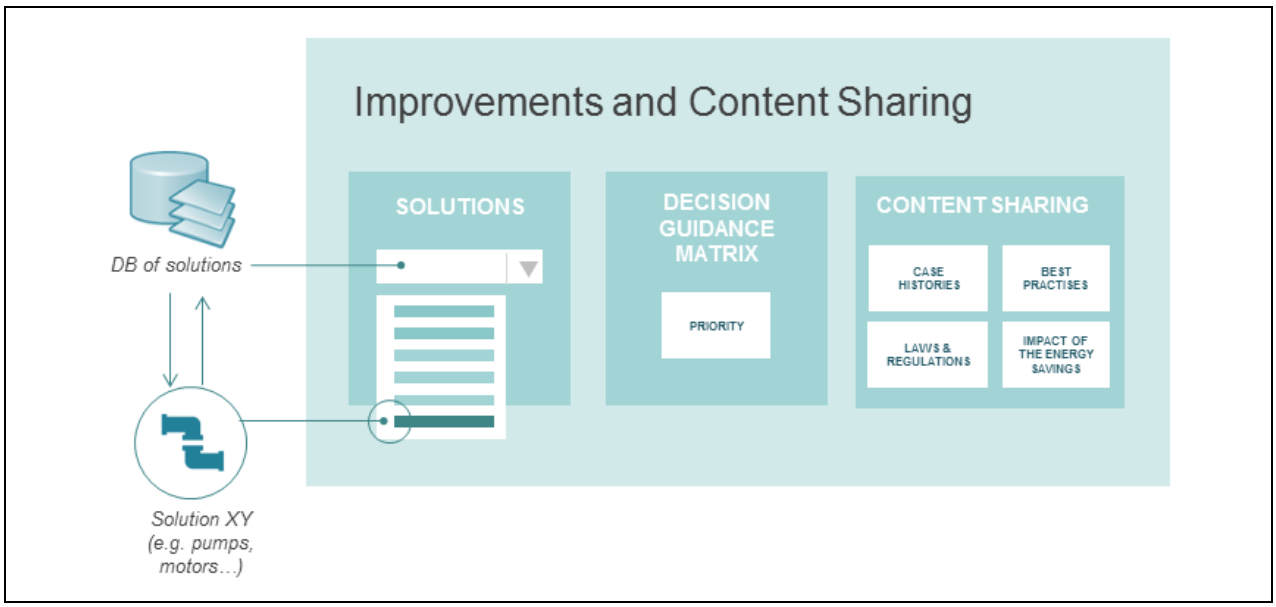

Figure 4: Informational tools for improvements and content sharing

3.2.3. Feedback and reporting tools

This category includes a set of tools (**Figure 5**) providing feedback data about energy savings gained by the proposed measures.

Using this set of tools users can:

- Introduce their story on the improvement of energy efficiency in certain water circuits.
- Gain a WaterWatt Certificate (for the companies with energy efficient IWC).
- Obtain a distinction status (for persons and companies who have reached considerable energy savings by improving their circuits).
- Access a feedback interface on the real energy savings with the proposed measures.
- View diagrams on total energy savings reached by industrial sectors.

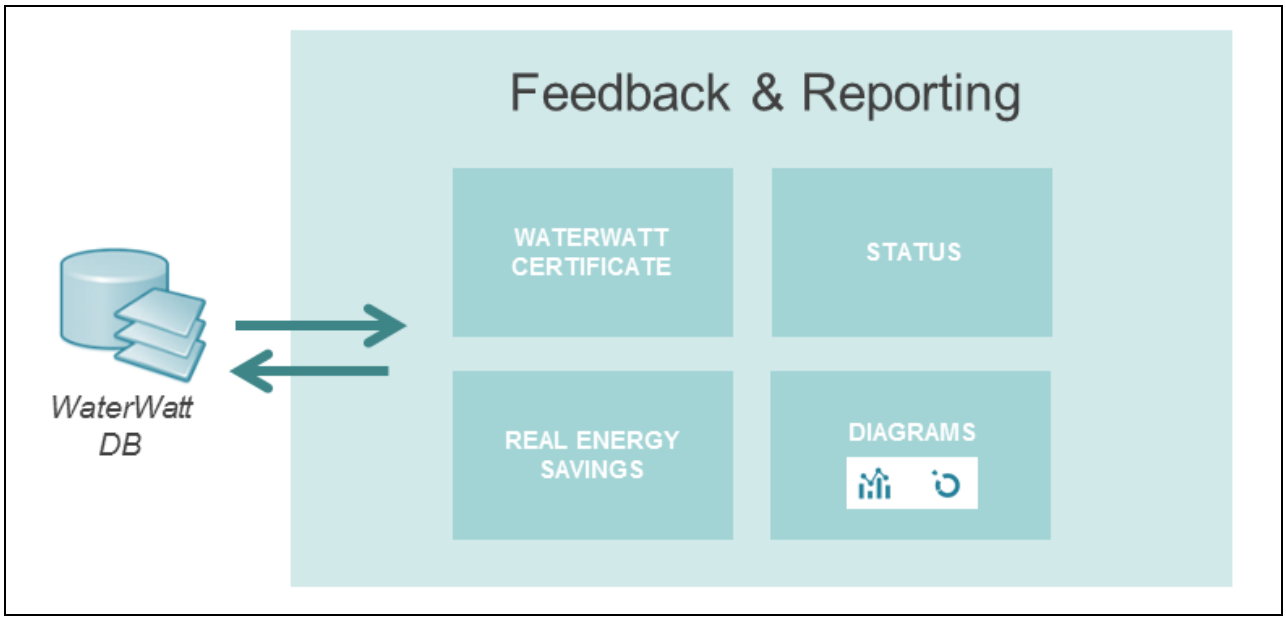

Figure 5: Feedback and reporting tools

3.2.4. Tools to support specific training actions

This category includes a set of tools (**Figure 6**) supporting specific training actions, including forum and E-learning.

Using this set of tools users can:

- Access online service of open discussion and expression of ideas (forum).
- Benefit from E-learning services, online seminars and further dissemination activities.

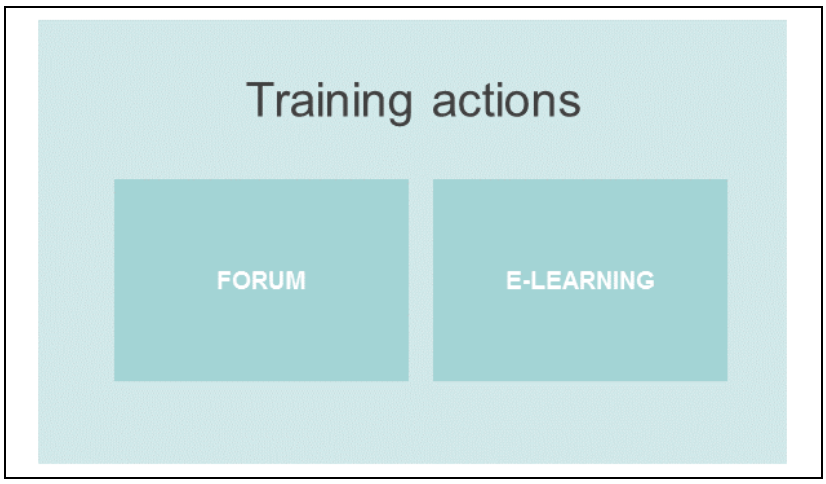

Figure 6: Tools to support specific training actions

3.2.5. Tools to report, share and communicate output and outcomes

This category includes a set of tools (Figure 7) for accessing specific report sections in the Web Dashboard of the E^3 Platform showing relevant outputs.

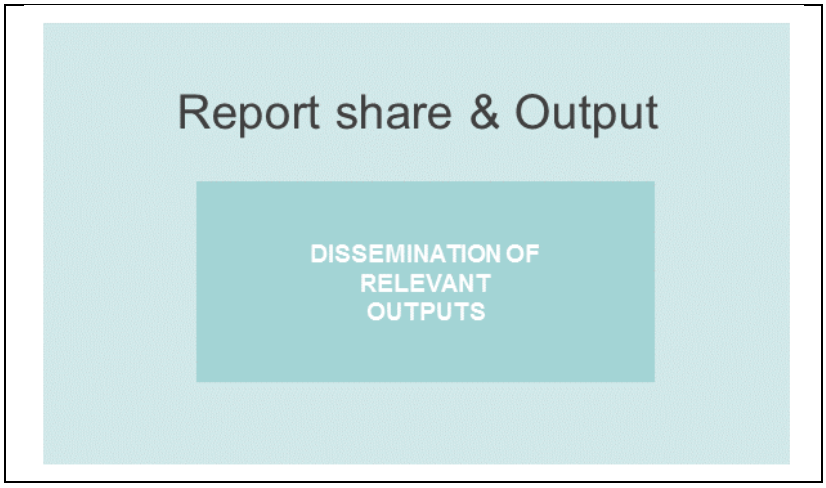

Figure 7: Tools to report, share and communicate output and outcomes

4. E3 Scenarios, Requirements and Use Cases

This section describes significant usage scenarios, in order to show how users can interact with the E^3 Platform. Scenarios describe the steps, the events, and the actions, which occur during the interaction.

4.1. Methodology of collection of requirements, scenarios and use cases

In the frame of case studies in various industrial branches it was identified that a typical industrial E^3 Platform user would be an infrastructure manager who has his energy saving plan and could use E^3 Platform tools to achieve these savings in industrial water circuits. They build our main focus group because they take decision on investment and improvement of energy efficiency. We interviewed people in these positions to define the most common demands, made further suggestions and documented their reactions.

Further users are researchers looking for energy efficient technologies and energy efficiency consulters in search for tools and case study results. Also such groups as lawyers, EU representatives and interested public representatives will be provided with a comprehensive overview of the energy efficiency potential in industrial water circuits and the ways to use it.

4.2. Scenarios

The main scenarios for the use of E^3 Platform are:

1. User wants to assess information on energy efficiency of industrial water circuits
2. User wants to evaluate energy efficiency of their water circuit
3. User wants to improve energy efficiency of their water circuit
4. User wants to design a new water circuit
5. User wants to share their experience
6. User wants to obtain recognition for energy efficient circuits

On the following pages these scenarios will be discussed in detail.

4.2.1. Scenario 1: User wants to assess information on energy efficiency of industrial water circuits

User Maria is an EC representative working in energy efficiency department. For her report on saving potential in various industrial branches she searches for benchmarks and maximal possible energy savings as well as their economic viability. Maria accesses the web dashboard

of the E^3 Platform and reads case study histories as well as consults the forum to get information on the current issues on energy efficiency. To use the database she needs to register. After registering and successful log in she searches the database for energy efficient solutions and benchmarks.

4.2.2. Scenario 2: User wants to evaluate energy efficiency of their own water circuit

User Thorsten is an operational engineer in a chemical factory specialized in detergents production. He wants to make an improvement suggestion on energy efficiency. One of the possible fields is reduction of energy consumption of pumps in the water circuit. To identify the improvement potential he reached the web interface of E^3 Platform and uses the decision guidance matrix for further steps. After completing a questionnaire, Thorsten receives an automated answer on the improvement potential.

4.2.3. Scenario 3: User wants to improve energy efficiency of their own water circuit

User Bob is an Infrastructure Manager of an industry specialized in producing steel wires. He wants to know, if it is possible to improve a particular water circuit used in the plant. Bob accesses the web dashboard of E^3 Platform and uses the decision guidance matrix for further steps. He accesses a pre-evaluation section, where he completes and submits a questionnaire able to provide a first evaluation related to Bob's circuit. Using automated suggestions for improvement measures, he can simulate his circuit with the E^3 Platform software to estimate energy savings and payback times. Since he does not have an account yet, Bob follows the steps to register onto the platform. Then, after successful login he creates a simulation model which can be saved online into his account. Running the simulation of various circuit adjustments he finds the optimal configuration.

4.2.4. Scenario 4: User wants to design a new water circuit

User Jana is an Infrastructure Manager at a sugar refinery. The production should be increased by 30 % and she needs an additional water circuit. She registers to E^3 Platform and after successful log in she can use the simulation software. She builds up a circuit and simulates various operational conditions to choose the right size and amount of pumps and cooling units. She saves the simulation results to her online account.

4.2.5. Scenario 5: User wants to share their experience

User Marc has found that after implementing some of the suggestions from E^3 Platform the real saving were different from those estimated by the simulation software. He uses his account data to log in and shares his experience in a forum.

4.2.6. Scenario 6: User wants to obtain a recognition for energy efficient circuit

User Betty has designed a new circuit applying the best available technology. The specific energy consumption is lower than in 80 % circuits of her branch. She creates an account, logs into the E^3 Platform, shares her case study history and after evaluation of the case by an administrator her company is awarded a WaterWatt energy efficiency certificate.

4.3. Requirements

Below all identified requirements are listed using methodologies described in Chapter 4.1 (Methodology of collection of requirements). Requirements are divided in two categories: functional requirements and nonfunctional requirements.

- Functional requirements describe **what** the system should do and typically they specify a behaviour or a function.
- Nonfunctional requirements cover all the remaining requirements, which are not covered by the functional requirements. They specify **how** the system should behave.

Each requirement contains the fields illustrated in following table.

Table 1: Requirement fields

ID requirement	Identifier of requirement, used to trace requirement during system development
Type	Type of requirement (functional or nonfunctional)
Description	Description of requirement
Priority	Assigned priority
Uses cases IDs	List of use cases IDs related to requirement

Assigned priorities are based on the most know severity rating scales applied in HCI (Human Computer Interaction) and usability engineering:

- Must have: the requirement is essential for considering the system complete; if this requirement is not delivered the system will be considered to have failed or to have violated standards.
- Should have: important requirement that is preferable to have for avoiding users' confusion or irritation; if it is not delivered within the current version, it can be temporarily circumvented.
- Might have: 'nice to have' requirement; it addresses a non-critical problem or a general question about.

4.3.1. Functional Requirements

Table 2: Functional Requirement 1: Download of App

ID requirement	**1**
Type	Functional - App
Description	Allow users to download WaterWatt App.
Priority	Must
Uses cases IDs	UC1

Table 3: Functional Requirement 2: Register

ID requirement	**2**
Type	Functional - Access
Description	Allow users to register on E^3 Platform
Priority	Must
Uses cases IDs	UC2, UC3, UC4, UC5, UC6, UC7, UC9, UC10, UC11, UC12, UC13, UC14, UC15

Table 4: Functional Requirement 3: Web Dashboard

ID requirement	**3**
Type	Functional - Access
Description	Web Dashboard must be accessible to registered and non-registered users with different access to the functionalities.
Priority	Must
Uses cases IDs	UC2, UC3, UC4, UC5, UC6, UC7, UC8, UC9, UC10, UC11, UC12, UC13, UC14, UC15, UC16, UC17

Table 5: Functional Requirement 4: Database Search

ID requirement	**4**
Type	Functional - Database
Description	Allow users to research solutions for the improvement of EE.
Priority	Must
Uses cases IDs	UC3

Table 6: Functional Requirement 5: Decision Guidance Matrix

ID requirement	**5**
Type	Functional – Decision guidance matrix
Description	Allow users to get the list of possible measures prioritized for improving EE of IWCs.
Priority	Must
Uses cases IDs	UC4

Table 7: Functional Requirement 6: Self-assessment

ID requirement	**6**
Type	Functional – Self-assessment
Description	Allow users to obtain EE of certain existing IWC assessed in comparison to the theoretical efficiency of the circuit.
Priority	Must
Uses cases IDs	UC5

Table 8: Functional Requirement 7: Information Retrieval

ID requirement	**7**
Type	Functional – Know-how
Description	Allow users to get information about the topic of energy consumption in water circuits.
Priority	Must
Uses cases IDs	UC3, UC4, UC15

Table 9: Functional Requirement 8: Completing of Short Questionnaire

ID requirement	**8**
Type	Functional – Questionnaire
Description	Allow users to evaluate energy efficiency of particular water circuits by completing a short questionnaire.
Priority	Must
Uses cases IDs	UC8, UC14

Table 10: Functional Requirement 9: Completion of Long Questionnaire

ID requirement	**9**
Type	Functional – Questionnaire
Description	Allow users to evaluate energy efficiency of particular water circuits by completing a long questionnaire.
Priority	Must
Uses cases IDs	UC9, UC10, UC16

Table 11: Functional Requirement 10: Simulation of Measures

ID requirement	**10**
Type	Functional – Simulation
Description	Allow users to simulate improvement measures in certain water circuits.
Priority	Must
Uses cases IDs	UC5, UC7, UC10, UC11, UC12, UC13

Table 12: Functional Requirement 11: Evaluation of Economics

ID requirement	**11**
Type	Functional – Simulation
Description	Allow users to evaluate the economic feasibility of certain improvement measures for particular water circuits by modifying parameters of circuit model.
Priority	Must
Uses cases IDs	UC10, UC12

Table 13: Functional Requirement 12: Simulation of Automation Measures

ID requirement	**12**
Type	Functional – Simulation
Description	Allow users to optimize automation of pump groups and cooling ventilators.
Priority	Should
Uses cases IDs	UC13

Table 14: Functional Requirement 13: Contacting Experts

ID requirement	**13**
Type	Functional – Contact
Description	Allow users to contact a WaterWatt expert.
Priority	Should
Uses cases IDs	UC14

Table 15: Functional Requirement 14: Web Dashboard Forum

ID requirement	**14**
Type	Functional – Forum
Description	Allow users to share experiences and to raise and discuss questions using the Web Dashboard forum.
Priority	Must
Uses cases IDs	UC15

Table 16: Functional Requirement 15: WaterWatt Certification

ID requirement	**15**
Type	Functional – Certificate
Description	Allow users to improve visibility obtaining the WaterWatt certification for energy efficient circuits.
Priority	Must
Uses cases IDs	UC16

4.3.2. Nonfunctional Requirements

Table 17: Nonfunctional Requirement N1: Encrypted Communications

ID requirement	**N1**
Type	Nonfunctional - Security
Description	Communications between the system's databases and the clients must be encrypted.
Priority	Must
Uses cases IDs	UC1, UC2, UC3, UC4, UC5, UC6, UC7, UC8, UC9, UC10, UC11, UC12, UC13, UC14, UC15, UC16, UC17

Table 18: Nonfunctional Requirement N2: User-friendly Interface

ID requirement	**N2**
Type	Nonfunctional - Usability
Description	The user interface of the Web Dashboard must be designed and implemented to ensure ease-of-use.
Priority	Must
Uses cases IDs	UC2, UC3, UC4, UC5, UC6, UC7, UC8, UC9, UC10, UC11, UC12, UC13, UC14, UC15, UC16

Table 19: Nonfunctional Requirement N3: Multilanguage Support

ID requirement	N3
Type	Nonfunctional - Usability
Description	The Web Dashboard shall be available in several languages.
Priority	Should
Uses cases IDs	UC2, UC3, UC4, UC5, UC6, UC7, UC8, UC9, UC10, UC11, UC12, UC13, UC14, UC15, UC16

Table 20: Nonfunctional Requirement N4: Modelling

ID requirement	N4
Type	Nonfunctional - Modelling
Description	The Web Dashboard must simulate models of IWCs.
Priority	Must
Uses cases IDs	UC5, UC7, UC9, MUC10, MUC11, UC12, UC13

Table 21: Nonfunctional Requirement N5: User Model Administration

ID requirement	N5
Type	Nonfunctional - Modelling
Description	The Web Dashboard must enable the user to administrate personal IWC models (new, save, restore, delete).
Priority	Must
Uses cases IDs	UC5, UC7, UC9, MUC10, MUC11, UC12, UC13

4.4. Use cases

The following describes the use cases, namely a list of actions helpful to define in a specific context the interactions between a specific actor (user) and a system in order to achieve a goal.

Each use case contains the fields illustrated in following table.

Table 22: Use case fields

ID use case	Unique identifier of the use case, used to trace it during system development.
Description	Description of use case.
Category	Use case belongs to a specific category (and subcategory).
Requirement IDs	List of requirements IDs related to use case.
Goal	Final user objective.
Pre-conditions	Mandatory pre-conditions.
Trigger	Action that initiate the use case.
Post-conditions	Conditions after execution of the use case.
Actors	Actors involved in the use case.
Steps	Interactions between actor and system to reach the goal.

Table 23: Use case UC1: App Download

ID use case	**UC1**
Description	A user downloads the WaterWatt mobile application from the app store.
Category	Mobile App
Requirement IDs	1, N1
Goal	Access to contents provided by WaterWatt App.
Pre-conditions	• Android/iOS • Internet connectivity
Trigger	User wants to download the app.
Post-conditions	WaterWatt app installed.
Actors	User
Steps	1. Access to the App Store. 2. Search the WaterWatt App 3. Download and install the WaterWatt App

Table 24: Use case UC2: User Registration

ID use case	**UC2**
Description	A user becomes a registered WaterWatt user.
Category	Web Dashboard
Requirement IDs	2, 3, N1, N2, N3
Goal	Register on E^3 Platform.
Pre-conditions	• E^3 Platform online • Internet connectivity
Trigger	User wants to login in E^3 Platform.
Post-conditions	The user has created an account and a profile within the E^3 Platform.
Actors	User
Steps	1. Click on Sign in 2. Fill in the registration form, which include name*, surname*, password*, email* 3. Send the form 4. Confirm by clicking on link in email received to activate login.

Table 25: Use case UC3: Database Search

ID use case	UC3
Description	A user searches solutions for the improvement of energy efficiency in IWCs in general.
Category	Web Dashboard – EE Database
Requirement IDs	2, 3, 4, 7, N1, N2, N3
Goal	Knowledge about possible improvements in EE of IWC in general.
Pre-conditions	• E^3 Platform online • User must be logged in to use the database • Database of EE available. • Internet connectivity.
Trigger	User wants to research in EE Database for solutions.
Post-conditions	• List of detailed EE solutions • Optionally bookmarked single solutions • Optionally saved search
Actors	User
Steps	Option 1: 1. Insert search parameters in input box and launch the search. 2. Access to results found. 3. Select a single result to access more detailed data. 4. Bookmark most interesting results for later access 5. Save the search conditions Option 2: 1. Browse all the repository, navigating by categories of solutions. 2. Select a single category to access all solutions within category. 3. Select a single solution to access more detailed data. 4. Bookmark most interesting results for later access 5. Save the search conditions

Table 26: Use case UC4: Listing of Measures

ID use case	UC4
Description	A user wants to know which are the suggested measures, in general, for EE improvements in IWCs.
Category	Web Dashboard
Requirement IDs	2, 3, 5, 7, N1, N2, N3
Goal	Knowledge about possible measures, in priority order, able to improving EE of IWC in general.
Pre-conditions	• E^3 Platform online • Decision guidance matrix available • User must be logged in to use the database • Internet connectivity
Trigger	User wants to access decision guidance matrix E3 section.
Post-conditions	List of prioritized measures.
Actors	User
Steps	1. Access to decision guidance matrix 2. Read related information

Table 27: Use case UC5: Self Assessment

ID use case	UC5
Description	A user wants to self-assess the energy efficiency of a particular existing IWC.
Category	Web Dashboard – Self-assessment
Requirement IDs	2, 3, 6, 10, N1, N2, N3, N4, N5
Goal	Has energy efficiency of certain existing IWC assessed in comparison to the theoretical efficiency of the circuit (model based).
Pre-conditions	• E^3 Platform online • User must be logged in to use simulation software • Internet connectivity • Relevant data of certain existing circuit provided by user • Energy Efficiency KPIs defined
Trigger	User wants to self-assess EE of a certain existing circuit.
Post-conditions	The user gets an assessment of EE of a certain existing circuit.
Actors	User
Steps	1. Access to self-assessment section. 2. Build particular circuit by adding, in order, the single components, selecting them from displayed toolbar. 3. For each component (e.g. pump) insert the required data. 4. Run the assessment procedure. 5. Access to results of assessment procedure (compare the annual kWh in the model and in the real world circuit).

Table 28: Use case UC6: Access E^3 Platform Database

ID use case	UC6
Description	A user wants to get information on topic energy consumption in water circuits to improve particular circuits
Category	Web Dashboard
Requirement IDs	2, 3, N1, N2, N3
Goal	• To evaluate individual improvement potential. • To compare certain circuits to the state of the art. • To gather information to use in a proposal or a publication.
Pre-conditions	• E^3 Platform online • User must be logged in • Internet connectivity
Trigger	User wants to know state of the art in EE of IWC
Post-conditions	User gets the information and the suggestion to check the efficiency of a certain circuit by completing a questionnaire
Actors	User
Steps	1. Access E^3 Platform database from the menu 2. Choose one of the following: ✓ Benchmarks by industrial branch ✓ Benchmarks by country ✓ Maximal theoretical efficiency ✓ Case studies

Table 29: Use case UC7: Accessing Guidelines

ID use case	UC7
Description	A user wants to learn using the E^3 Platform tools for improving energy consumption in water circuits.
Category	Web Dashboard - Guidelines
Requirement IDs	2, 3, 10, N1, N2, N3, N4, N5
Goal	To improve particular water circuits or to offer a consulting service for circuit owner.
Pre-conditions	• E^3 Platform online • User must be logged in • Internet connectivity
Trigger	User wants to acquire knowledge and learn to use tools.
Post-conditions	User gets the information and links to the tools.
Actors	User
Steps	1. Access Guidelines from the menu 2. Chose one of the following: ✓ Podcasts ✓ Tools with instruction manuals, including WaterWatt simulation software ✓ Publications, case studies ✓ Payback time of improvement measures

Table 30: Use case UC8: Evaluation of Energy Efficiency of Particular IWC

ID use case	**UC8**
Description	A user wants to evaluate energy efficiency of particular water circuits.
Category	Web Dashboard
Requirement IDs	3, 8, N1, N2, N3
Goal	To obtain improvement potential.
Pre-conditions	• E^3 Platform online • Internet connectivity
Trigger	User wants to know own positioning and improvement potential.
Post-conditions	User has completed a **short questionnaire**, obtained feedback about his positioning among other users and recommendations on improvement.
Actors	User
Steps	1. Access short questionnaire from the menu 2. Complete it online

Table 31: Use case UC9: Improvement of Energy Efficiency of Particular IWC

ID use case	**UC9**
Description	A user wants to improve particular water circuits.
Category	Web Dashboard
Requirement IDs	2, 3, 9, N1, N2, N3, N4, N5
Goal	To obtain improvement potential and improvement recommendations.
Pre-conditions	• E^3 Platform online • User must be logged in • Internet connectivity
Trigger	User wants to obtain improvement recommendations and payback times.
Post-conditions	User has completed a **long questionnaire**, obtained feedback about his positioning among other users and recommendations on improvement. User receives a link to simulation software.
Actors	User
Steps	1. Access long questionnaire from the menu 2. Complete it online 3. If the automatic answers are not specific enough and user requires personal consulting - save the questionnaire and send a message to WaterWatt contact person.

Table 32: Use case UC10: Estimation of Economics of Improvements

ID use case	UC10
Description	A user wants to estimate economic feasibility of improvements for certain water circuits.
Category	Web Dashboard
Requirement IDs	2, 3, 9, 10, 11, N1, N2, N3, N4, N5
Goal	To obtain customized payback times.
Pre-conditions	• E^3 Platform online • User must be logged in • Internet connectivity
Trigger	User wants to obtain improvement recommendations and payback times.
Post-conditions	User has completed a long questionnaire, obtained feedback about his positioning among other users and recommendations on improvement with payback times. User receives a link to simulation software to customize the recommendations and estimate payback times.
Actors	User
Steps	1. Access long questionnaire from the menu 2. Complete it online 3. Use the automatic answers to build simulation model of a circuit and estimate payback times

Table 33: Use case UC11: Accessing Tools to Simulate Improvements

ID use case	**UC11**
Description	A user wants to simulate improvements in certain water circuits.
Category	Web Dashboard
Requirement IDs	2, 3, 10, N1, N2, N3, N4, N5
Goal	To customize improvement recommendations.
Pre-conditions	• E^3 Platform online • User must be logged in • Internet connectivity
Trigger	User wants to know customized improvement potential.
Post-conditions	User has built a basic model of a certain circuit, specified changes, has run a simulation and received saved kWh/a.
Actors	User
Steps	1. Access simulation section from the menu 2. Read manual or see demo 3. Build a model of the certain circuit 4. Save the model 5. Introduce changes 6. Run the simulation

Table 34: Use case UC12: Simulate Improvements with Payback Time

ID use case	UC12
Description	A user wants to evaluate economic feasibility of improvements for certain water circuits by specific changes.
Category	Web Dashboard
Requirement IDs	2, 3, 10, 11, N1, N2, N3, N4, N5
Goal	To obtain customized payback times.
Pre-conditions	• E^3 Platform online • User must be logged in • Internet connectivity
Trigger	User wants to know customized improvement potential.
Post-conditions	User has built a basic model of a certain circuit, specified changes, has run a simulation and received saved kWh/a with expected payback time.
Actors	User
Steps	1. Access simulation section from the menu 2. Read manual or see demo 3. Build a model of the certain circuit 4. Save the model 5. Introduce changes 6. Indicate energy price 7. Run the simulation

Table 35: Use case UC13: Accessing Tools to Simulate Improvements of Automation

ID use case	**UC13**
Description	A user wants to improve automation of particular water circuits.
Category	Web Dashboard
Requirement IDs	2, 3, 10, 12, N1, N2, N3, N4, N5
Goal	To optimize automation of pump group and cooling ventilators.
Pre-conditions	• E^3 Platform online • User must be logged in • Internet connectivity
Trigger	User wants to obtain optimized pump automation algorithm.
Post-conditions	User has built a basic model, specified changes, has run a simulation and received estimation on saved kWh/a, CO2 and money along with the optimal automation parameters.
Actors	User
Steps	1. Access simulation section from the menu 2. Read manual or see demo 3. Build a model of your circuit 4. Save the model 5. Introduce changes 6. Run the simulation

Table 36: Use case UC14: Expert-based Evaluation of Certain IWC

ID use case	UC14
Description	A user wants to receive an evaluation for a certain circuit by a WaterWatt expert.
Category	Web Dashboard
Requirement IDs	2, 3, 8, 13, N1, N2, N3
Goal	To contact a WaterWatt expert
Pre-conditions	• Web page with contact data is online • User must be logged in • Internet connectivity
Trigger	User wants to outsource the evaluation.
Post-conditions	User has sent a request to WaterWatt expert and receives a confirmation.
Actors	User
Steps	1. Access contact form in the menu 2. Provide contact information and basic details to the circuit in a short questionnaire

Table 37: Use case UC15: Access to Discussion Forum

ID use case	**UC15**
Description	User wants to share their experiences/ask questions in discussion forum.
Category	Web Dashboard
Requirement IDs	2, 3, 7, 14, N1, N2, N3
Goal	To share experiences or to ask questions.
Pre-conditions	• Web page with discussion forum is online. • User must be logged in • Internet connectivity
Trigger	User wants to improve the information on the web page, show his expertise, and help others.
Post-conditions	User has posted a text and is notified when someone replies.
Actors	User
Steps	1. Access discussion forum from the menu 2. Select a suitable thread or create a new one 3. Post your comment/ answer a comment.

Table 38: Use case UC16: WaterWatt Energy Efficiency Certificate

ID use case	**UC16**
Description	User wants to obtain WaterWatt energy efficiency certificate.
Category	Web Dashboard
Requirement IDs	3, 9, 15, N1, N2, N3
Goal	To obtain internal and external visibility.
Pre-conditions	• Web page with discussion forum is online. • User must be logged in • Internet connectivity
Trigger	To obtain internal and external visibility.
Post-conditions	User has obtained a certificate and his case is listed under case studies.
Actors	User
Steps	1. Access long questionnaire from the menu 2. Enter data for circuit registration and case study history online 3. Submit data 4. If the improvement possibilities are few - press apply for certificate button - data will be sent to WaterWatt expert who will contact the user after plausibility check for additional data.

Table 39: Use case UC17: Maintenance of Database

ID use case	UC17
Description	Administrator wants to enhance the database: • Validate external user values input and include it into benchmark • Validate external user experience input and include it into database.
Category	Web Dashboard
Requirement IDs	3, N1
Goal	Check the input values by registered and unregistered users and integrate them into the database.
Pre-conditions	• E^3 Platform online • User must be logged in as administrator • Internet connectivity
Trigger	Updated database delivers better data
Post-conditions	Database is updated.
Actors	Administrator
Steps	1. Access the latest inputs 2. Evaluate the inputs (mark valid or invalid). 3. The valid inputs will be automatically integrated into benchmark. 4. The invalid will stay where they are with "invalid" mark, the date of evaluation and the name of evaluator.

5. Conclusion

This document presents the concept, the use cases and the requirements definition for the WaterWatt E^3 Platform. In continuity with the approach applied since the initial stages of the WaterWatt project, the contents come from an iterative and participative process. It involves discussion with researchers as well as with engineers and operators of cooling circuits and further stakeholders from various industrial sectors.

So far six main use scenarios and seventeen use cases with according requirements have been identified. During the further platform implementation and development in WP 4 the basis provided by this document will be enhanced and widened according to the user feedback.