



D7.5 Report on Dissemination and Standards Work

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1. Introduction

The goal of the Waternomics Project is to explore how ICT can help households, businesses and municipalities to reduce their consumption and losses of water in the framework of a water management program. A key component of the Waternomics Project is the collection of water consumption and contextual information from different sources to allow effective data analytics that will drive decision-making that optimises water consumption: e.g., planning, adjustments and predictions and to raise user awareness of water consumption.

Within this project, WP 7 aims at disseminating the project outcomes to a wide range of audience: pilot users, commercial water management stakeholders, public audience, etc. This deliverable summarises the dissemination and standardisation activities carried out during the first two years of the project and outlines its strategy for the third and last year.

1.1 Work Package 7 Objectives

Work package 7 gives home to, amongst others, the work on dissemination and standards in Waternomics. This includes the ensuring compliance of project results with industry standards, involving external stakeholders with the project, development of promotional materials for conferences and events, sharing of research results with the scientific community, setting up and maintaining the project website and social media and sharing of project results with a broad audience. The dissemination and standards related objectives of WP7 are:

- To educate end-users, resource managers and decision makers on water information platform and tools
- To ensure proper dissemination of the project results
- To ensure project results are supported by and compliant with standards

1.2 Purpose and Target Group of this Deliverable

The objective of this deliverable is to report on the progress of Task 7.1 (Dissemination) and Task 7.5 (Standards). More specifically, in this document we report on the dissemination strategy, the dissemination measures taken and their impact. Next to that, this document reports on the work on standards.

The main target groups for this deliverable are the members of the European Commission and dissemination managers of collaborative European research projects.

1.3 Relations to other Activities in the Project

This deliverable reports on the dissemination efforts from the different work packages (WP1 – WP6) of the project. Dissemination activities from WP1 to WP6 cover most of the scientific and exploitation dissemination. Furthermore, this deliverable reports on efforts from Task 7.4 and Task 7.5: dissemination and standards work.

1.4 Document Outline

The remainder of this deliverable is as follows:

1. **Section 2** gives an overview of the standardisation activities carried out within the project.
2. **Section 3** defines the dissemination strategy adopted in the project with respect to the target stakeholders and target activities.
3. **Section 4** reports on the project dissemination material and its online presence.
4. **Section 5** highlights the dissemination activities of the ICT4Water cluster.
5. **Section 6** lists the scientific contributions of the project in terms of research papers and project deliverables.

6. **Section 7** shows the exploitation dissemination with respect to participations in industry events and stakeholders engagement activities.
7. **Section 8** lists the training activities, i.e., university education, hackathons and online material.
8. **Section 9** discusses the pilot specific dissemination activities.
9. **Section 10** gives a set of KPIs for measuring the effectiveness of the dissemination activities.
10. **Section 11** summarizes the deliverable.

1.5 About Waternomics

Climate change, increased urbanization and increased world population are several of the factors driving global challenges for water management. In fact, the World Economic Forum has cited “The Water Supply Crises” as a major risk to global economic growth and environmental policies in the next 10 years. In parallel, the United Nations has called for intensified international collaboration. To help reduce water shortages, Waternomics will explore the technologies and methodologies needed to successfully reduce water consumption and losses from households, companies and municipalities. Waternomics is a three-year EU-funded project that started in February 2014 that will develop and introduce ICT as an enabling technology to manage water as a resource, increase end-user conservation awareness and affect behavioural changes, and to avoid waste through leak detection. In saving water, energy will also be conserved (treatment and pumping) as will the CO₂ associated with energy production. Unique aspects of WATERNOMICS include personalized feedback about end-user water consumption, the development of a methodology for the design and implementation of systematic and standards-based water resource management systems, new sensor hardware developments to make water metering more economic and easier to install, and the introduction of forecasting and fault detection diagnosis to the analysis of water consumption data.

WATERNOMICS will be demonstrated in three high impact pilots that target three different end users/stakeholders:

1. Domestic users in Greece implemented by a water utility
2. Corporate operator in Italy provided by a major EU airport
3. Public and Mixed-use based demonstration in Ireland

Through these contributions, WATERNOMICS will pioneer a new dialogue between water stakeholders. It will enable the introduction of Demand Response principles and open business models through an innovative human centric approach that uses personalized water data, water availability based pricing, and gamification of water usage statistics. To maximize impact, the project highlights business development, exploitation planning, and outcome oriented dissemination.

2. Overview of standardisation activities

Many standards were identified and discussed in detail in Deliverable 2.1 and Deliverable 1.2. These standards contributed to the development of the Waternomics Methodology and therefore the Waternomics project as a whole. This section, in light of the implementation of the Waternomics methodology at each pilot site, investigates how Waternomics aligns to each standard and can be an underpinning tool in the implementation of existing standards. Waternomics has also identified gaps in existing standards and regulations and suggests that standardising water footprint reporting and consumer information across, for example, industry sectors can improve transparency for consumers and drive water efficiency measures.

2.1 Overview of Relevant Standards

Table 1 documents the main current standards related to energy management, energy auditing, water footprints and environmental management. The standard number, its title and brief description are provided. Many of these standards were used in the development of the Waternomics methodology (see Deliverable 2.1 for full details on the Waternomics methodology), other standards (ISO 14044:2006, ISO 19011:2011, ISO 14031:2013) were also identified as concurring with the goals of the Waternomics methodology and are also listed and described later in the section.

Table 1 Selected Standards on energy and environmental management

Standard	Title	Description
ISO 14001 (2015)	Environmental Management Systems – Requirements with guidance for use	Presents guidelines on how to plan and execute an environmental management system within an organization. It follows the Plan-Do-Check-Act cycle.
ISO 14004 (2016)	Environmental Management Systems – Guidelines on implementation	Presents general guidelines for implementation of an environmental management system.
ISO 14046 (2014)	Environmental Management Water Footprint – Principles, requirements and guidelines	Specifies principles. Requirements, and guidelines related to water footprint assessment of products, processes and organisations based on life cycle assessment or stand-alone assessment.
ISO 50001 (2011)	Energy Management Systems – Requirements with guidance for use	Presents guidelines on how to plan and execute an energy management plan within an organization.
ISO 50002 (2014)	Energy Audits – Requirements with guidance for use	Specifies the process requirements for carrying out an energy audit. It is applicable to all types of establishments and organisations.
IPMVP (2012)	International Performance and Measurement Verification Protocol – Vol 1 Concepts and options for Determining Energy and Water Savings	Provides a framework to plan, measure or calculate and verify the outcome of energy efficiency measures, related to energy and water savings.
ISO 14044 (2006)	Environmental Management – Life cycle assessment – Requirements and guidelines	Provides guidelines on carrying out a life cycle assessment study the guidelines are provided to fulfil the requirements of IS 14040:2006, Environmental management – Life cycle assessment – Principles and framework.
ISO 19011 (2011)	Guidelines for auditing management systems	Provides guidelines on a broad scope of management system auditing to cover generically the wide range of new management systems standards which have been published recently.
ISO 14031 (2013)	Environmental Management – Environmental performance – Guidelines	This standard sets out a process called environmental performance evaluation (EPE) that allows organisations to measure, evaluate and communicate their environmental performance using key performance indicators (KPIs), based on reliable and verifiable information.

2.2 Waternomics Methodology and Standards

A review of the developed Waternomics Methodology was undertaken as part of its implementation at the four project pilot sites. Initially it is clear that the methodology allows for a clear and comprehensive means of ensuring an organisation can achieve twin goals of reducing water consumption and complying with standards. The feedback and lessons learned from the Pilot Site implementation have informed Deliverable 6.2 – Waternomics Integrated Outcome (Methodology, Software & Data Management and Analysis components). Furthermore, a review of how various pilot sites can use Waternomics to underpin compliance with standards such as those in Table 1 is also considered. An example of this would be an organisation such as NUI Galway by implementing the Waternomics methodology has taken many of the steps necessary to ensure compliance with ISO14046.

The relationships between the Waternomics methodology [1] and related standards (from that initially proposed in Deliverable 2.1) is shown in Figure 1. The overlap with standards is extended here in. The Waternomics methodology can underpin water management measures that feed into compliance with environmental and energy management standards.

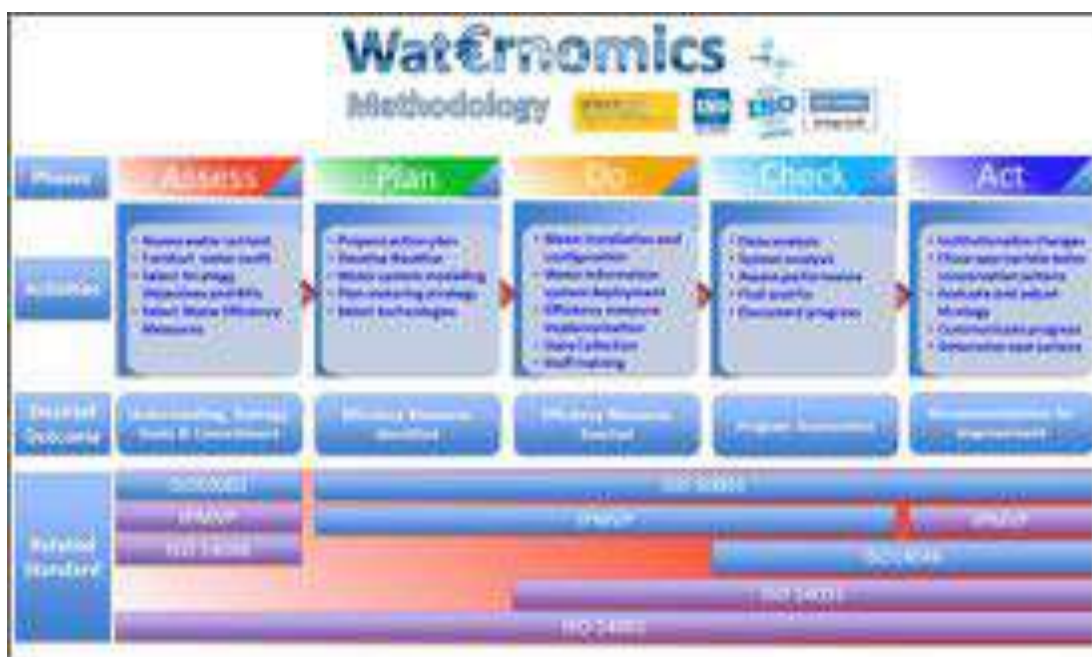


Figure 1 Updated Waternomics methodology - Following implementation of the Waternomics methodology at pilot sites the standards shown in purple have been found to be strongly underpinned by the methodology.

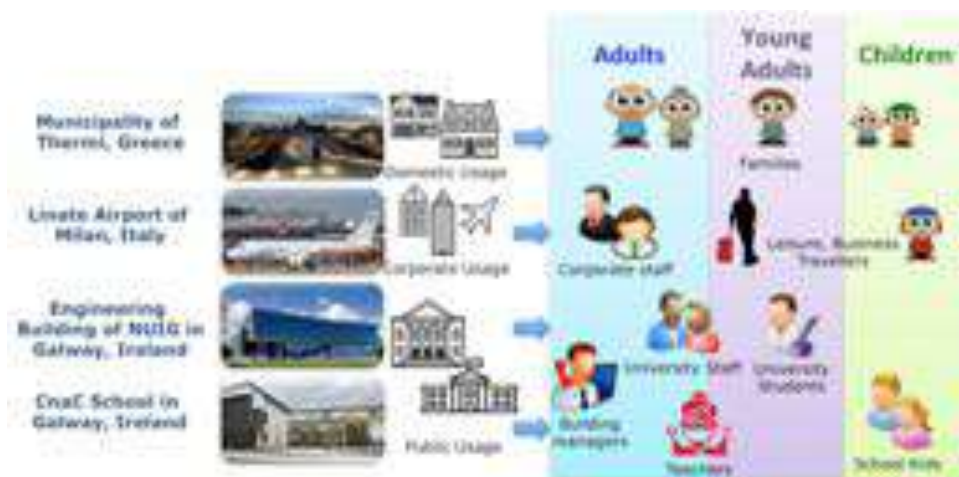


Figure 2 Pilot Sites and target user groups [2]

The work undertaken at the project pilot sites (Figure 2) in implementing the Waternomics Methodology is well aligned with the requirements of many aspects of existing environmental e.g. water aspects of ISO 14001:2015 – Environmental Management Systems (Figure 3)Figure 3)Figure 6, and water footprint assessment for ISO 14046:2014 (Table 2).

2.2.1 Waternomics and ISO 14000 series

ISO 14001:2015 Environmental Management System (EMS) Standard sets out the criteria for an EMS that can be certified. It maps out a framework that a company or organization can follow to set up an effective EMS. Following the Plan-Do-Check-Act cycle, systems accredited to ISO 14001 provide for continued improvement, reducing waste and improving resource efficiency. A company or organisation developing an EMS compliant with ISO 14001 must determine the scope and procedures that will be implemented and these must be clearly defined.

National University of Ireland, Galway is registered for An Taisce's Green Campus Programme, which is based on the EU EMAS (Eco-Management and Auditing System) approach, and the Seven Steps correspond with the criteria of ISO 14001:Standard.

NUI Galway – Green Campus

1. Green Campus Committee
2. Environmental review
3. Action plan
4. Monitoring and Evaluation
5. Curriculum work
6. Informing and involving
7. Green Charter

Currently over 335 companies in Ireland are certified to ISO 14001 National Standards Authority, Ireland. Assessment of water usage and efficiency is a requisite part of any EMS for a university (Green Campus) or other organisation as is the implementation of a sustainable viable water management system and these are aspects that the Waternomics methodology can enable. Another standard that ISO 14001 draws on is ISO 14031 – Environment Performance Evaluation (EPE). ISO 14031 provides guidelines allowing organisations to measure, evaluate and communicate environmental performance using key performance indicators

(KPIs), based on reliable and verifiable information¹. ISO 14031 can be used to support an EMS or used independently. EPE requires continual collection and assessment of data and information to provide current evaluations of performance and to provide evaluation of trends over time. In Waternomics we propose “assess water context” which acts almost as a quick sanity check for comparison with measured data, whereas later we have data analysis and systems analysis which also during the auditing process shows an organization that data needs to be evaluated. Environmental audits also gather this information and can be used with EPE or as part of the EMS to establish if targets are being achieved, ISO 19011 details guidelines on auditing management systems.

ISO 14001:2015

- Context of Organisation
- Leadership
- Planning
- Support
- Operation
- Performance Evaluation (ISO 14031)
- Improvement

Figure 3 shows all of the aspects of ISO 14001:2015 and corresponding steps within the Waternomics methodology that fulfil ISO 14001:2015 requirements with respect to water management.

¹ ISO 14031:2013 Environmental Management – Environmental performance – Guidelines. International Standard Organisation, SAI GLOBAL

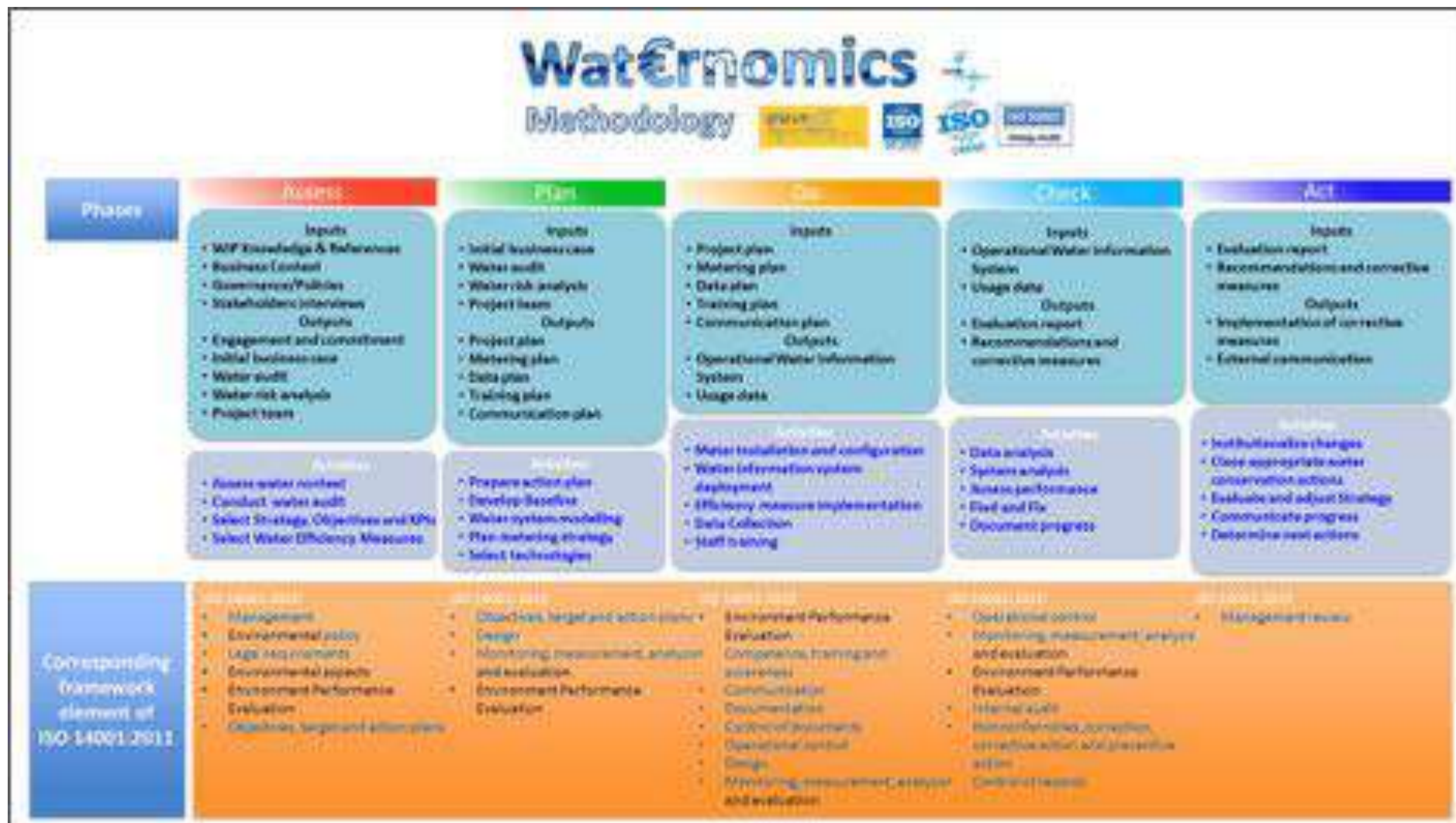


Figure 3 Waternomics methodology and compliance with ISO 14001:2011

2.2.2 Waternomics and ISO 14046:2014

ISO 14046 specifies principles, requirements and guidelines related to water footprint assessments of products, processes and organisations based on life cycle assessment [3]. A water footprint is described as a metric that quantifies the potential environmental impacts related to water, if a complete assessment of all the potential environmental impacts related to water are not addressed then the term ‘water footprint’ can only be used with a qualifier. The qualifier will describe the environmental impact category assessed in the water footprint assessment, for example a ‘water scarcity footprint’.

The water footprint assessment is a compilation and evaluation of the inputs, outputs and the potential environmental impacts related to water used or affected by a product, process or organisation.

A water footprint assessment can be conducted as a stand-alone assessment or as part of a comprehensive life cycle assessment of all environmental impacts. The assessment can be carried out for a particular product, a process, facility or for a whole organisation potentially consisting of a number of facilities. Whichever unit is chosen for water footprint assessment boundaries must be clearly identified in the scope of the assessment, these boundaries specify which unit processes are part of the system being assessed. Examples of various boundary types are shown in Figure 4.

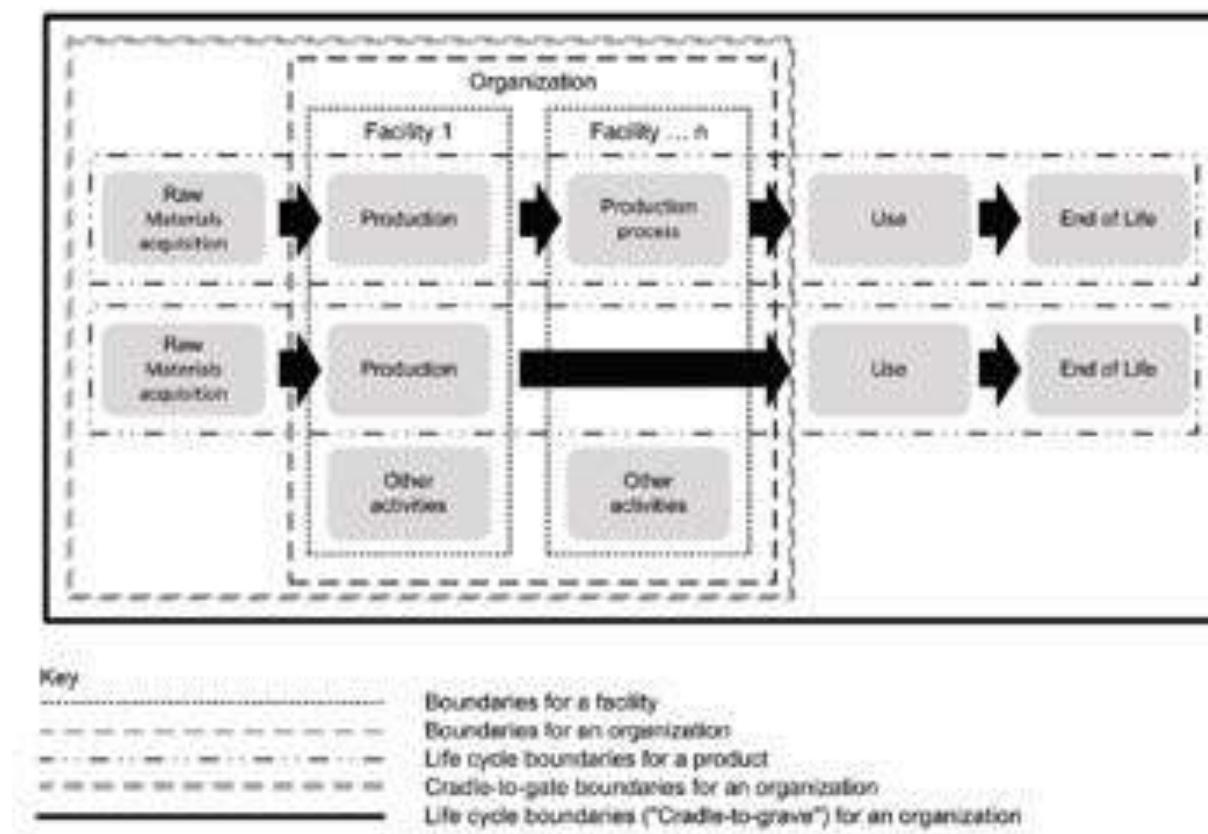


Figure 4 Examples of different system boundaries for water footprint assessment of an organisation (ISO 14046:2014)

The phases of a water footprint assessment are shown in Figure 5; Goal and scope definition, Water footprint inventory analysis, Water footprint impact assessment and Interpretation of results.

Waternomics methodology covers many aspects of the requirements of ISO 14046:2014 for water footprint assessment. The Waternomics methodology could be used to carry out the water footprint inventory study, and the water footprint impact assessment, though some qualifiers will need to be applied as not all potential environmental impacts related to water may be addressed. The ‘water scarcity footprint’ is an obvious assessment that could be carried out utilising the Waternomics methodology,

however for the assessment to fully comply under ISO 14046:2014 emphasis needs to be placed on the environmental impacts of the water consumption of a site.

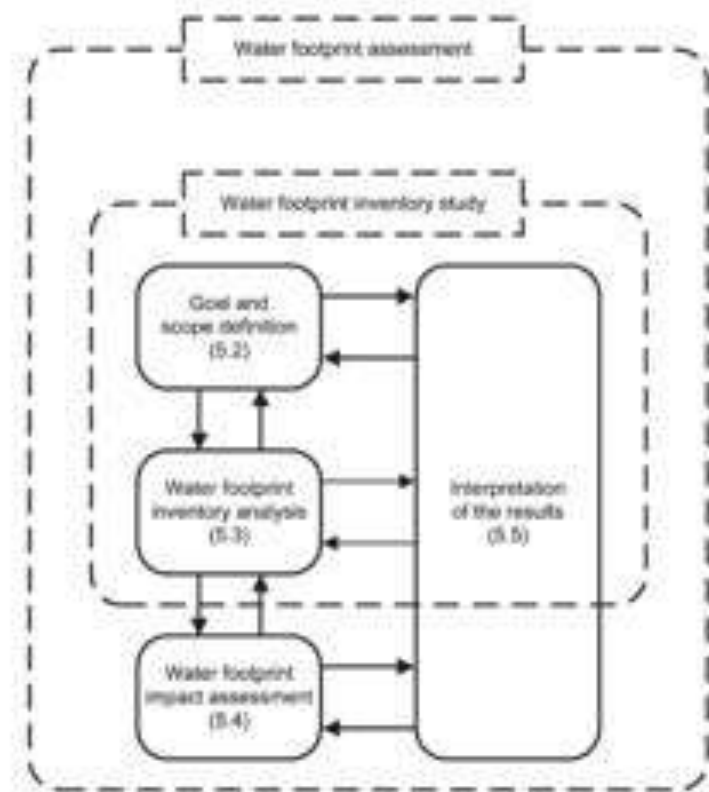


Figure 5 Phases of a water footprint assessment (ISO 14046:2014 [3])

Through the implementation of the Waternomics methodology the pilot sites are fulfilling the requirements of a water footprint assessment. Detailed in Table 2 is an overview of the ways in which the pilot sites in Waternomics are covering the aspects of a water footprint assessment.

Table 2 Steps taken by pilot that comply with ISO 14046:2014

Municipality of Thermi, Greece	Linate Airport of Milan, Italy	Engineering Building, NUI Galway, Ireland	Coláiste Na Coiribe, Galway, Ireland
Goal and scope definition <ul style="list-style-type: none"> Assess water footprint of a municipality Domestic users Household 	Goal and scope definition <ul style="list-style-type: none"> Assess water footprint of an airport Corporate users All Airport activities related to water use 	Goal and scope definition <ul style="list-style-type: none"> Assess water footprint of a university Public users All building activities related to water use 	Goal and scope definition <ul style="list-style-type: none"> Assess water footprint of a school Public users All school activities related to water use

Water footprint inventory analysis <ul style="list-style-type: none"> • Data collection • Description of unit procedures • Data sources • Calculation procedures • Validation of data • Baseline 	Water footprint inventory analysis <ul style="list-style-type: none"> • Data collection • Description of unit procedures • Data sources • Calculation procedures • Validation of data • Baseline 	Water footprint inventory analysis <ul style="list-style-type: none"> • Data collection • Description of unit procedures • Data sources • Calculation procedures • Validation of data • Baseline 	Water footprint inventory analysis <ul style="list-style-type: none"> • Data collection • Description of unit procedures • Data sources • Calculation procedures • Validation of data • Baseline
Water footprint impact assessment <ul style="list-style-type: none"> • Impact assessment • CO₂e • Water Scarcity • Uncertainty 	Water footprint impact assessment <ul style="list-style-type: none"> • Impact assessment • CO₂e • Water Scarcity • Uncertainty 	Water footprint impact assessment <ul style="list-style-type: none"> • Impact assessment • CO₂e • Water Scarcity • Uncertainty <ul style="list-style-type: none"> ○ retention periods 	Water footprint impact assessment <ul style="list-style-type: none"> • Impact assessment • CO₂e • Water Scarcity • Uncertainty
Interpretation of results <ul style="list-style-type: none"> • Results • Conclusions • Assumptions and limitations • Data quality assessment 	Interpretation of results <ul style="list-style-type: none"> • Results • Conclusions • Assumptions and limitations • Data quality assessment 	Interpretation of results <ul style="list-style-type: none"> • Results • Conclusions • Assumptions and limitations • Data quality assessment 	Interpretation of results <ul style="list-style-type: none"> • Results • Conclusions • Assumptions and limitations • Data quality assessment

2.2.3 Waternomics and ISO 50000 series

The Waternomics methodology is closely aligned with ISO 50001:2011 [4] on energy management systems. This standard provides guidelines on establishing an energy management system that assesses energy efficiency, use and consumption within an organisation. The standard addresses requirements applicable to energy use including measurement, documentation and reporting, design and procurement, processes and personnel. The Waternomics methodology applies the fundamentals of the ISO 50001:2011 PDCA method (Plan – Do – Check – Act) to the water management. Following the same framework as ISO 50001:2011 allows the Waternomics methodology to follow a recognised standard methodology which leads it to simultaneously comply with aspects of other ISO standards. The Waternomics and ISO 50001:2011 frameworks are presented in Figure 6 and show the compliance of the Waternomics methodology with the ISO 50001:2011 framework but applied with respect of water as opposed to energy. Currently 14 companies in Ireland are certified to ISO 50001 with the National Standards Authority, Ireland.

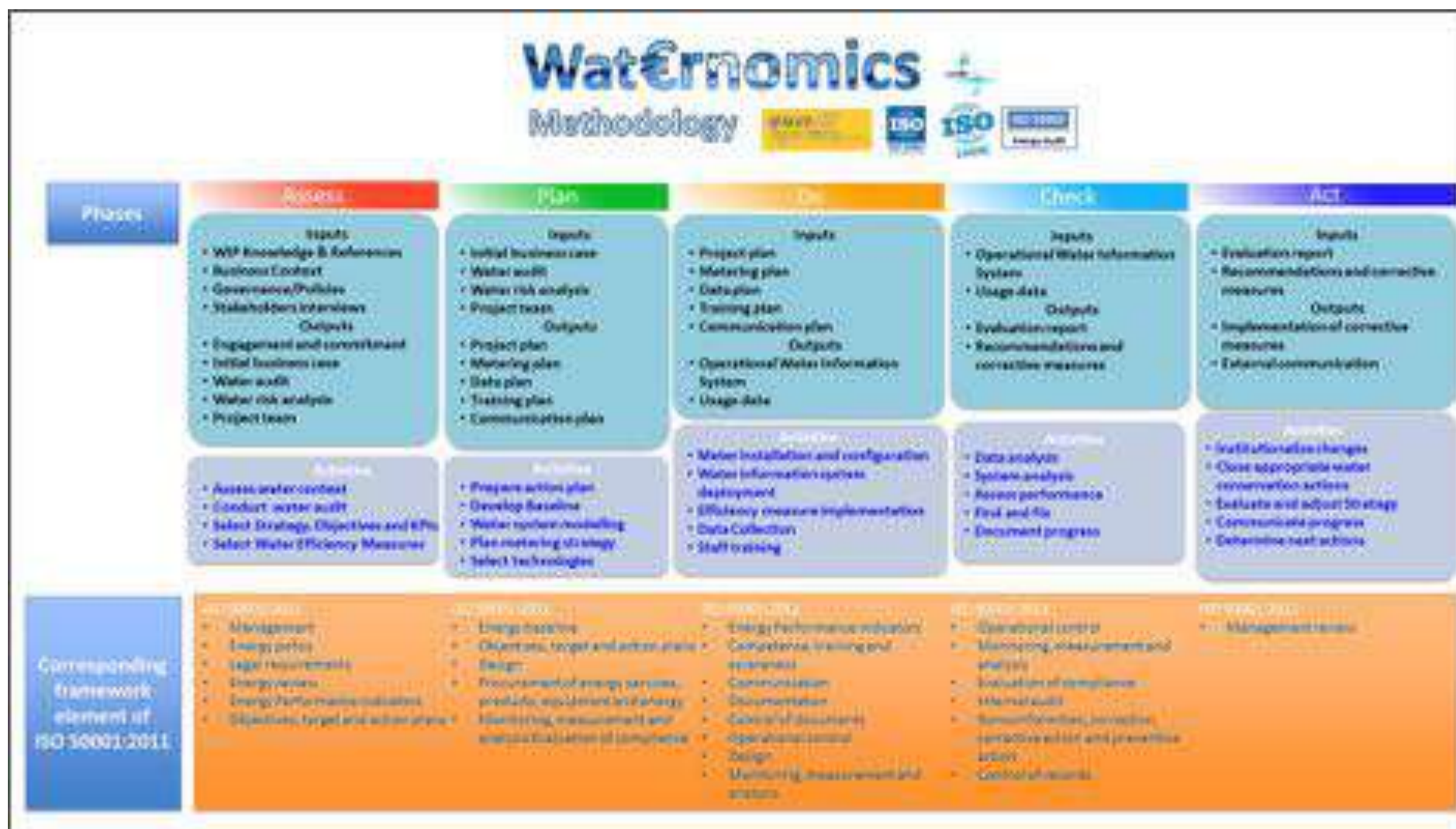


Figure 6 Waternomics methodology and ISO 50001:2011

2.2.4 Waternomics and IPMVP

The International Performance Measurement and Verification Protocol (IPMVP) *Volume 1: Concepts and Options for determining Energy and Water Savings* [5] is a common protocol to verify the energy and water savings reported by organisations due to Energy Conservation Measures (ECMs) and Water Efficiency Measures (WEMS). The main purpose is to increase the certainty and reliability of the level of savings. The protocol is based around a Measurement and Verification Plan (M&V Plan) containing activities listed below:

- meter installation calibration and maintenance
- data gathering and screening
- development of a computation method and acceptable estimates
- computations with measured data
- reporting, quality assurance, and third party verification of reports

IPMVP is not a standard thus there is no formal compliance mechanism.

The Waternomics methodology adheres to the objectives set by IPMVP Volume 1, many of these activities are specified in the Waternomics methodology in phases Assess, Plan, Do, Check and Act, see Figure 6 and Figure 7. The main activities of IPMVP as outlined in the lower portion of Figure 7 are all specifically covered in the Waternomics methodology by activities which are described in Figure 1.

Waternomics methodology makes it easy for organisations to comply with IPMVP if all activities in the Waternomics methodology are followed. The methodology is flexible and can be applied to many different organisational types as highlighted in through the pilot site activities. The methodology provides a clear and practical framework to allow its ease of implementation. Steps and details are explained very clearly in an easy to follow manner cutting out the need for users to probe through protocols and standards.

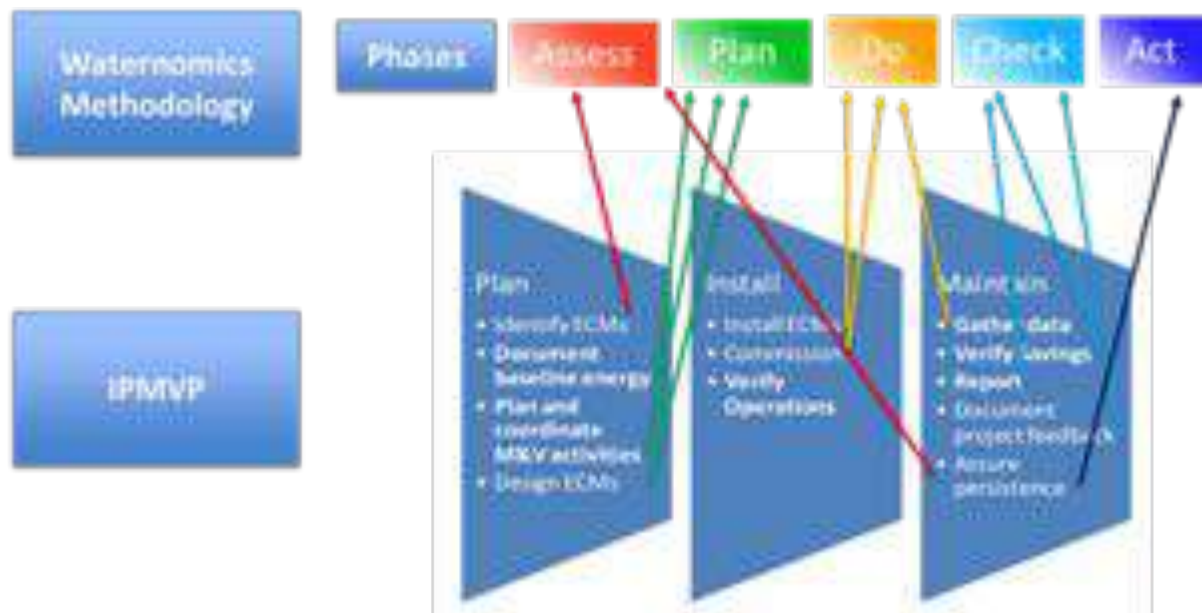


Figure 7 IPMVP – Process timeline and correspondence with Waternomics Methodology

2.3 Building Environmental Assessments

Building environmental assessments and rating methods, are a systematic technique used to assess the extent of resource efficiency of a building as a whole. The rating methods are voluntary and assess the environmental aspects of a building, themes assessed include; site constraints, resource management (including water), transportation, social, economic, and innovation. They are not a legal requirement and

cover many other themes than just energy unlike Building Energy Regulations (BER) & Energy Performance Certificate (EPC), which fulfil the legal requirements of the EU Energy Performance of Buildings Directive (EPBD). There are a number of different building environmental assessment methods created by countries across the globe each taking into account different issues relating to political, economic, social, environmental and technological influences. An area highlighted for change in order to promote the efficient use of water resources is to better manage levels of water consumption in buildings¹.

Many of the methods work on a tariff or credit system with points awarded for attaining specific sustainability indicators, designed to meet national and global target on greenhouse gas emissions. The value applied to water efficiency in each method varies based on geo-climatic, social, political as well as environmental factors. The methods employ a standardised criterion with which buildings can benchmarked and compared against each other.

Building environmental assessments and rating methods are summarised in Table 3.

Table 3 Overview of Building environmental assessments and rating methods

Building Environmental Assessments				
Name	Referred Name	Developer	Focus	Comment
Building Research Establishment Environmental Assessment Methodology	BREEAM	BRE Global, UK	<ul style="list-style-type: none"> • Credits are given for physical fixtures and fittings that reduce water consumption • a credit is also given for the installation of a water meter and for major leak detection system • credits are also available for the reduction in water consumption • places a lot of emphasis on technological solutions – fixtures and fittings 	<ul style="list-style-type: none"> • credit for water meter • emphasis on physical fixtures and fittings
Code for Sustainable Homes	CSH*	BRE Global, UK	<ul style="list-style-type: none"> • Consumption of 80 l/p/d or less is required to reach the highest rating • promotes rainwater recycling. • rewards for reduction in potable water usage through any available means 	<ul style="list-style-type: none"> • promotes reduction in water by any means • low daily allowance
Leadership in Energy and Environmental Design	LEED	Green Building Council, US	<ul style="list-style-type: none"> • Credits are awarded for a reduction in water usage compared to benchmark figures and recommended guidelines • fittings are required to consume 20% less than the baseline • promotes water efficient fixtures • discourages the use of potable water for irrigation 	<ul style="list-style-type: none"> • discourages the use of potable water for irrigation. • emphasis on physical fixtures and fittings
Green Star	Green Star	Green Building Council, Australia	<ul style="list-style-type: none"> • Credits given for the installation of a water meter and effective monitoring mechanism • promotes reduction in potable water consumption 	<ul style="list-style-type: none"> • promotes metering and monitoring alternative water sources • no direct promotion of alternate water sources

*CSH discontinued and to be replaced by the Home Quality Rating by BRE

¹ Kemi Adeyeye. 'Water Efficiency in Buildings'. Wiley Blackwell. 2014

Building Environmental Assessments				
Name	Referred Name	Developer	Focus	Comment
Comprehensive Assessment System for Built Environment Efficiency	CASBEE	IBEC, Japan	<ul style="list-style-type: none"> • rewards based on the number of interventions included rather than for a reduction in water consumption leading to the use of cheap and inefficient water reducing interventions reducing overall sustainability of building long term. 	<ul style="list-style-type: none"> • promotion of conservation measures • emphasis on physical fixtures and fittings
Hong Kong Building Assessment Scheme	HK-BEAM	HKGBC, Hong Kong	<ul style="list-style-type: none"> • water quality survey • water conservation plan • credits for reduction in water consumption • credits for reduction in water used for irrigation or alternative supply for irrigation • water recycling systems • emphasis on reduction of discharge to foul services • water audit, water use inventory 	<ul style="list-style-type: none"> • water recycling systems • water audit, water use inventory • emphasis on physical fixtures and fittings • only allows credit for 10% from rainwater and nothing for additional savings

The schemes listed above reward reduction in water consumption, installation of rainwater harvesting, reduction in potable water consumption for irrigation and the installation of water meters. Some schemes place major emphasis on installing physical fixtures and fittings which can provide significant water savings if implemented correctly however the schemes do not emphasize the need to monitor and assess the correct operation of these conservation measures.

Currently, the assessment methods have less focus on water than on energy efficiency but going forward, such assessment methods may need to be adapted to suit the increasing unpredictability of water availability and provide greater focus on water consumption.

Implementing a Waternomics methodology would improve existing water efficiency ratings within these assessments and thus drive efficient water consumption in buildings, by providing a mechanism for monitoring and measuring water consumption. The need for continual improvement is evident and it is not just enough to install conservation measures but there needs to be an approach to continual water monitoring and improvement.

The promotion and dependence of water reducing technologies in the absence of on-going performance assessment can be problematic as there is little benefit to an installed water consumption reducing technology that is not working correctly.

At the NUIG Engineering Building Pilot site, NUI Galway, see Figure 2-8, the application of the Waternomics methodology helped to identify the issues surrounding a malfunctioning rainwater harvesting system and the relevant management and maintenance personnel have been notified. The manager's dashboard application of the Waternomics Platform allows for simple fault detection and diagnosis by alerting managers of anomalies in water usage as they occur. (A rule based FDD system developed as part of Waternomics was tested and validated using this known fault in the rainwater harvesting

system at the Engineering Building.

Pilot Site – NUI Galway

- Rainwater harvesting system installed – 75m³ storage tank
- Rainwater harvesting system has been out of operation since 2013
- Major water wastage
- No enforcement to trigger timely repair
- Identified need for continual robust monitoring and for continual assessment to encourage find and fix practices

Figure 2-8 Pilot site observation

2.4 Identification of Gaps in Current Standards

This section identifies gaps in current standards relating to water management that the Waternomics methodology addresses. It also highlights key areas to be addressed by any proposed water management system (e.g. data integrity etc.) that existing standards may not fully examine.

At the highest level, there is no specific international standard for water management systems and although, water management may be considered as part of wider energy and environmental management systems, this is insufficient. The management of water usage is closely related to energy management, as water and energy are two highly related resources and require similar methods of metering to analysis usage, both are a user controlled resource and water can be wasted in a similar manner to energy wastage (e.g. user leaves tap running/user leaves lights on), the two resources are also subject to tariffs, however such tariffs and tariff structures are less consistent in the water sector than in energy. The water sector may benefit from the experience and practices of the energy sector in terms of management (measuring, monitoring, analysing and evaluating) and also in terms of pricing structure.

There are however differences in terms of technical infrastructures between energy and water sectors and these may present various challenges (e.g. a water meter and an energy meter), water is also subject to environmental compliance regulation and health regulations unlike the energy sector.

ISO 50001:2011 highlights the use of ‘data which is accurate and repeatable’ and ISO 14001:2015 identifies the need for an organisation to determine the methods for monitoring, measurement, analysis and evaluation to ensure valid results. A robust methodology for accomplishing these fundamentals is necessary. The area of data integrity presented a number of difficulties during the early pilot phase of Waternomics in particular;

- Data collection, data screening
- Robustness of data collection system/processes
- Accuracy of data – calibration and validation of sensors

These are areas highlighted in the Waternomics methodology with activities and actions concerning them detailed, however through the pilot phase implementation these issues have been the cause of issues and delays. It is recommended that the activity of data verification become a separate activity placed within the ‘Do’ phase of the Waternomics methodology.

Gaps in building environmental assessment methods are also highlighted in the section above, with the focus clearly on installation of fixtures and fittings in the absence of adequate monitoring and continual improvement mechanisms in place.

2.5 Water Usage Presentation

The section makes recommendation for the standardisation of presentation of water use across users: households, public buildings, business organisations (pilot sites). Similar to the energy sector where consumers can compare typical annual costs and choose an energy provider based on energy usage e.g. day/night rates to reduce costs. The same ideology can be applied to the water sector for the comparison of typical annual costs for an average family/set of people so they can better choose a water provider or tariff option based on water needs. Emphasis would be placed on water availability and the dynamic pricing structure options depending on peak usage and water availability. Much like the energy sector water could be priced cheaper at night when there is very low usage, to encourage water heavy activities to be carried out over night or for water to be stored in homes/buildings to free up space in the treated reservoirs. This would allow for water to be treated throughout the night at the treatment plant ready for peak morning usage, there will also be less demand in the mornings due to overnight usage and storage. Reduced electricity costs could be obtained at water treatment plants if they avail of a cheaper night rate electricity tariff.

Water tariffs are currently a highly debated issue in many countries. A pricing structure that suits consumers and utilities will be forefront on this debate for many years to come. Strides have been made in many EU countries to charge for water based on consumption.

However, consumers need to be presented with tariff options that are easily understandable and applicable to their water use. A number of tariff options should be available giving people options of a flat rate or allowing them to make greater savings if water is used conservatively but potentially penalise heavily if usage is over a certain threshold. This incentivises consumers to monitor and conserve water usage.

Average water use of people, e.g. family of 4, single person could be presented in an easily understandable form to allow quick assessment of personal agreement with average users from similar households or organisations.

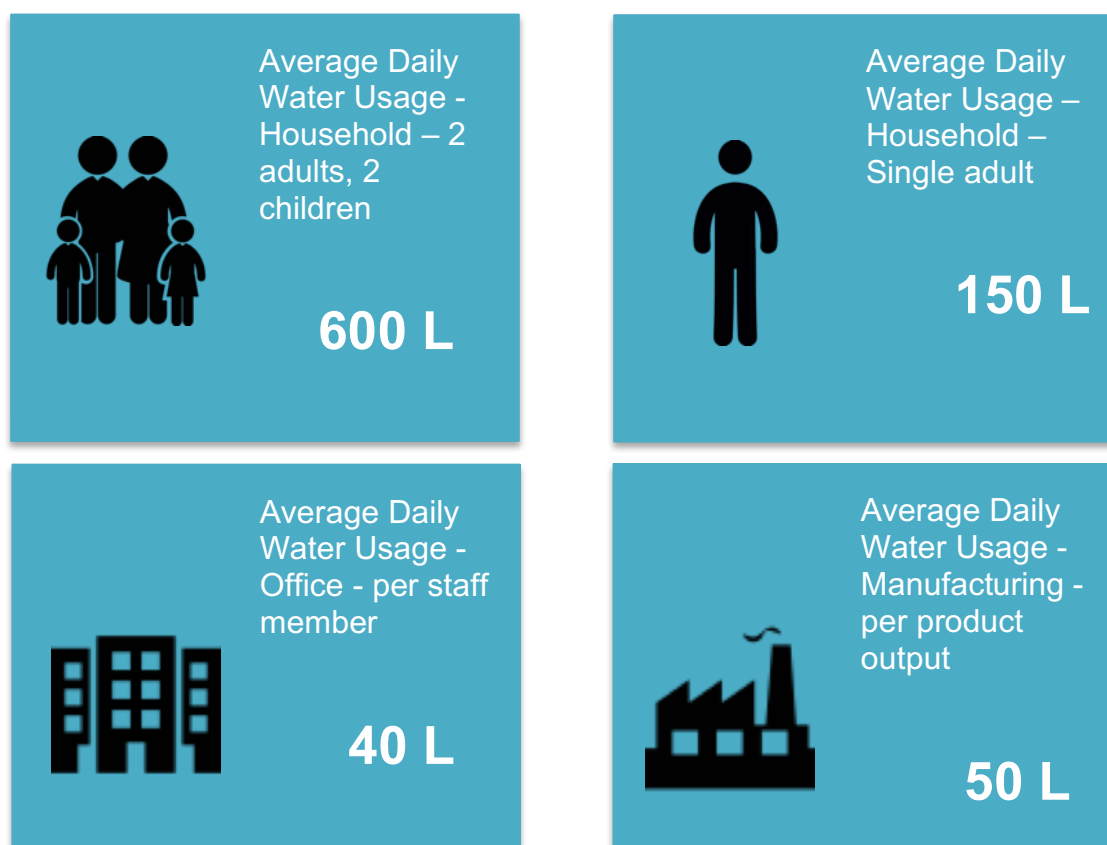


Figure 9 Examples of comparative understandable water consumption

Households would be dependent on the number of people living in the house taking into consideration adults and children, Offices dependent on whether they were a standard type with toilets and kitchen only or also provided shower facilities, with water use presented based on staff numbers. Public buildings should be treated similarly to offices (number of occupants) but may have added facilities e.g. laboratories (University/School) and highly dependent on occupancy hours. Manufacturing industries water footprint assessed based on product output.

There is a need for comparative studies across sectors to assess water usage. The water footprint standard goes some way to achieve this but for the comparison of a product or organisation sufficient equivalence of the organisations must be met.

The water flavours metaphors application on the Waternomics Platform shown in Figure 10 presents metaphors to convert quantities of water into other indicators such as price of water and water footprints. The applications also show the CO₂ equivalent values displayed beside the water volume on the platform for user to see the environmental significance of their water usage.



Figure 10 Water flavours metaphors



Figure 11 CO₂e visual

2.6 Reporting frameworks and standards

Environmental reporting by companies became commonplace in the 1980's when companies in the chemical industry, faced with potential reputational damage, began to report environmental performance, measures and impact. More recently, some companies now produce sustainability reports next to their annual financial reports. Such actions to improve green credentials is driven by a need for increased transparency and accountability towards stakeholders. Due to the effects of climate change and population growth, there is an increasing awareness that availability of resources like water, is not secure into the future and this poses a risk for business. Investors recognise that information about natural capital and financial capital is equally essential for an understanding of corporate performance.

Sustainability reporting

Sustainability reporting is voluntarily for companies and as a result, a variety of reporting frameworks have been developed. This section provides an overview of some of these reporting frameworks that have been developed by various groups of stakeholders.

Five frameworks that originated from industry initiatives are described in brief. All frameworks adopt a holistic approach and cover environmental policies, strategy, governance, risks, business model and value chain.

Global Reporting Initiative (GRI)



The most well-known reporting framework for companies is the Global Reporting Initiative (GRI) first published in 2000. GRI primarily focuses on sustainability reporting and develops and publishes the GRI Guidelines which help organisations with measuring and reporting their most critical impacts on the environment, society and economy. The GRI Guidelines focuses on Materials and Boundaries where Materials are issues that are significant to a business' economic, environmental and social impacts and that substantively influence the assessments and decisions of its stakeholders. The Boundary describes whether the impact lies inside or outside the organisation. As such, an organisation is also expected to report on Materials in other parts of the value chain.

The GRI Guidelines includes the following water related indicators:

G4-EN8: Total water withdrawal by source

G4-EN9: Water sources significantly affected by withdrawal of water

G4-EN10: Percentage and total volume of water recycled and reused

G4-EN22: Total water discharge by quality and destination

G4-EN26: Identity, size, protected status, and biodiversity value of water bodies and related habitats significantly affected by the organization's discharge of water and runoff

CEO Water Mandate – Corporate Water Disclosure Guidelines.



The CEO Water Mandate is a special initiative of the UN Secretary-General and the UN Global Compact. Their goal is to mobilise business leaders and offer them a platform to share best practices, which are assembled in the Water Stewardship Toolbox. The CEO Water Mandate builds upon GRI and adopts the same five core indicators as mentioned above. They make a distinction between different levels of reporting for different industry sectors depending on their exposure to water related risks.

Climate Disclosure Standards Board (CDSB)



The Climate Disclosure Standards Board (CDSB) is an international consortium of business and environmental NGOs who developed a framework for reporting environmental information. The CDSB framework contains Guiding Principles and Reporting Requirements which help companies with reporting their impact on environment. CDSB does not prescribe specific KPI's. Reporting topics related to water are water use and consumption, emissions to water, disclosure of regulatory risks including water standards and disclosure of physical risks like changes in

water availability and quality and rising sea levels.

While the above-mentioned frameworks focus on providing supplementary reports in addition to financial reporting, two initiatives are developing frameworks for integrated reporting, being the IIRC and SASB.

International Integrated Reporting Council (IIRC) Integrated Reporting <IR>



IIRC developed an integrated reporting framework, called <IR>. According to their website, "<IR> is enhancing the way organizations think, plan and report the story of their business." <IR> is considered the next step in corporate reporting by taking not only financial information into account but also include relevant non-financial information in an integrated report. IIRC specifically focuses on providers of capital and

their need for information that covers the full range of factors that materially affect the ability of an organization to create value over time. <IR> doesn't prescribe specific metrics or KPI's. Water is considered natural capital and an organization needs to report about any natural capital if considered relevant by the organization.



Sustainability Accounting Standards Board (SASB)

SASB's mission is "to develop and disseminate sustainability accounting standards that help public corporations disclose material, decision-useful information to investors." Similar to <IR>, SASB focuses on investors and other providers of capital with the goal to provide them with more non-financial information which improves their decisions to invest in a specific company or not. Water is covered in

“Environment”, one of the five sustainability dimensions. The approach of SASB is to develop industry specific reporting standards. Each industry standard contains a limited set of detailed metrics. From the three researched transportation standards, Airlines, Marine and Rail, only the Marine industry standard includes water related metrics.

Also, the accountancy sector is developing sustainability reporting standards. The two most well-known are AA1000AS and ISAE3000. In short, ISAE3000 provides rigorous procedural guidance for undertaking an assurance engagement whereas in AA1000AS the emphasis lies on the relevance of the reported information for stakeholders. Both assurance standards are briefly explained below.

Accountability - AA1000AS/APS/SES

Accountability first launched the AA1000-series of accounting standards in 2003. The standards are principles-based and help organisations become more accountable, responsible and sustainable. Focus is on the assurance process and the standard does not prescribe specific KPI's. AA1000AS includes two levels of assurance, high assurance and moderate assurance.

International Federation of Accountants (IFAC) - ISAE3000

IFAC launched the International Standards on Assurance Engagements (ISAE3000), which professional accounting networks have to be compliant with. ISAE3000 focuses on processes and procedures and makes no mention of specific KPI's. The word “water” is not in the standard.

Authorities and NGO's also have reporting frameworks and some of these are described below.



United Nations - System of Environmental and Economic Accounts for Water (SEEA-Water)

The SEEA-Water framework is an elaboration of the Handbook of National Accounting: Integrated Environmental and Economic Accounting, commonly referred to as SEEA-2003, which describes the interaction between the economy and the environment and covers the whole spectrum of natural resources and the environment. The SEEA-Water conceptual framework is a set of standard tables focusing on hydrological and economic information and includes a set of supplementary tables covering information on social aspects. The standard tables constitute the minimum data set that all countries are encouraged to compile.

Water related data to be collected includes:

- Physical use and physical supply, split by industry sectors and households
- Emissions
- Hybrid supply and sewerage
- National expenditures account
- Financing and asset account



European Union - Water Framework Directive (WFD)

The Water Framework Directive (WFD) introduces economic principles and methods for the management of Europe's waters. WFD adopts the model of managing water by river basin - the natural geographical and hydrological unit. WFD describes two reporting levels: Water Body level and River Basin district or sub-unit level. Key objective is the general protection of the quality of water with respect to aquatic ecology, special habitats, drinking water resources and bathing water. The directive is accompanied with an implementation guide, providing guidelines for member states on how to plan and conduct the economic analysis, and guidelines for reporting which provides guidance to member states on how to

report the aspects of WFD to the European Commission. Tables, structures and standards for electronic reporting are provided. WFD reporting obligations regards to economic analysis are split in the following four components:

1. Characterisation and trend analysis; Economic importance of water uses
2. Economic analysis for selecting measures; Cost and benefits of measures
3. Assessing cost recovery and pricing; Cost recovery for water services, social, economic and environmental impact for justifying proposed cost recovery.
4. Key assumptions and information use; Quality and uncertainty of information used, proposed data collection.

European Water Stewardship (EWS) Standard

The EWS Standard aims to give indicators for the whole water cycle: from extraction to re-allocation. The main aim is to map, grade and evaluate water management based on redesign, reuse, recycle and re-allocate measures. The European Water Stewardship has been developed within the stakeholder process coordinated by the European Water Partnership (EWP). The European Water Stewardship (EWS) operates within the context of EU Policy and will ultimately contribute to the current flagship activities of the European Commission to achieve “Resource Efficiency” and to follow the “European Blueprint”.

Finally, various countries have developed their own country specific reporting standards. Here, the role of water in reporting frameworks from the UK, Australia and the US is being described.

UK - Environmental Reporting Guidelines: Including mandatory greenhouse gas emissions reporting guidance



The Department for Environment, Food and Rural Affairs (DEFRA) has developed the Environmental Reporting Guidelines, helping quoted companies with becoming compliant with greenhouse gas reporting and help companies with implementing voluntary reporting on a wide range of other environmental matters, including water, waste, emissions and resource efficiency. DEFRA describes a five-step process for reporting on key environmental impacts and seven actions for the

development of an environmental strategy. DEFRA describes how to measure and report impact of water use in direct operations and the supply chain.

Water use reporting topics:

- Source of supply (abstracted, supplied, harvested, mix)
- Wastewater (re-use, recycle, return to source, discharge to sewer)
- % of direct operations in water scarce regions
- Total water usage (m3 annual)
- Direct abstraction (m3 per annum)
- Water returned to source (m3 per annum)
- Harvesting/use of rain water
- Investments in water efficiency measures
- Supply chain: % of supply chain located in regions vulnerable to droughts, floods or pollution

AU - Australian Water Accounting Standard 1 (AWAS1)



In Australia, the Water Accounting Standards Board (WASB) as part of the Bureau of Meteorology, has developed and published the Australian Water Accounting Standard (AWAS1). Their objective is to general purpose water accounting reports which enable comparison of water reports of a single entity over time and between reporting entities. The AWAS1 general purpose report contains five reporting elements, being:

1. Water assets
2. Water liabilities
3. Net water assets
4. Changes in water assets
5. Changes in water liabilities

The standard includes 185 principles, describing the general features, structure and content and assurance of a general-purpose water accounting report.

US – EPA Sustainability Indicators

The Environmental Protection Agency (EPA) in the US is currently developing a framework for the establishment of sustainability objectives, goals, indicators, and metrics as a basis for evaluating and reporting of the agency's progress. EPA's Office of Research and Development has collected and stored sustainability indicators from different organisations worldwide (DOSII database) and argues that selecting the appropriate set of sustainability indicators depends on the perspective of the various stakeholder groups and interested parties. Also, different spatial scales demand different sets of sustainability indicators.

2.7 Conclusions

Recommendations regarding updating of existing standards in respect of water management systems, water auditing and water foot printing are outlined above in Section 2.2.

The Waternomics Methodology addresses key aspects in terms of implementing a sustainable water management system that are wholly consistent with the efforts of organisations to achieve current certifiable environmental performance standards. The lack of specific focus on water management in current standards is highlighted in the preceding section and the potential role of the Waternomics methodology in providing a basis for future revised standards identified.

There is currently no standard that deals specifically with water management within organisations. Although many aspects of current environmental standards relate to energy management which has a correlation with water d however there are some instances when it is not appropriate to use energy management techniques alone. With greater emphasis being placed on water conservation and the responsible use of water, the need for a specific management system that deals with water monitoring and conservation is likely to continue grow.

3. Dissemination Strategy

To disseminate the project results in the best possible manner, Waternomics implements a multi-channel and multi-audience approach. We adopted a 3-phased dissemination approach that includes:

1. *Planning* of a dissemination strategy,
2. *Execution* of the dissemination strategy, and
- 3. *Sustainability* of the dissemination activities.

The first step includes the definition of the overall dissemination strategy, identifying the objectives, target audiences, and channels for dissemination. This phase took place in the first 3 months of the project (Feb 2014 – April 2014).

The second phase includes the dissemination activities based on the strategy created in the first phase, and using the channels already setup. This phase takes place during the entire duration of the project with a stronger intensity from month 6 until the end of the project (June 2014 – January 2017).

Finally, the third phase will focus on the sustainability of Waternomics dissemination activities. This phase takes place in the last 12 months of the project (Feb 2016 – January 2017), with a special attention to standardization, training and the exploitable project results.

The dissemination strategy of Waternomics described in this deliverable has been updated continuously as the project advances in order to address emerging challenges and opportunities, thus guaranteeing a successful dissemination during the time of the project and sustainability after the end of the project.

3.1 Planning

The WATERNOMICS's dissemination strategy amounts to (i) circumscribing the target audience of WATERNOMICS, (ii) understanding its particular needs, (iii) specifying the goals and objectives of this dissemination, (iv) introducing impact indicators that quantify the success of the dissemination, (v) determining dissemination tools and assigning impact factors to them as well and (vi) mapping these dissemination tools to different target groups.



Figure 12 – Dissemination strategy

The dissemination strategy of WATERNOMICS defines the organization profile and the methodology required to reach the target audience, considering the purpose, expectations and key arguments.

3.1.1 Target Stakeholders

At the start of the project, some initial stakeholders were identified for dissemination of Waternomics results based on the subjects where the project was expected to advance the state of the art. This is based initially on the DOW and has been updated in the duration of the project, as well as populated by specific groups, organisations and individuals as and when they were identified. Target stakeholders have been split into five groups, as shown in Figure 13, being policy makers, water industry, consumers, pilot partners and the scientific community.

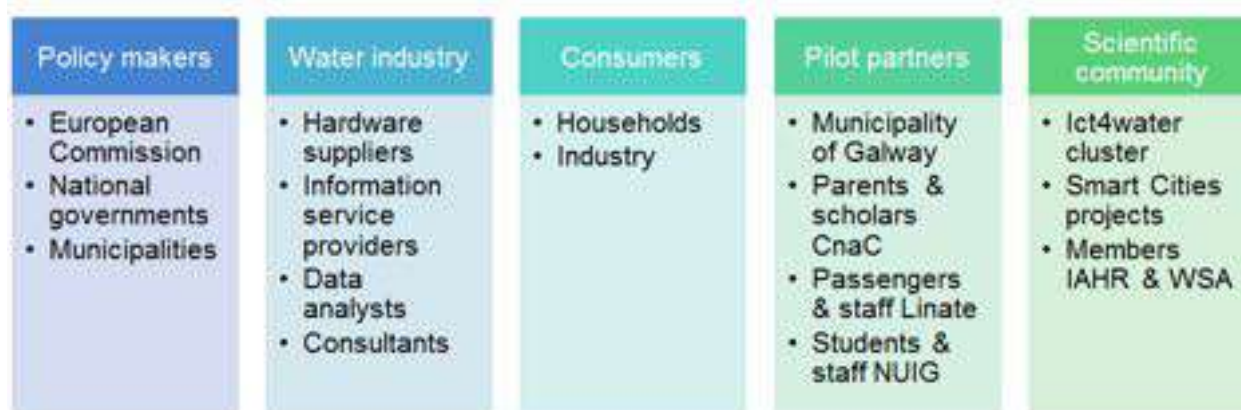


Figure 13 – Waternomics target audience

Each stakeholders segment has a specific need or interest. Table 4 shows the stakeholder interests in relation to the Waternomics project.

Table 4 – Stakeholder interests

No.	Stakeholder segment	Interest
1	Policy makers	Evidence based solutions for societal and environmental issues, economic growth and job creation.
2	Water industry	New technologies, products or services that can enhance or improve their operations. Case studies.
3	Consumers	Access to sufficient and affordable drinking water. Reduction of carbon footprint. Case studies.
4	Pilot partners	Ideas for solutions for environmental, organisational and/or economic issues.
5	Scientific community	Sharing of research results. New technologies, models and theories. Validated research. Applied research.

3.1.2 Dissemination channels

Table 5 shows the available dissemination channels and their target audience and objectives.

Table 5 – Waternomics dissemination channels

Channel	Target audience	Objective
Project website	Water industry, scientific community, water consumers	Increase brand awareness, share key ideas and research results
Blog	Water industry, scientific community, water consumers	Share key ideas and research results
Electronic newsletter	Water industry, scientific community	Share research results, attract stakeholders
Workshops	Pilot stakeholders, policy makers	Validate research results, business validation
Presentations	Scientific community, policy makers	Share research results
Publications	Policy makers, scientific community, water industry	Share research results
Ict4water website	Scientific community	Sharing of research results, collaboration research projects

Stakeholder meetings	Policy makers	Shape smart water agenda
Flyer	Water industry, scientific community	Increase brand awareness
Training activities	Pilot stakeholders	Knowledge transfer, increase smart water awareness
Social media (Flipboard, Slideshare, Twitter, YouTube)	Water consumers, water industry	Increase impact research results, increase awareness hydroinformatics

3.2 Execution

Table 6 presents the dissemination plan containing details about the dissemination campaigns in Waternomics in terms of which audience they will target, what will be the main topics and focus, and how they will be implemented with respect to particular channels and activities.

Table 6 – Dissemination plan

No.	Campaign	Target audience	Goal	Channel(s)
1	Waternomics Kick-off (M1-M12)	Scientific community, water industry	Increase visibility of Waternomics project	<ul style="list-style-type: none"> • Waternomics website • Social media • Ict4water cluster • Papers on scientific conferences • Flyer
2	Waternomics policies (M6-M36)	Policy makers	Share ideas	<ul style="list-style-type: none"> • Roundtable sessions • Demonstration
3	Linate pilot (M18-M30)	Pilot stakeholders	Share Linate pilot results, increase water awareness	<ul style="list-style-type: none"> • Workshops • Training • Public display
4	Thermi pilot (M18-M30)	Pilot stakeholders	Share Thermi pilot results, increase water awareness	<ul style="list-style-type: none"> • Workshops • Training sessions
5	NUIG pilot (M18-M30)	Pilot stakeholders	Share NUIG NEB pilot results, educate in water management	<ul style="list-style-type: none"> • Workshops • Training sessions • Hackathon
6	CnaC pilot (M18-M30)	Pilot stakeholders	Share CnaC pilot results, increase water awareness	<ul style="list-style-type: none"> • Presentations • Training sessions • Hackathon • Public display
7	Waternomics exploitation (M24 - M36)	Water industry, water consumers	Share exploitable results, validate business models	<ul style="list-style-type: none"> • Presentation • Publications • Demonstrations • Interviews
8	Waternomics for scientists (M13 – M36)	Scientific community	Share scientific results	<ul style="list-style-type: none"> • Publications • Presentations • Newsletter • Website • Blog • Ict4water cluster
9	Waternomics results (M30- M36)	Scientific community, water industry, water consumers	Share final project results	<ul style="list-style-type: none"> • Website • Blog • Newsletter • Workshop • Presentations • Publications • Ict4water cluster • Social media

3.3 Sustainability

Dissemination in the final year of the project is covered by the “Waternomics Exploitation”-campaign and will focus on impactful results and the support of sustainable use of project results. Examples of impactful results are: solutions to a problem, facts and data, tools and methods, recommendations and guidelines. The following table lists the expected and available results, origin from the work leading to the official deliverables.

Table 7 – Sustainable project results

Result	Nature	Specific target audience
Linate pilot results	Case study, lessons learned	Airport operators
Thermi pilot results	Case study, lessons learned	Municipalities
NUIG NEB pilot results	Case study, lessons learned	Universities
CnaC pilot results	Case study, lessons learned	Schools
Flow Data Analyser	Low cost tool	Process industry
Acoustic Leakage Detector	Solution	Research projects
Fault Detection Diagnosis Rules	Method	Real estate owners
Water Application Market	Solution	Water utilities, municipalities
Waternomics Methodology	Method, guidelines	Consultancy agencies
Water Management Training	Training	Universities, schools
Drought Monitoring System	Tool	Municipalities

Next to that, scientific results will be transferred to the ict4water cluster, who will ensure continuous public availability of research results from all member projects.

4. Dissemination Material and Online Presence

4.1 Brochures and Posters

Brochures and Posters made for disseminating Waternomics key ideas have been designed at an early stage of project. Multiple updates have been carried out for including new ideas.

The brochure describes the key ideas in a generic way, avoiding jargon where possible. Target audience for the brochure is twofold:

1. The Waternomics project members. To create a coherent message, the brochure guides project team members in their communication with external stakeholders. By capturing the key ideas and by making them explicit in a brochure, project partners are encouraged to exchange information and spread the ideas and results of the Waternomics project. Furthermore, this brochure will provide guidance in developing the key and supporting messages for specific communication activities, e.g. for specific project results or project milestones.
2. External stakeholders involved in the four pilots. With the brochure, pilot stakeholders like senior managers, water managers, policy makers and other decision makers will be informed about the rationale behind the Waternomics project. The brochure is deliberately designed in such a way that is visually appealing and easy to read and aims to inspire its readers to investigate and implement water efficiency measures in their immediate environment.

In the same format, two additional brochures have been prepared, being the “Waternomics Methodology”-brochure (D6.1) and the “Waternomics Results and Impact”-brochure.

The poster shows the global water challenge and Waternomics’ idea of how information technology could contribute to resolving this challenge. The poster is targeted at the end-users of the four pilots and the general public in the immediate area around the pilots. The goal of the poster is to raise awareness about the global drinking water problem and to show how technology can be used in resolving this problem. The poster invites the interested reader to obtain further information about the pilot, Waternomics or the ICT4Water cluster by displaying the QR-code and links to the websites.

Deliverable D7.2 reported on these dissemination materials, Appendixes A & B show examples of the brochures and posters.

4.2 Project Website

In order to facilitate Waternomics project dissemination the project has produced a public project website with a description of the project. The Waternomics website was designed and written by NUIG and supported by each partner with feedback and content.

The project website has been updated regularly to include more content and reach an attractive design. The address of the website is www.waternomics.eu.

Regular monitoring of the website visitors’ statistics has always been an active task in this Work package. Current statistics of the website are shown in Figure 14 and more details are included in Appendix C.

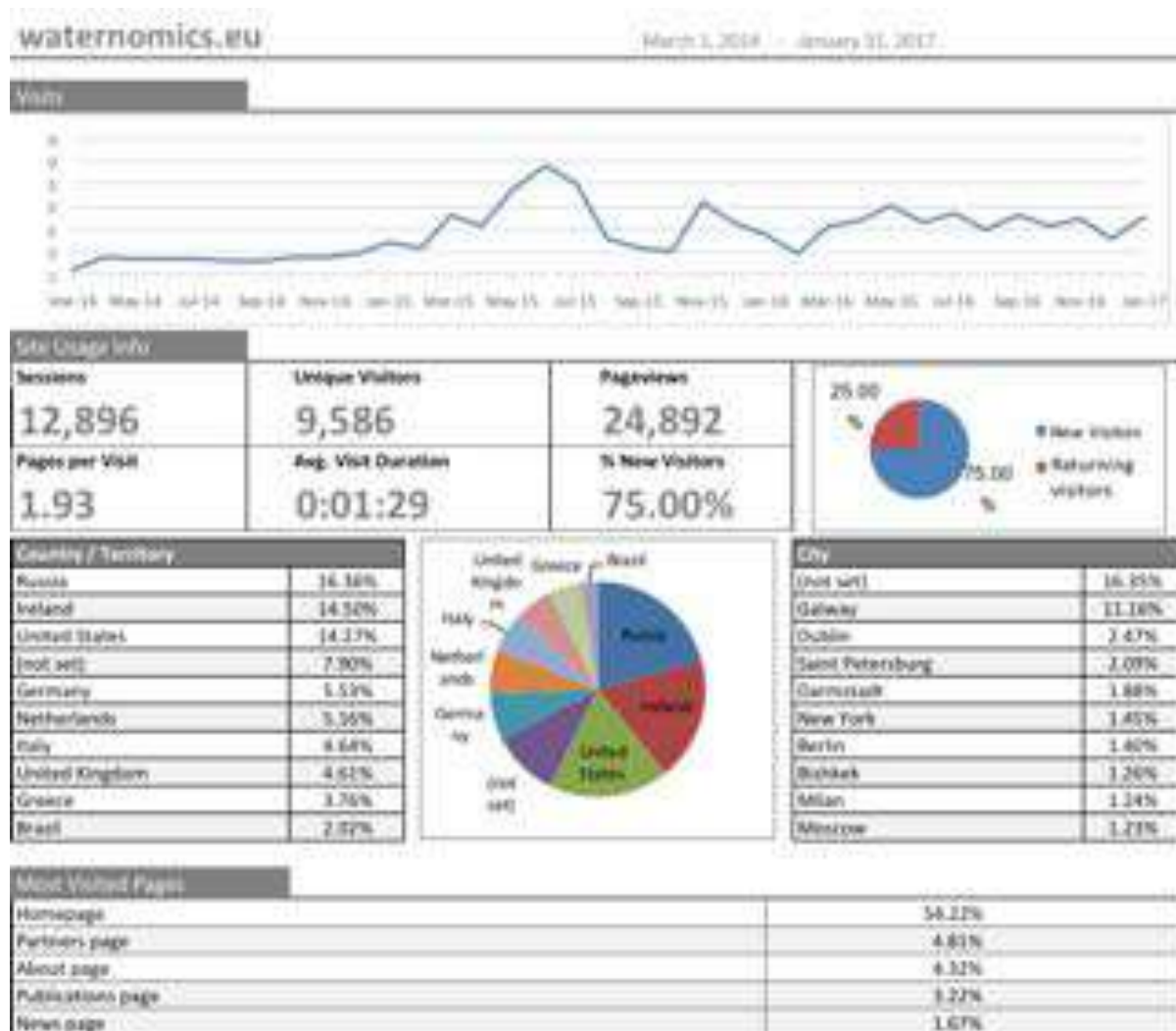


Figure 14: Usage statistics of Waternomics.eu from March 1, 2014 to January 31, 2017

4.3 Twitter Account

Twitter(@wateronomics_eu)

Status per 05-02-17: Tweets: 632, Followers: 649, Following: 945

4.4 Slideshare

(Status per 05-02-2017)

Table 8 – Presentations on Waternomics slideshare account

Presentation	Date	Views	Downloads
1 Waternomics – ICT for Water Resource Management	Nov 2014	788	19
2 Interactive water services – the Waternomics approach	Aug 2014	422	6
3 Waternomics project overview	Apr 2014	398	5
4 Daniel Coakley waternomics iirc	Nov 2014	214	2
5 Waternomics – Development of a Water Information Platform	Nov 2014	591	4
6 The impact of ICT on a water utilities business model	Jun 2015	730	50
7 Business drivers for adopting smart water technology	Jul 2015	672	2
8 WATERNOMICS: Serving diverse user needs under a single water information platform	Jul 2015	584	2
9 Low cost sensors for collecting water data	Jul 2015	599	50
10 Waternomics project overview for EIP Water Conference	Feb 2016	573	1
11 Open Day Thermi – Project overview and methodology (Greece)	Oct 2016	124	1
12 Open Day Thermi – Results Thermi domestic pilot	Oct 2016	193	1
13 Open Day Thermi – Results Linate airport pilot	Oct 2016	133	1

14	Open Day Thermi – Results CNAC and NEB pilot	Oct 2016	150	1
15	Waternomics Smart Water Management	Nov 2016	47	1
16	Waternomics – ICT for water resource management	Nov 2016	42	1
17	Waternomics Flyer – ICT for water resource management	Nov 2016	47	1
18	Waternomics methodology	Nov 2016	52	1
19	Waternomics banner 1	Nov 2016	49	0
20	Waternomics banner 2	Nov 2016	48	0
21	Waternomics – Water Information Platform	Nov 2016	167	3
22	Research Toolbox	Nov 2016	87	3
23	Water usage visualization	Nov 2016	40	0
24	Making your very own android apps	Nov 2016	38	0
25	Automated leak detection	Nov 2016	103	0
26	Business value of a smart water system (EUW)	Nov 2016	168	0
27	Waternomics Applications Platform 1-pager	Jan 2017	45	0
28	Waternomics Methodology Design Sustainable Buildings	Jan 2017	18	0
29	Waternomics Model based FDD 1-pager	Jan 2017	35	0
30	Waternomics Results & Impact	Jan 2017	53	0
31	Waternomics: Making sense of water data	Jan 2017	25	0
32	Final event: Welcome and project overview	Jan 2017	46	0
33	Key impacts for smart water management	Jan 2017	54	0
34	Water conservation in Galway City	Jan 2017	37	0
35	Waternomics Applications Platform	Jan 2017	35	0
36	Waternomics Methodology overview	Jan 2017	49	0
37	Waternomics overview of the pilots' objectives, measures	Jan 2017	69	0
38	Business Models and Exploitation	Jan 2017	42	0
39	Africa Water	Jan 2017	34	0
40	Smart Cities – Perspectives from the South	Jan 2017	60	0
41	Shazam that water leak	Jan 2017	80	0

4.5 Blogs and News

Table 9 lists the news articles that have been posted on the Waternomics website. These articles reflect the advancement of the project activities. For this reason, one can notice a relatively quiet period during the first year of the project. Starting from August 2015 the project results start to appear and consequently more articles become available.

Table 9 – News from Waternomics.eu

#	Title	Date
1	Kick off meeting	February 2014
2	Deputy Mayor of Thermi visits Insight Galway	February 2014
3	From application to value proposition	April 2014
4	Saving water through better information	December 2014
5	Comics for Waternomics usage scenarios	December 2014
6	Planning for water savings at Linate airport	January 2015
7	Got leaks? – we can hear them!	January 2015
8	Preparing Waternomics pilot at Thermi	January 2015
9	Smart Water for Irish schools	January 2015
10	AFDD improves efficiency of water network	January 2015
11	Paper accepted at BIS 2015	March 2015
12	Six papers accepted at IAHR 2015	March 2015
13	Paper accepted at DEBS 2015	April 2015
14	Waternomics Water Value Map	May 2015
15	The W3C Interest Group on the Web of Things	May 2015
16	How to measure water flow	August 2015
17	Waternomics and ICT4Water at Pint of Science Ireland – Galway	August 2015

18	Waternomics in Smartest House	August 2015
19	ICT4Water Open Day	September 2015
20	Waternomics at the Big Data Analysis in Earth Sciences Summer School	September 2015
21	ICT 2015 Innovate, Connect, Transform	October 2015
22	ECOMODO 2015 – “The Green Technologies Expo”	October 2015
23	Waternomics exhibits at ECOMODO	November 2015
24	Anytime, anywhere, the notifications will be delivered	November 2015
25	The story of a very successful sensors installation	December 2015
26	Introducing the Waternomics Applications Platform	December 2015
27	Why an Application Platform?	January 2016
28	Waternomics targets diverse user groups	January 2016
29	Making users feel like home	February 2016
30	EIP Water Conference 2016	February 2016
31	Waternomics Workshop for the Engineers Week	February 2016
32	Diverse users, multiple applications, one platform for all	February 2016
33	Apps Building for school kids using MIT App Inventor and Waternomics Data	March 2016
34	Waternomics at EIP Water Conference	March 2016
35	Water Conservation Workshop – Water Aware Event for Secondary School Students at NUI Galway	March 2016
36	From notifications, to actions and motivation	March 2016
37	Waternomics Workshop at Coláiste na Coiribe	March 2016
38	(Big) Data Analytics for Environmental Sustainability	April 2016
39	Water Flavours	April 2016
40	Ict4water cluster meeting at LET2016	April 2016
41	Altantec’16 Festival	April 2016
42	Waternomics at NUI Galway Civil Engineering TY Week	May 2016
43	Waternomics at Atlantec’16	June 2016
44	Waternomics hosts two interns at NUIG	June 2016
45	Research Toolbox – Data Analysis with Python: A Waternomics Case Study	June 2016
46	Waternomics installs public displays at Linate airport	July 2016
47	Inviting users to visualize details about water consumption in public spaces	August 2016
48	Waternomics installs a public display at the Engineering Building, National University of Ireland, Galway	August 2016
49	Linked Water Dataspace: Real-time pipeline	September 2016
50	WKAN and OpenCube demo – Catalog Service and Data Explorer	September 2016
51	Training and Feedback Session at Coláiste na Coiribe School	September 2016
52	A Shazam-like household water leakage detection method	October 2016
53	ECOMONDO 2016 – The Green Technology Expo	November 2016
54	Waternomics at ECOMONDO 2016	November 2016
55	Exploiting Hydraulic Model to Enhance Water Network Operation, Performance Monitoring and Control with FDD Algorithm	November 2016
56	Automated Leak Detection System for the Improvement of Water Network Management	November 2016
57	SEA will host a “Water Fair” in Linate Airport	November 2016
58	Launch of the Public Display App at Colaiste na Coiribe School in Galway, Ireland	January 2017
59	Design Thinking workshop	January 2017

60	Waternomics Final Event	January 2017
61	Waternomics events for January 2017	January 2017

4.6 Youtube

To make project ideas and results available to a wider audience and show the impact of a smart water system, videos have been prepared showing the pilot installation process and the value proposition design process. Together with the Ecomondo promotional video and the ict4water video, the videos were included in the Waternomics YouTube channel. Furthermore, the videos were embedded in the Waternomics project website and blog posts. Table 10 shows the number of views on the Waternomics videos.



Figure 15 – Waternomics YouTube channel

Table 10 – Views on Waternomics videos

	Title	Published	Views
1	Waternomics – From application to value proposition	Apr 2015	197
2	Waternomics household installation smart water pilot Thermi	Oct 2015	58
3	R2M Solution SRL – ECOMONDO	Dec 2015	231
4	SEA video sustainability	Jun 2016	11
5	SEA public video	Sep 2016	37
6	Waternomics INSIGHT NUIG	Nov 2016	16
7	Retention time observer	Nov 2016	13
8	WKAN and OpenCube demo	Nov 2016	17
9	Waternomics platform real time pipeline	Nov 2016	10
10	Waternomics demo: Interactive display	Nov 2016	30
11	Demo QRcode app	Nov 2016	14
12	Waternomics demo secure query service	Nov 2016	4
13	Insight@NUIG partner in Waternomics	Dec 2016	47
14	Public display for school	Dec 2016	3
15	Engineering Building at NUIG, a pilot site of Waternomics project	Dec 2016	20
16	Coláiste na Coiribe - pilot site for the Waternomics project	Dec 2016	26
17	Department of Civil Engineering at NUIG partner in Waternomics	Jan 2017	9
18	Introducing Waternomics project	Jan 2017	13
19	Acoustic leak detection by Waternomics	Jan 2017	2
20	Acoustic leak detection by Waternomics	Jan 2017	12
21	Water conservation in Galway City	Jan 2017	7
22	Waternomics: Key Impacts for Smart Water Management	Jan 2017	7
23	Waternomics: Shazam that Water Leak	Jan 2017	6
24	Waternomics: Overview of the Pilots Objectives, Measure and Outcome	Jan 2017	7
25	Waternomics Business Models and Exploitation	Jan 2017	7
26	Waternomics Methodology	Jan 2017	4
27	Waternomics: Making sense of water data	Jan 2017	9
28	Key technologies for Smart Cities	Jan 2017	17
29	Africa Water	Jan 2017	4
30	Waternomics Application Platform: Applications for everyone	Jan 2017	25
31	Introducing Waternomics project	Jan 2017	146

4.7 ResearchGate

In November 2015, a project was created on ResearchGate to create more exposure for Waternomics amongst the broader scientific community. A total of fifteen papers and reports have been published resulting in 95 reads, 162 references and 26 followers (status 05-2-2017). The link to the ResearchGate project is <https://www.researchgate.net/project/Waternomics-2>

4.8 Newsletters

To actively inform water professionals and other stakeholders, Waternomics publishes an electronic newsletter. The newsletter contains articles about the progress of the project, project results and dissemination activities.

Table 11 – Waternomics electronic newsletters

Issue	Recipients	Total opens	Clicks
#1 January 2015	41	75	17
#2 December 2015	52	36	1
#3 July 2016	57	37	0

subscribers: 53 (2-1-17)

Next to the electronic newsletter, a paper newsletter has been prepared and distributed to a select number of recipients. The first issue has been distributed in January 2015 to 66 recipients from 10 different countries. Appendix E shows a copy of the first edition of the paper newsletter.

Table 12 – Waternomics hardcopy newsletter

Issue	Recipients	Countries
#1 January 2015	66	10
#2 May 2016	73	10
#3 January 2017	84	10

4.9 Interviews

Project members have given three interviews for online forums, as listed in the table below.

Table 13 – Waternomics Interviews

Platform	Interviewee	Title
Waterforum (Dutch)	S. Smit	Europees project Waternomics gaat met behulp van ICT water besparen
Vakblad H2O (Dutch)	S. Smit	ICT en flexibele beprijzing voor duurzamer waterverbruik
Delo (Slovenia)	W. Derguech	Znanost in prihodnost Evrope v digitalnem gospodarstvu

5. ICT4Water Cluster Dissemination Activities

The Waternomics project has taken leadership in setting up and maintaining dissemination activities for the ict4water cluster. To increase the visibility of the cluster and to increase the impact of the activities of the cluster projects, a dedicated website has been developed for ict4water, displaying the cluster members, latest news and project results. Next to that, a quarterly electronic newsletter has been prepared and distributed to a growing list of interested people. Waternomics collects the input from the cluster projects, manages lay-out design and distribution of the newsletter. Finally, Waternomics is actively involved in the organisation of ict4water cluster events. For the ict4water Open Day, Waternomics has managed the poster presentations and for the ICT2015 event Waternomics has managed the design of the booth and provided staff for manning the booth.

5.1 ICT4Water Website

The website www.ict4water.eu is on-line since July 1, 2014. Its usage statistics from its launch to January 31st, 2017 is available in Figure 16.

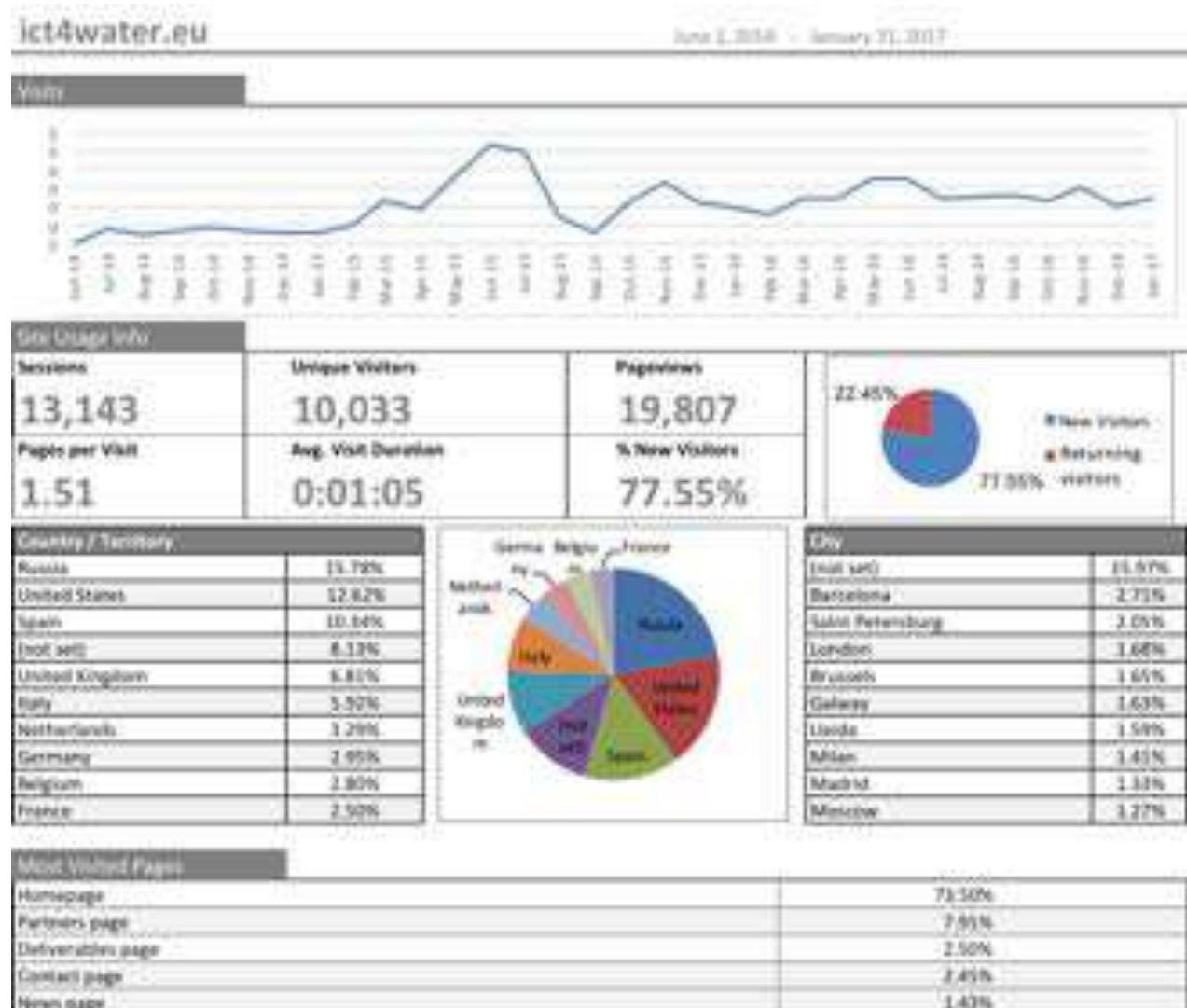


Figure 16: Usage statistics of ict4water.eu from June 1, 2014 to January 31, 2017

5.2 Twitter Account

Twitter(@ict4water_eu)

Status per 05-02-17: Tweets: 1706, Followers: 550, Following: 653

5.3 Electronic newsletters

BM-Change has taken the initiative to generate and publish an electronic newsletter covering the activities of the ICT4Water cluster. The ICT4Water electronic newsletters are used to give an overview of the progress of the projects in the ICT4Water cluster. The source of its contents can be adapted from current activities, white papers, external communications, etc. Four newsletters are planned to be published each year. The first newsletter has been published in the 4th quarter of the year 2014. Post-project publication of the ICT4Water newsletter will be managed by BM-Change, member of the ICT4Water core team.

Table 14 – Overview ICT4Water electronic newsletters

Issue	Recipients	Total opens*	Clicks
#1 October 2014	28	897	14
#2 February 2015	66	450	12
#3 May 2015	78	479	39
#4 September 2015	116	475	40
#5 November 2015 (ICT2015 Special)	135	663	102
#6 January 2016	147	499	53
#7 May 2016	152	356	44
#8 September 2016	162	252	28
#9 January 2017	167	169	17

No. of subscribers for the ICT4Water newsletter is 170 per 05-02-2017.

5.4 Events and Cluster Meetings

Waternomics has participated in various ICT4Water cluster meetings and events. During these meetings, project results and ideas have been shared with the European Commission and member projects from the ICT4Water cluster. Waternomics was present at the cluster meetings and events as listed as the following:

- February 2, 2014, Brussels, Belgium, European Commission, DG-Connect.
- July 15, 2014, Bari, Italy, 16th International Conference Water Distribution Systems Analysis
- August 17, 2014, New York, USA. Hydroinformatics conference 2014
- March 19, 2015, Brussels, Belgium. European Commission, DG-Connect. ICT4Water cluster meeting.
- September 22, 2015, Barcelona, Spain. ICT4Water Open Day
- October 19-22, 2015, Lisbon, Portugal. ICT2015
- February 9, 2016, Leeuwarden, the Netherlands. EIP Water Conference
- June 17, 2016, Jerez, Spain, ICT4Water cluster meeting
- November 15-17, 2016, Barcelona, Spain, European Utility Week

6. Scientific Dissemination

6.1 Publications

Table 15 lists the scientific publications accepted and published since the beginning of the project.

Table 15: Research Papers from Waternomics project

No	Title	Title of the periodical or the series	Year of Publication
1	ACRyLIQ: Leveraging DBpedia for Adaptive Crowdsourcing in Linked Data Quality Assessment [6]	20th International Conference on Knowledge Engineering and Knowledge Management	2016
2	NoSym: Non-Symbolic Databases for Data Decoupling- abstract [7]	Conference on Innovative Data Systems Research (CIDR)	2017
3	Water Analytics and Management with Real-time Linked Dataspace	Government 3.0 - Next Generation Government Technology Infrastructure and Services (Book)	2017
4	The ambiguity of innovation drivers: The adoption of information and communication technologies by public water utilities [8]	Journal of Cleaner Production	2016
5	Tackling Variety in Event-Based Systems [9]	ACM International Conference on Distributed Event-Based Systems	2015
6	Linked Water Data For Water Information Management [10]	International Conference on Hydroinformatics	2014
7	Flag-Verify-Fix: Adaptive Spatial Crowdsourcing leveraging Location-based Social Networks [11]	SIGSPATIAL International Conference on Advances in Geographic Information Systems	2015
8	Efficient task assignment for spatial crowdsourcing: A combinatorial fractional optimization approach with semi-bandit learning [12]	Expert Systems with Applications	2016
9	Interactive Water Services: The Waternomics Approach [13]	International Conference Water Distribution Systems Analysis	2014
10	Waternomics: a cross-site data collection to support the development of a water information platform [14]	Computing and Control for the Water Industry Conference	2015
11	The impact of adopting a Water Information Platform on a utilities business model [15]	IWRA World Water Congress	2015
12	Water Conservation with Novel Application of Fault Detection Diagnostics (FDD) Applied to a Rain Water Harvesting System in Ireland [16]	IWRA World Water Congress	2015
13	NUIG lead EU funded project to increase water usage efficiency [17]	http://www.engineersjournal.ie/	2015
14	Waternomics (ICT for water resource management) methodology and water information platform [1]	Procedia Environmental Science, Engineering and Management	2015
15	Waternomics (ICT for water resource management) methodology for deployment of a water management system [18]	Workshop at International Conference on Artificial Intelligence Application and Innovation	2015
16	Standards-based methodology for the design and implementation of a water management system [19]	International Electronic Conference on Sensors and Applications, Sciform Electronic Conference Series	2015
17	Modeling and Querying Sensor Services using Ontologies [20]	International Conference on Business Information Systems	2015
18	Engaging users in tracking their water usage behaviour [21]	Computing and Control for the Water Industry Conference	2015
19	WATERNOMICS: Low cost sensors and systems for collecting water usage in three pilots [22]	IAHR World Congress	2015
20	WATERNOMICS: Serving diverge user needs under a single water information platform [23]	IAHR World Congress	2015
21	Business drivers for adopting smart water technology [24]	IAHR World Congress	2015
22	Assessment and Planning for the Application of Fault Detection and Diagnosis (FDD) to Building Water Networks, A WATERNOMICS Approach [25]	IAHR World Congress	2015
23	Sustainable water networks, an automated fault detection and diagnosis of water network systems [26]	Sustainable Places	2016

24	WATERNOMICS: Development of a water information platform based on a linked sensor data framework [27]	IIRC	2014
25	A Shazam-like household water leakage detection method [28]	WDSA	2016

Other publications are planned for the future period as listed below:

Table 16: Future Research Papers from Waternomics project

Publication	Lead partner	Type	Year
Lessons from IOT and Human Awareness	NUIG	Journal Paper	2017
A Real-time Linked Dataspace for Internet of Things enabled Smart Environments	NUIG	Journal Paper	2017
Online Task Matching & Assignment in Spatial Crowdsourcing: A state-of-the-art review	NUIG	Journal Paper	2017
Acoustic leakage detection on the household level. Planned for submission to Urban Water journal	UNESCO-IHE	Journal article	2017
Value proposition design in the Waternomics project	BMC	Conference paper	2017
Waternomics application platform as an ecosystem of water related apps	Ultra4	Journal article	2017
Research on usage of actual Waternomics apps from end users	Ultra4	Journal or conference paper	2017
Research on behaviour change caused by Waternomics apps usage on domestic environments	Ultra4	Journal or conference paper	2017

6.2 Deliverables

The following list of deliverables has been made available on the Waternomics website:

- D1.1 – Usage case and Initial Exploitation Scenarios
- D1.2 – Water ICT Technologies, Policies and Standards V1
- D1.3 – System Architecture and KPIs
- D2.1 – Waternomics Methodology
- D3.1.1 – Linked Water Dataspace
- D3.1.2 – Linked Water Dataspace
- D3.3 – Waternomics Apps
- D5.1 – Pilot Plan
- D7.2 – Waternomics “Key Ideas” Brochure and Poster
- D8.1 – Public summary of the project

The following list of deliverable is waiting for review results before publically releasing them:

- D5.2 - Consolidated WATERNOMICS Pilot Reports (Corporate, User and Municipal)
- D6.1 - WATERNOMICS Methodology Brochure
- D6.2 - WATERNOMICS Integrated outcome (Methodology, Software & Data Management and Analysis Components)
- D7.3 - WATERNOMICS Water Bill
- D7.5 - Report on Dissemination and Standards Work

7. Exploitation Dissemination

During the project, Waternomics has engaged with industry representatives through round table sessions, workshops, demo's and tests, fairs and interviews. Goal of these activities was to share ideas and results from the project and to validate the underlying assumptions. The next paragraphs provide an overview of the dissemination activities undertaken for the support of exploitation activities.

7.1 Industry Events

- **Round table session - Malpensa, Italy: May 29, 2014**

SEA operates three airports (Malpensa, Linate and Orio) and has a close relationship with the communities (cities and municipalities) in which these airports are located. The Malpensa Roundtable titled “Italian workshop for the management of water resources open to local area stakeholders” provided an opportunity to engage these local area communities in the thematic area of Waternomics. In attendance were four local area mayors with technical staff and a local area water distribution company. In addition, the workshop served as a networking event as sister ICT4WATER project ICEWATER was invited and attended.



- **Association of Energy Engineers Water Event: May 29, 2014**

A Drop in the Ocean or Money down the Drain: “Water Management in Industrial, Commercial and Domestic Sectors” – Green Isle Hotel, Dublin, Ireland. This free event was hosted by the Irish Chapter of the Association of Energy Engineers (AEE). We attended this event to get a better understand of issues and current approaches for Irish Stakeholders.

- **Irish Stakeholder Workshop - Dublin, Ireland: June 4, 2014**

Irish Water are a new semi-state company establish by the Irish state to manage nationwide water and wastewater treatment, supply and distribution. A meeting was organised with a number of key technical staff in order to make them aware of the Waternomics project, outline the key objectives and deliverables, and help identify any synergies which may exist.

- **Round table session -Thermi, Greece: June 13, 2014**

In order to gain early feedback from national and regional stakeholders about Waternomics ideas and to capture information on issues, barriers and opportunities in the market, a round table session was organised in Thermi, Greece. In this session, fourteen representatives from municipalities, public and private water companies and project members from Waternomics, discussed the ideas presented by Waternomics. They exchange ideas, problems and practices followed in municipalities for water management and conservation. The target of the Thermi pilot was introduced and stakeholders from water utilities expressed their ideas and thoughts on what kinds of features and information they would be willing to provide to their customers using technologies from Waternomics. Business exploitation and opportunities were also discussed in order to help initiate discussions and thinking about potential business value of such a solution for water utilities.



- **Ecomondo – Rimini, Italy, November 3-6, 2015**

Ecomondo is a major exposition on green technologies and the circular economy in Europe. The 2015 edition attracted 1200 exhibiting companies and 103,514 visitors over four days. Partner R2M was present with a booth. In its booth, the project was presented to visitors by Domenico Perfido, Andrea Costa and Daniele Bortoluzzi where video monitors, project flyers and a poster were used to highlight various aspects of project results and activities. Also on display was an interactive totem/touch screen display with project information uploaded which soon became a booth highlight.



- **Fair on Home Automation and Smart Living, Eindhoven, the Netherlands, November 19 & 20, 2015**

The fair attracted 3000 (Dutch) professional stakeholders in house automation, building, housing, technology, care... (installers, system integrators, building corporations. Partner VTEC was present with a booth presenting the Waternomics smart homes demo and flyers.

- **Interviews with water utility of Thermi, April 5, 2016**

Just before the launch of the pilot and with the applications platform developed we had an interview with the stakeholders from the water utility of Thermi to discuss the potential benefits for them as a water utility from such a platform. The discussions aimed to demonstrate the abilities of the platform to the water utility and identify their first reactions and thoughts for post-project exploitation plans. Moreover, feedback was also given on a potential redesign of the water bill for households that has been designed for the Deliverable 7.3.



- **European Utility Week 2016, Barcelona, November 15-17, 2016**

European Utility Week is a major event for the utility industry in Europe. The event attracted over 11.000 attendees from 113 countries. Partner BM-Change was present and gave a presentation about business models for smart water systems and participated in the panel discussion. Flyers and brochures were used to highlight the project ideas and results.



- **Water Fair, Linate, December 1-2, 2016**

On December 1-2 2016, SEA hosted a two day “Water Fair” in Linate Airport, Italy.

At the event, SEA – R2M and Ultra4 presented the Waternomics project outcomes. Representatives from local municipalities, institutional Bodies, water utilities and corporate staff members attended the event.



7.2 Stakeholders Engagement Activities

• ICT2015, Lisbon, Portugal, October 18-22

From October 18 until October 22, the city of Lisbon hosted the largest ICT event organised by the European Commission. Over 4000 people from all over Europe and working in different domains like research, politics, industry, investors and academics, attended this event. ICT4Water was selected as one of the five flagship initiatives which were invited to present their work at the off-site pavilion, located at the Praça do Comércio. As one of the members of the ICT4Water core team, Waternomics was heavily involved in the organisation and preparations for this major event. Sander Smit from BM-Change managed the design of the booth and Wassim Derguech from NUIG manned the booth during the event. Waternomics presented itself with flyers, poster and video to a broad audience, ranging from local citizens and scholars to visits from Günther Oettinger, EU Commissioner for Digital Economy and Society and Roberto Viola, Director General of DG-Connect.



• Smart Homes Eindhoven demo

Waternomics has installed a demo of their flow meter with application in the smartest house in the Netherlands. The Smartest House combines and shows state of the art technology in the areas of health and energy. In the period June 2015-January 2016, 550 persons visited the house through guided tours from which 198 consumers and 352 professionals, including 8 R&D managers from water utilities.



• Water Value Map Workshop, Pellikaan Health Club, Netherlands, October 10, 2015

Validation of the Water Value Map as developed in the project at health club Pellikaan located in Goirle, the Netherlands. Participants in the workshop were Club Manager Eugenie Curfs and member from the technical staff John van Dun. The workshop was organised and facilitated by Sander Smit from partner BM-Change.



• Brabant Water test, October 2015

Partner VTEC has conducted tests with a mobile version of their ultrasonic flow meter together with Dutch water utility Brabant Water. Goal was to verify if mobile solution was suitable for the detection of peaks in water usages at a secondary school in the Netherlands.

• Arkema test, November 2015

Partner VTEC has conducted tests with a mobile version of their ultrasonic flow meter in industrial environment, together with Arkema, active in the chemical industry.

• Smart Homes Alkmaar demo, May 2016

Partner VTEC has anticipated in a start-up competition and has been chosen as one of five start-ups to participate in the “Slimmere Zorg” program in Alkmaar to execute a next development

cycle and participate in a local pilot in Alkmaar, the Netherlands, in collaboration with the Smart-Homes foundation. The Waternomics Ambient Assisted Living set-up is being tested in combination with other care applications.

- **Field lab Smart Base, May 2016**

The Dutch Ministry of Defence has organised a market consultation to find innovative solutions that, amongst others, reduces the energy and water footprint of their field bases abroad. Partners VTEC and BM-Change have been discussing the use of Waternomics foreground to reduce the water footprint of Dutch military field-bases and investigated the specific requirements for this application.

- **Simaxx presentation, September 2016**

Partners BMC and VTEC have engaged with Simaxx, a provider of smart building solutions, and presented the Waternomics project and results. As a follow up, integration of Waternomics sensors and application with the Simaxx platform is being investigated, a pilot project has been defined together with Kraft who wants to make available one of its S-Clusiv shared office buildings in Eindhoven, the Netherlands, for the pilot.

- **2nd Green Session Chapter Lombardia di GBC Italia, Milan, October 25, 2016**

On October 25 2016, R2M presented Waternomics outcomes at a workshop organized by GBC Lombardia. Waternomics objectives well match the targets of the workshop as they are the following:

- Promote the culture and practice of sustainable construction
- Promote relations with other organizations and local structures, even associative, which deal with issues linked to the environment and to sustainable building
- Promote practices related to sustainable building in local institutions and maintaining relations with them.



In addition, the stakeholder tests and workshops, thirty-eight one-on-one stakeholder interviews have been conducted. Appendix D provides an overview of these interviews with industry representatives.

7.3 Series of Final Events



• UX Design Workshop

As part of the final event activities, Waternomics in collaboration with UX Design Galway hosted a UX Design workshop around Design Thinking. The idea was to introduce what Design thinking is, how it was applied for the design of some of the Waternomics apps followed by a workshop for living the UX design experience.

The event took place at Insight Centre for Data Analytics at NUIG on 26/01/2017 from 19:00 to 20:30.

• Research Seminar

As part of the series of final events, Wassim Derguech presented the Waternomics project results and impact to an academic audience.

The event took place at Insight Centre for Data Analytics at NUIG on 27/01/2017 from 15:00 to 16:00.

• Final Event

This is the final event where the Waternomics team aimed to showcase the technology developed within the project, to present the technical achievements of the different partners and to show the final results and impact of Waternomics project.

The event took place at one of the pilot site, the Engineering Building at NUIG on 31/01/2017 from 09:00 to 16:00. The agenda of the day is shown in Table 17.



Table 17: Agenda of the Waternomics Final Event

Session Topic	Time	Presentation - Theme	Presenter	Affiliation
	09:00	Welcome and Registration		
Introduction	09:30	Welcome + Waternomics Overview	Edward Curry	Insight@NUIG, Ireland
	09:40	Waternomics Key Impacts for Smart Water Management	Eoghan Clifford	Civil Engineering Department, NUIG, Ireland
	09:50	Water Conservation in Galway City	Elizabeth Fanning	Galway City Council
	10:00	Galway City - European Green Leaf 2017	Elizabeth Fanning	Galway City Council
	10:10	Coffee Break		
ICT4Water Technologies	10:30	Waternomics: Shazam that Water Leak! (Sensors and Faults)	Joanne Crave	IHE, The Netherlands
	10:45	Waternomics: Making Sense of Water Data	Wassim Derguech	Insight@NUIG, Ireland
	11:05	Waternomics Applications Platform: Water apps for everyone	Christos Kouroupetroglou	Ultra4, Greece
	11:25	Waternomics: Methodology	Sander Smit	BMC, The Netherlands
	11:45	Panel: Open discussion on Technology-related challenges	All presenters	
	12:05	Lunch Break		
Pilot Impacts	12:50	Tour of the pilot installations and live demos	Aodh Dalton, Wassim Derguech and Louise Hannon	Civil Engineering Department, NUIG, Ireland
	13:20	Waternomics: Overview of the Pilots Objectives, Measures and Outcomes	Louise Hannon	Civil Engineering Department, NUIG, Ireland
	13:40	Panel: Pilot Experiences	All involved members from Waternomics project	
	14:00	Coffee Break		
Uptake of ICT4Water Technology	14:20	Waternomics: Business Models and Exploitation	Sander Smit	BMC, The Netherlands
	14:40	Water Technology in Developing World	Bruce McCormack	EUROGI, Ireland
	15:00	Key Technologies for Smart Cities	Adeboyega Ojo	Insight@NUIG, Ireland
	15:20	Panel: Business Models for ICT4Water	All presenters	
	15:40	Closing	Edward Curry	Insight@NUIG, Ireland



8. Training and Education Activities

8.1 University Education

8.1.1 Using Waternomics data and services in existing teaching programs

As part of its curriculum for the second year of engineering classes, the Mediterranean College of Thessaloniki in Greece provides a course on Team Work and Project Management.

During this course, students are given a project idea that they have to develop during second semester of the academic year. Dr. Christos Kouroupetroglou (Ultra4) introduced the theme of smart water management in the student's projects.

Two groups, of 5 students are actively working on the development of applications using Waternomics data and services. The projects will be released as open source by the end of the academic year and will be included in the Waternomics marketplace.

8.1.2 Data cleaning and preparations lecture for University Students

At the National University of Ireland, Galway, A master of data analytics is given with a variety of courses targeting various aspects of data analytics. One of the courses is designed as a series of case studies for data analytics that covers various aspect of the data management lifecycle. Wassim Derguech (NUIG) was invited as a guest lecturer to showcase Waternomics data cleaning and preparation process.

The lecture consists of 2 hours teaching followed by 1 hour lab. During the teaching session, Wassim gave the theoretical background related to data cleaning and preparation including various techniques such as: filtering, identification of duplicates, identification of missing data, detection of outliers, etc.

Students are also give an assignment for data cleaning and preparation as well as performing statistical data analysis to identify outliers and identify a water consumption baseline. The students were given a dataset from Waternomics data: 1 year of sensor data from the Engineering Building pilot site.

8.1.3 Application Development Workshops for University Students

In the context of university educational trainings, Waternomics offered workshops for Engineering students to create water visualization applications for a slot of 2 hours.

A workshop designed by Wassim Derguech (NUIG) included access to Waternomics data and Water Flavours application. Details about the teaching materials used in these workshops are available in Section 8.3. The following table lists talks given in such context.

Table 18: University trainings – Application development workshops

Date	Venue	Given by
April 2016	The Mediterranean College of Thessaloniki in Greece	Wassim Derguech and Christos Kouroupetroglou



Figure 17: Water data visualization workshop at the Mediterranean College of Thessaloniki in Greece

8.1.4 Other talks and lectures for University Students

University students at all levels and most importantly postgraduate students are interested in research projects, as they constitute a primary source of ideas for their projects and research topics. Waternomics

team works towards communicating its research at universities for this purpose. The following table lists talks given in such context.

Table 19: University trainings – Talks and Lectures

Date	Title	Venue	Presented by
November 2014	Watnomics – ICT for Water Resources Management (joint with Engineers Ireland West)	Engineering Building, NUIG	Eoghan Clifford, Daniel Coakley, Mark McCaffrey (NUIG)
April 2015	Watnomics – ICT for Water Resource Management	Insight Centre for Data Analytics at NUIG	Wassim Derguech
April 2016	(Big) Data Analytics for Environmental Sustainability	The Mediterranean College of Thessaloniki, Greece	Wassim Derguech (NUIG)



Figure 18: Big Data Analytics for Environmental Sustainability – Talk given at the Mediterranean College of Thessaloniki in Greece

8.2 Open Data Hackathon

The use of Open Data for developing Water Applications is one of the objectives of Watnomics project. Multiple Sources of Open Data are used in the project, e.g., Water footprints, water prices, open calendars, etc.

Watnomics team organized Open Data Hackathons for developing Android Mobile applications using data from Watnomics platform. Details about the teaching materials used in these Open Data Hackathons are available in Section 0. The following is the list of the organized hackathons:

Table 20: Open Data Hackathons

Date	Venue	Target Audience	Animated by
February 2016	The Insight Centre for Data Analytics, NUIG	Secondary School Students	Souleiman Hasan and Wassim Derguech
March 2016	The Engineering Building, NUIG	Secondary School Students	Wassim Derguech
March 2016	Coláiste na Coiribe	Secondary School Students	Wassim Derguech and Souleiman Hasan

8.1 Water Awareness Workshops

Water Awareness workshops were held at the NUIG and Coláiste na Coiribe pilot sites in March 2016. The events were attended by over 140 secondary students in total (aged 13 – 18 years).

The Water Awareness Workshop focused on the themes of water as a resource, the effort and energy required to produce potable energy, the role of the individual in responsible water usage and school water audits. The Practical Workshop Task set for attendees of simulating the water treatment process in class proved to be ultimately very informative as a visual aid for students. The School Water Audit Workshop Task showed that attendees really understood the nature of the different water usage at the school with some groups estimating a whole school daily water use to within 10% of the average recorded by Metering.



Figure 19: Apps building workshop at Coláiste na Coiribe

Holding the Workshops at Coláiste na Coiribe, which is one of the Waternomics Project Pilot sites, was a great opportunity to engage with the students and explain and examine the Waternomics concepts. The students completed a water awareness questionnaire at the beginning the workshops and a similar one on completion to baseline the awareness of the importance of water conservation issues among post-primary students as reported in WP 5 and WP6.

Table 21: Water Awareness Workshops

Date	Venue	Target Audience	Animated by
March 2016	The Engineering Building, NUIG	Secondary School Students	Louise Hannon and Joanne Comer
March 2016	Coláiste na Coiribe	Secondary School Students	Louise Hannon and Joanne Comer

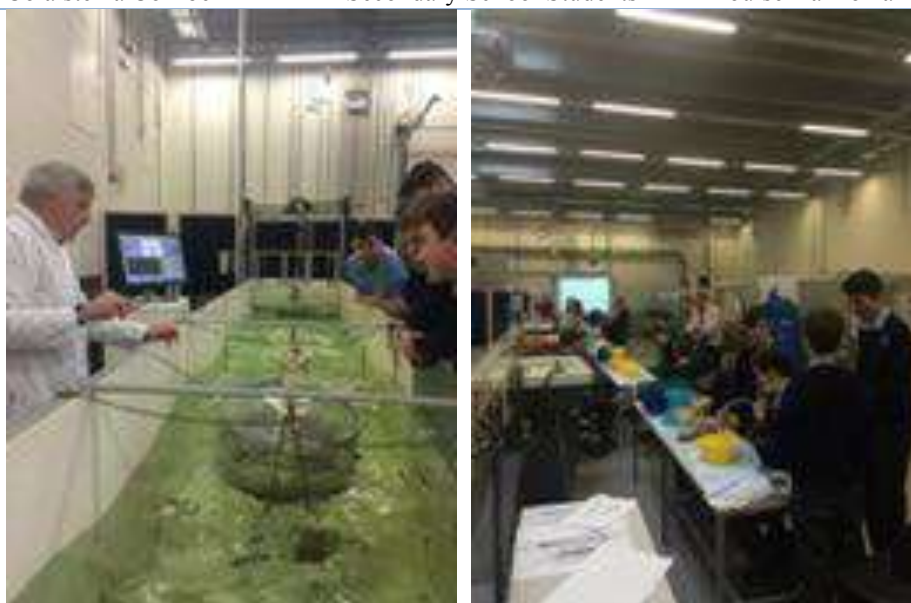


Figure 20: Water conservation with school kids workshop at NUIG

8.2 Professional Training

UNESCO-IHE's MSc programme focuses on international students that already have some years of work experience as water professional. In addition UNESCO-IHE regularly provides tailor-made trainings, e.g. for water ministries, river basin authorities, and utilities. First the Waternomics platform will be presented and discussed as an example of present-day information system in lectures of UNESCO-IHE's MSc specialisation in Hydroinformatics. Afterwards these Waternomics lectures may become part of tailor-made trainings on demand.

8.3 Online Training Material

Online teaching materials include slides available on the waternomics slideshare account. Additionally, other teaching materials can be found in the waternomics.eu website http://waternomics.eu/?page_id=100

These include:

- Android apps building using MIT app inventor and Waternomics Data
- Water Data Visualisation using Play Framework

A series of teaching videos is under development and should be made available via our youtube channel as well as the project website.

9. Pilot Specific Activities

9.1 Linate Airport

9.1.1 Overview

Dissemination activities have been made a natural part of Linate Pilot activities with the goals of reaching out to:

- The general public
- The airport community
- The SEA leadership and staff
- Airport passengers
- Local municipalities and the region of Lombardia
- The scientific community with focus on researchers working in the same topic area and projects with pilot activities similar to Linate

Highlights to date include:

- Dissemination to Airport Council Europe¹ (ACI-Europe)
- Engagement of the environmental manager and staff of SEA who disseminate directly to the decision makers operating the Linate and Malpensa airports
- Engagement of the SEA communication department to develop high-quality material for display in the terminal areas
- The conduct of one consortium level meeting at Linate, 11 technical meetings and stakeholder interviews reaching out to approximately 50 SEA staff members and/or organizations operating within the airport
- Dissemination to four local-area mayors at a dedicated workshop
- 3 scientific papers/presentations linking to the Linate Pilot
- Clustering/networking and dissemination to one local area university running a water related pilot in the city of Milan
- The “launch” of touchscreen displays in the terminals with high-quality project dissemination information and the opportunity to interact with the project
- Project “facts” / “snippets” broadcast on the terminal monitor system / news network
- Press release and launch event surrounding the kick-off of the water management system at Linate
- Papers/presentations related to Linate pilot results

9.1.2 Events to date targeting airport related stakeholders

Staff Engagement via Linate Pilot technical meetings

(M3 – M8 – M11 – M12 – M18 – M21 – M24 – M26 - M33)

¹ ACI Europe represents over 500 airports in 45 European countries. Their membership is comprised of airport operators of all sizes, along with national airport associations, educational establishments and world business partners. SEA is a partner of the ACI Europe, The ACI Europe is informed about the Waternomics project and they wrote a letter of support during the initial phase of the project. Through SEA partner ACI Europe will be informed about the Waternomics project progress.

Twelve technical meetings have been conducted from April 2014 to January 2017. These meetings have had the dual purpose to disseminate projects objectives between SEA staff and project personnel and to gain knowledge related to the water distribution network and the development of the Linate water conservation measures. These meetings have reached various parts of the SEA staff to include the communication department, executives making decision about the tendering process and installation schedules, and departments responsible for the maintenance and operation of the water distribution system to include billing to airport shops/restaurants.

Main outcomes:

1. Increased awareness of project objectives throughout SEA staff and airport organizations
2. Dissemination aspects linked to the planning and development of pilot activities
3. Better understanding of the Linate Pilot and SEA organization attained by consortium partners
4. Waternomics Application Platform launch and staff training session

Local area municipality round table session – Milan (Malpensa), Italy (M4)

A roundtable workshop/discussion titled “Italian workshop for the management of water resources open to local area stakeholders” provided an opportunity to engage local area communities surrounding the Malpensa airport in the thematic area of Waternomics, this is described earlier in this document as part of the stakeholders’ engagement activities (par. 7.1).

Main outcomes:

1. Project and Linate Pilot disseminated to four local area municipalities with several mayors in attendance
2. Invitation to link project dissemination to local area media channels
3. Invitations for future collaboration and request for further follow ups

Consortium Meeting in Linate Pilot (M9)

The 2nd Waternomics project meeting was held at Linate Airport 8 – 9 October 2014 in association with SEA and all of the Waternomics consortium partners. The meeting was a success and important step forward for the project. For the researchers, it was a good opportunity both to view first-hand the complexities of a corporate environment and in specific an airport where security, flight schedules and services to passengers must be accommodated always and to disseminate the project objectives among the airport staff. For the airport staff, it was interesting to interface with the Waternomics platform developers about what types of information, tools and means of communication would help them do their job better with respect to resource management. The meeting is also published on the R2M web site¹.

**Information platform design requirement interviews (M20)**

During M20, a series of interviews with SEA staff were conducted using paper or PowerPoint prototypes of dashboards and/or Waternomics Information Platform applications. These interviews served the purpose to get staff input, determine user needs and test initial design ideas. In doing so, a natural part of the interview was also to explain the project, pilot, objectives and how they could engage in the activities being conducted. Interviewees were provided take away information about the project and means to keep updated as the project continued.

¹ <http://www.r2msolution.com/r2m-co-hosts-a-waternomics-consortium-meeting-in-collaboration-with-sea-to-design-water-efficiency-measures-at-linate-airport/>

Main outcomes:

1. Increased awareness and engagement with SEA staff members
2. Feedback to consortium on how to make technical solutions and communication measures more effective

R2M presented the Waternomics project at ICEWATER Workshop – (M20)

R2M have presented the Waternomics project, methodology and targets with particular attention to the Linate pilot plan at ICEWATER workshop held in Milan in September 2015. ICEWATER is part of the ICT4Water Cluster, a cluster that links together 10 running European research projects working on developing ICT tools to facilitate water resource management as well as other researchers working in the field. At this conference participated also a local water utility (Metropolitane Milanese) that carries the supply, treatment and distribution of water for drinking purposes in the city of Milan.



Main outcomes:

1. Project and pilot disseminated to approximately 50 stakeholders
2. Linkage made to the channels and networks of University of Bocconi and Metropolitane Milanese for further exploitation

R2M presented the Waternomics project at AIAI 2015 – (M20)

R2M chaired the 11th International Conference on Artificial Intelligence Applications and Innovations in France. This conference is a major technical event in the fields of Artificial Intelligence and Soft Computing. Its general focus is to present different perspectives on how Artificial Intelligence may be applied and offer solutions to real world problems. A special track was offered for the Waternomics project and in the paper published also the Italian pilot site was mentioned as the demo site to implement the Waternomics Waster System Management.

R2M Solution presented Waternomics at the 19th ECOMONDO industrial trade fair – Rimini, Italy (M22)

R2M hosted a stand, posters, and presentations featuring Waternomics and its leadership of Linate Pilot activities at ECOMONDO in Rimini, Italy. This event is recognized as one of the most important expositions on green technologies and attracted approximately 1200 exhibitors and over 100,000 visitors over four days. At its booth, the touchscreen displays that will be fielded at the Linate Pilot were utilized and tested. Waternomics was also a paper and conference presentation. Of particular interest, R2M was covered by a national TV network which made an interview of the R2M Linate Pilot Manager Domenico Perfido which was aired on national TV and is currently also available in the program's archive, on YouTube¹ and on the R2M website (photo available in the paragraph 7.1 of this document).

Main outcomes:

1. Hundreds of persons with industrial focus reached and made aware directly at the exposition.
2. Thousands of persons reached via Television and internet media channels

R2M Chairs ICT4Water special session at the 2nd ECSA – Online (M22)

¹ <https://www.youtube.com/watch?v=2GauQBzGq2I&feature=youtu.be>

R2M's CEO Thomas Messervey chaired the Session "Sensing Technologies for Water Resource Management" at the 2nd International Electronic Conference on Sensors and Applications (2nd ECSA) – Online in M22. Hosted by SciForum, this conference is an innovative online series that targets making conference opportunities more available to a broader audience worldwide through the elimination of fees and travel requirements. The conference has given more visibility to the Waternomics project with the focus on the Italian Pilot Site and the technologies for implementation of a Water System Management. Also a paper has been published on the topic: "Standards-based methodology for the design and implementation of a water management system".

Main outcomes:

1. New channel and scientific audience connected to the Waternomics project
2. Opportunity to make the topic theme a running part of the conference series
3. Methodology and its application to Linate disseminated

Water awareness questionnaire (M25)

The first water awareness questionnaire has been implemented among the SEA staff in M25. The questionnaire identifies the attitudes and behaviour of end users in terms of their water usage and it provides a baseline through which to perform the measurement of the Waternomics WEM dealing with water awareness and water consumption reduction after to have implemented the meters' installation and the Waternomics platform launch.

Main outcomes:

1. Awareness and engagement level increased across approximately 20 staff members
2. Feedback attained for pilot and technical activities

R2M presented the Waternomics project at Sustainable Places 2016 – (M30)

R2M chaired the 4th International Conference Sustainable Places in France. This conference is the fourth edition of a successful event that brings together the stakeholders of Energy Efficiency of Built Environment innovation in Europe. Sustainable Place 2016 aims to gather scientists, researchers, and engineers from research institutes and the industry, around one of the greatest challenges that our societies have ever faced: ensuring the long-term environmental sustainability of ever-growing, densifying urban areas, in a resource-constrained world.

Waternomics was presented with conference session and a paper was published about the model based FDD performed in the Italian pilot site.

2nd Green Session Chapter Lombardia di GBC Italia, Milan, October 25, 2016 – (M33)

On October 25 2016, R2M presented Waternomics outcomes at a workshop organized by GBC Lombardia. The Linate Pilot experience within the Waternomics project was presented to the scientific, politic and industrial audience.

R2M Solution presented Waternomics at the 20th ECOMONDO industrial trade fair – Rimini, Italy (M34)

R2M hosted posters, and presentations featuring Waternomics and its leadership of Linate Pilot activities at 20th ECOMONDO international fair in Rimini, Italy. Waternomics was also a paper and conference presentation.



The R2M Linate Pilot Manager Domenico Perfido presented the new model based fault detection and diagnosis method to the audience.

Main outcomes:

1. More than fifty persons from industrial and scientific environments participated to the conference.
2. About one hundred persons reached via poster session.

R2M Chairs ICT4Water special session at the 3rd ECSA – Online (M34)

R2M's CEO Thomas Messervey chaired the Session "Sensing Technologies for Water Resource Management" at the 3rd International Electronic Conference on Sensors and Applications (3rd ECSA) – Online in M34. Hosted by SciForum the conference has given more visibility to the Waternomics project with the focus on the Italian Pilot Site and the technologies for implementation of a model based fault detection and diagnosis. Also a paper has been published on the topic: "Automated leak detection system for the improvement of a water network management".

Main outcomes:

1. Opportunity to target a worldwide scientific audience
2. Model Based FDD and its application to Linate disseminated

9.1.3 Training and Open Days at pilot environment

Waternomics Platform Launch event (M32)

A launch event was held in Linate pilot in M32. The trigger for this event is completion water metering installation and fielding of the touchscreen displays. At the event, SEA staff was introduced, trained and invited to explore the Waternomics Platform and the project innovations. In the terminals, project personnel were able to interact with persons exploring the touchscreen displays

Main outcomes:

1. Waternomics Platform training to SEA staff members
2. Engagement with terminal passengers
3. Increased pilot visibility to the general public

Water awareness questionnaire M36

The second water awareness questionnaire has been implemented among the SEA staff in M36. The questionnaire identifies the attitudes and behaviour changes of end users in terms of their water usage after the implementations of the Waternomics WEMs

Main outcomes:

Increased awareness and engagement of the SEA staff

Pilot open day M35

An open end-user seminar was held in M35 in the Linate Pilot. The open end-user seminar allowed the end-users of the WATERNOMICS project to share their experience. For example, large businesses of the wider municipality area were invited to learn from the experiences in the Linate airport and also representatives from institutional bodies, water utilities and corporate staff members attended the event.

9.2 Municipality of Thermi

9.2.1 Stakeholders Interviews

Technical meeting for Thermi pilot - Greece (M5)

The meeting took place during two consecutive days. On the first day the team of Waternomics (Ultra4, VTEC, Thermi) visited a number of interested household owners in their places and examined the current typical infrastructure in indicative households. Pictures were taken of water consuming devices and tubing in order for VTEC to start designing their sensors.

Second day's meeting took place at Thermi's offices and involved a number of initially interested participant household owners. The aim of the meeting was to elicit user needs and brainstorm on functionality and information end users in domestic environments would need to see in their devices.

Main outcomes:

1. Photos of existing infrastructure and identification of potential limitations
2. Initial features list for domestic environment
3. KPIs and requirements from domestic users

Thermi paper prototypes user tests – (M10, M11)

During M10 and M11 a series of interviews with household owners was conducted based on specific paper prototypes of applications. Paper prototypes demonstrated potential UI design principles and tested ideas such as categories of applications and different layouts for dashboard applications. The interviews also included a short part discussing the potential of using mobile devices to register personalized usage of water based on 2 developed storyboard scenarios.

Main outcomes:

1. UI designs update
2. Testing module concepts for applications
3. Build your app tool proof of concept

Interviews with participants after installations (M26)

After the completion of installations in households, a round of interviews with household owners participating in the pilot study took place in order to track first reactions to installations and introduce the marketplace concept and the potential elements used in building an application. The purpose of the interviews also included gathering some initial feedback on the expectations users had after the installation and what are their initial reactions for post project exploitation scenarios.

Main outcomes:

1. Initial reactions to potential information provided in dashboards
2. Specific needs for dashboards applications per household
3. Initial reaction to post project exploitation potentials



Interim pilot interviews M33

After running the pilot for a period of about 2-4 months and having released a number of applications we conducted a 5 phone interviews with household owners to. The aim of the interviews was to check on how users interact and use the platform and the apps provided and identify strengths and weaknesses in using the platform. The interviews used also a number of questions trying to identify if there was in increase in users' consumption awareness. More specifically users were asked to tell us if they remember how much water they consume on a specific interval (e.g. daily, weekly) on a specific outlet. The information asked was already provided in apps they should be using.

Main Outcomes:

1. Water consumption awareness was not significantly increased
2. The information from the platform was not easily building into their daily routines
3. The need for a new app for getting daily/weekly and monthly digests was decided

Final pilot focus group and phone interview M36

Similar to the interim pilot interviews the focus group and phone interviews in the end of the pilot engaged once more with end users in a final round of feedback in order to examine the overall effects of the Waternomics applications to their water awareness and behaviour. The questionnaire was not used due to the small number of participants.



Main Outcomes

1. An increase in water awareness was reported.
2. The new app for daily/weekly/monthly digests was found very helpful
3. Water consumption was confirmed as a low priority on a household management since it does not relate to big amount of their budget. Therefore it was difficult to raise interest
4. The platform however, although not used very frequently was assessed as helpful

9.2.2 Demonstrations and Open Days

First test household installation M20

In M20 a complete installation of sensors in a household took place. Videos and photos were taken during the process in order to demonstrate to the rest of the participants the installation process and the overall outcome after their installation in the household. After the test installation a focus group with 5 participant household owners was conducted and some initial feedback was gathered in terms of the installation and design issues of the sensors.



Main outcomes:

1. Introduction of end users to the sensors installation process and infrastructure
2. Engagement of end uses in the sensor design process with feedback on the actual installation
3. Know how gained on the installation process

One on one app design sessions M26-M27

During the period following the launch event end users were contacted in order to provide assistance on the initial dashboards design. During the launch event end users have already been introduced to the app design process with the configuration tool. Continuing on that experience we kept the engagement with short interviews that were followed by application designs specific for each household's individual needs.

Main Outcomes:

1. Engagement of user in the app design process
2. More than 40 personalized dashboard applications for each different household

Pilot open day M30

During M30 the pilot was in the middle of its execution but some first experiences could be identified and presented. In parallel the other three pilots in public spaces and large businesses have also progressed and some experiences were collected. The pilot open day took place during M30 in Thermi and brought participants from the other pilots in Thermi to share their experiences during the pilot period. Thermi as a municipality is hosting a number of large businesses and public spaces such as schools and organisation buildings. Stakeholders from the local community were invited and participates in this open day learning from the experiences in the other pilots and discussing potential involvement in similar activities in the post-project period.



Main Outcomes:

1. Experiences exchange between pilots and local Thermi community
2. Post-project exploitation potentials identified
3. Raising awareness in local community

9.2.3 Launch Event M26

Pilot launch event M26

During M26 a pilot launch event was conducted where users were introduced to the pilot process and prepared for the next stages of the pilot. Moreover, initial set of questionnaires on water awareness was answered and initial feedback on post-project exploitation strategies was gathered. Finally end-users were introduced to the apps platform and access credentials were distributed to end users in order to access the platform. As a test case one of the participants volunteered in order to design the first dashboard applications for his/her household as a demo for the rest of the participants.



Main outcomes

1. Initial water awareness level gathered
2. Initial feedback on post project exploitation
3. Introduction to the applications platform and dashboards design process

9.2.4 Continuous pilot participants' involvement M28-M36

Throughout the pilot period we gradually introduced new features and apps to end-users to attract increasing engagement. This process took place with short newsletters directed to the participant households. This way users were constantly kept engaged and involved with the applications platform. An easy feedback mechanism was also provided through responding to the newsletter emails. A total of 10 newsletter campaigns were delivered and in average about 50% of recipients opened their emails.



Main Outcomes:

1. Users reported that the newsletters increased their interest for the features presented
2. Users demonstrated an increase on engagement with the apps at least for the periods close to newsletter delivery.

9.3 NUI Galway

9.3.1 Stakeholders Interviews/Consultation

Initial Internal Stakeholder Interviews M5

Internal stakeholder interviews were held in NUI Galway in M5, during these interviews, the Engineering Building Manager and Building Services Manager for the College were introduced to the Waternomics concept and invited to share their requirements for a water information system. The Waternomics Project Team are based in the Engineering Building and comprise students, academic staff and research staff and as such represent and present the views of these stakeholders.

Main outcomes:

- Features list for end-users from The Engineering Building Manager's perspective and from that of the University's Building Services Manager

External Stakeholder Interviews M5 – M11

External Stakeholder Interviews were held with Irish Water, Irish Water Headquarters, Dublin (M5), Arrabawn Dairies, Nenagh, Co Tipperary (M5) and Water Systems and Services Innovation Centre (WSIC), Nimbus Embedded Systems Research Centre, Cork (M11). The interviews provided excellent opportunity for dissemination, knowledge sharing and coordination of ideas and identification of common goals. The information gathered at these meetings informed the development of the Waternomics systems to satisfy the initial project commitments and also future adaptability for a wider market.

Main outcomes:

- Collaborative opportunities for Waternomics potential results
- Water Utility perspective

Stakeholder Questionnaires M25 – M33

A questionnaire survey was developed to identify the attitudes and behaviour of students in terms of their water usage. The questionnaire was carried out with 70 1st year undergraduate engineering students based in the Engineering Building. A control group of undergraduate students based in an area of the University campus remote from the Engineering Building was also completed the questionnaire survey. These questionnaires will be repeated at intervals following exposure to the Waternomics Platform at the NUIG Pilot Site.

Main outcomes:

- Baseline information regarding water use behaviour, attitudes towards and awareness of water conservation.
- Data regarding the effectiveness of the platform at improving awareness of water conservation

Internal Stakeholder Consultation M17-M20

A series of informal consultations were held with both the Building Manager and Building Services Engineer to approve the metering installation proposals at the Engineering Building and the preparation of a contract to carry out the necessary enabling and installation works.

Main outcomes:

- Completion of metering programme to satisfaction of the Engineering Building Manager and the University's Building Services Manager

9.3.2 Demonstrations and Open Days

Waternomics – ICT for Water Resources Management Lecture M10.

The Waternomics concepts were presented at a Lecture in M10, Waternomics – ICT for Water Resources Management. This lecture was a joint NUIG and Engineers Ireland event held in the Engineering Building attended by staff and students of Engineering and Engineers from the West of Ireland.

Main outcomes:

- Showcasing the work of the Waternomics Project
- Highlighting the issue of water management and the aims of the project in developing ICT tools to encourage and facilitate this aim

Water Awareness Workshops M26/M27

A number of Water Awareness workshops were held during March and April 2016 introducing the concept and aims of Waternomics. The workshops were held in the NUI Galway Pilot and these are described earlier in this document as part of the training and education activities. Students participating in the workshops completed questionnaires before and after the event to gather information water use behaviour, attitudes towards and awareness of water conservation.



Figure 21: Water Awareness Workshop at NUIG

Main outcomes:

- Highlighting the issue of water management and the aims of the project in developing ICT tools to encourage and facilitate this
- Baselining information regarding water use behaviour, attitudes towards and awareness of water conservation.

9.3.3 Launch Events

NUI Galway Managers Dashboard Launch M31

In early August, the NUIG Managers Dashboard was launched at a Training Workshop at the Engineering Building, the workshop followed a brief introduction and project recap, both presented by members of the NUIG and U4 project team. The attendees were introduced to the functionality of the applications and in particular some of the bespoke apps created for the pilot site such as, the Biggest User App, Rainwater Harvesting App, Meter Comparison App and Water Retention Observer App. The Engineering Building Manager and the University's Senior Building Services Manager attended. The feedback at the event was very positive and it was followed by newsletters in the following weeks.



Figure 22: NUIG Launch Events

Target Group

All academic, research, management and maintenance.

Main Outcomes

- Following the workshop, attendees will be able to access and use the Waternomics Platform and its data and understand what it can offer to all users

NUI Galway Public Dashboard Launch M31

In early September 2016 at the start of the academic year, a presentation on the Waternomics Projects was given to the new 2016/2017 1st Year Engineering Class to bring attention to some of the project innovations that are available at the pilot site and encourage interaction of users. This group would later (M36) take part in post intervention awareness surveys planned and these results compared to those (pre-intervention) from the 2015/2016 1st Year Engineering class carried out in M24. Student newsletter followed the launch event.

Target Group

All first year engineering students

Main Outcomes

- Following the launch presentation, attendees were aware of the project innovations and opportunities to interact with them.

9.3.4 User Interactions

Continued User Participation M28-M33

Throughout the pilot period, additional features and apps were developed and introduced to end-users. Notification of additions were communicated by student and manager e-newsletters providing updates to pilot users as well as through notifications on the platform itself. Specific additional training was also provided as necessary. Easy feedback mechanisms from the platform through dedicated email waternomics@nuigalway.ie and responding to the e-newsletters emails were provided in order to gather reactions to new features and apps introduced each time.

Main Outcomes:

1. Continuous involvement of end users
2. Continuous engagement with the apps platform and feedback gathered
3. A relevant, responsive systems that can evolve with user expectations and requirements



Figure 23: NUIG On-going User Interaction Specific Purpose Training and Student Newsletter

9.4 Coláiste na Coiribe

9.4.1 Stakeholders Interviews

Internal Stakeholders M5

Internal stakeholder interviews were held in the school in M5, during these interviews, the School Principal and one of the Teachers were introduced to the Waternomics concept and invited to share their requirements for a water information system.

Main outcomes:

- Features list for end-users from the School Management's perspective

Stakeholder Questionnaires M26 – M33

A questionnaire survey was developed to identify the attitudes and behaviour of students and teachers in terms of their water usage. The questionnaire was carried out by 15 teachers and 100 post primary students based in Coláiste na Coiribe. These questionnaires were repeated following a period of exposure to the Waternomics Platform.

Main outcomes:

- Baseline information regarding water use behaviour and attitudes towards and awareness of water conservation.
- Assess changes in water use behaviour and attitudes towards and awareness of water conservation

Internal Stakeholder Consultation M24 – M31

A series of informal consultations were held with both the school Principal and Building Contractor responsible for the installation of metering and public dashboard display at the new school building.

Main outcomes:

- Agreement regarding metering and information display programme to satisfaction of the School Authorities

9.4.2 Demonstrations and Open Days

Waternomics Workshops M26/M27

Two Water Awareness workshops introducing the concept and aims of Waternomics were held in Coláiste na Coiribe with post primary students in March 2016, these are described earlier in this document as part of the training and education activities. Students participating in the workshops

completed questionnaires before and after the event to gather information water use behaviour, attitudes towards and awareness of water conservation. Students from Coláiste na Coiribe also attended a Waternomics Transition Year Workshop held in NUIG in April 2016.



Figure 24: Water Awareness Workshop at Coláiste na Coiribe

Main outcomes:

- Highlighting the issue of water management and the aims of the project in developing ICT tools to encourage and facilitate this
- Introducing the concept of the role of the individual in water management
- Baselining information regarding water use behaviour, attitudes towards and awareness of water conservation.

Student Internship M29

Two students from Coláiste na Coiribe and another local secondary school undertook a summer internship project at NUIG. The internships were for a period of 1 week in June 2016. The students undertook data analysis work with the Waternomics Project Team and participated in user studies for the developing public dashboard applications. Students should have shown an interest in the Waternomics Project and have attended the Water Aware and Waternomics App Creator Workshops. Application process will be advised.

Target Group

Transition and 5th year students

Main Outcomes

- This scheme will further raise awareness of the Waternomics Project and its direct relevance to the students at Coláiste na Coiribe.
- Students completing the internship programme gained valuable experience in a research environment familiarity with data collection, analysis and reporting.
- The students prepared a scientific poster on water usage at the pilot site which is now on display in school building.

9.4.3 Launch Event

Coláiste na Coiribe Launch M32/33

The Coláiste na Coiribe Managers Dashboard was launched at a Training Workshop at the Engineering Building in M32, the workshop followed a brief introduction and project recap, both presented by members of the NUIG and U4 project team. The attendees were introduced to the functionality of the

applications and in particular some of the bespoke apps created for the pilot site. The feedback at the event was very positive and it was followed by e-bulletins in the following weeks.

The manager's dashboard launch event also facilitated final review installation approval of the public dashboard application accessible by students via a wall mounted tablet in the canteen area of the school.

The public dashboard application was launched in M33 at the school and following a recap of the project, students were invited to interact with the public dashboard and rewards were given to those who could relay a new fact etc. learned from their interaction.

Target Group

All students, teaching/maintenance staff.

Main Outcomes

- Following the workshop, attendees are able to interact with the public dashboard application to query water data.
- Students are encouraged to use the platform data to undertake projects at school and as the basis for national science competition. Contact details are given on the public dashboard screen.



Figure 25: Coláiste na Coiribe Launch

9.4.4 On-going User Interactions

Continued User Participation M28-M36

Throughout the pilot period, additional features and or improvements developed were introduced to end-users. Notification of additions were communicated by email to pilot users as well as by and notifications on the platform itself.

A short pencil survey questionnaire was also completed by students at the school following the public dashboard launch regarding their response of the application dashboard. In M36, Post intervention water awareness surveys were conducted with approximately 100 students in the junior and senior classes at the Pilot site and the results of these surveys are reported in D5.2 Pilot Report.

Main Outcomes:

- Continuous involvement of end users
- Continuous engagement with the apps platform and feedback gathered
- A relevant, responsive systems that can evolve with user expectations and requirements
- Impact analysis

10. Measurements/KPIs of the Dissemination Activities

As a regular activity through the duration of the project, the consortium will record details from every dissemination activity carried out.

To measure the progress and in the end the success of dissemination activities in Waternomics we defined a set of Key Performance Indicators (KPIs). These indicators will be quantified regularly and used to analyse the progress and the success, or failure, of the dissemination activities as described in the dissemination plan (Section 3). Furthermore, by monitoring these KPIs we will be able to identify where we can rework and/or refine activities aimed at specific stakeholders to ensure success in the future. In the following, we describe the KPIs to be considered, giving an estimated metric to evaluate them.

Table 22 – KPI's and measurements of dissemination activities

Campaign	Period	Channel	Criteria	End of campaign target	31-1-2015	31-1-2016	31-1-2017	Status
1 – Kick-off (finished)	M1-M12	Website	Sessions waternomics.eu	M.2 (Y1)	1.630	7.538	12.896	Excellent
			Unique visitors waternomics.eu	750 (Y1)	818	5.632	9.586	Excellent
			Page views waternomics.eu	4000 (Y1)	4.152	14.418	24.892	Excellent
		Social media	Twitter followers of @waternomics_eu	100 (Y1)	78	199	649	Good
			Tweets from @waternomics_eu	150 (Y1)	68	231	632	Good
		Press/media	Number of press releases	1 (Y1)	1	1	1	Good
			Number of interviews	0	2	2	3	Excellent
			Number of radio/tv performances	0	0	1	1	Good
2 – Waternomics policies	M6 – M36	Workshops	Number of workshops held	10	4	5	10	Good
			Number of participants in workshops	100	61	64	96	Good
		Publications	Number of published academic papers	30	2	22	30	Good
3 – Linate pilot	M18 – M30	Stakeholder meetings	Number of meetings	15	6	13	16	Excellent
			Number of participants	150	45	100	160	Excellent
		Training sessions	Number of training sessions	2	0	0	2	Good
			Participants in training sessions	20	0	0	30	Good
		Presentations	Number of presentations	5	0	4	8	Excellent
		Press/media	Radio interviews	1	0	1	1	Good
			Television performances	1	0	1	1	Good
4 – Thermi pilot	M18 – M30	Stakeholder meetings	Number of meetings	15	7	17	32	Excellent
			Number of participants	150	32	47	90	Good
		Training sessions	Number of training sessions	2	0	0	2	Good
			Participants in training sessions	20	0	0	15	Good
		Presentations	Number of presentations	5	1	2	5	Good
		Press/media	Radio interviews	1	0	0	0	Poor
			Television performances	1	0	0	0	Poor
5 – NUIG pilot	M18 – M30	Stakeholder meetings	Number of meetings	15	14	14	19	Excellent
			Number of participants	150	70	70	180	Good
		Training sessions	Number of training sessions	2	0	0	2	Good
			Participants in training sessions	20	0	0	60	Excellent
		Presentations	Number of presentations	5	1	3	12	Excellent
		Press/media	Radio interviews	1	0	0	0	Poor
			Television performances	1	0	0	0	Poor
6 – CnaC pilot	M18 – M30	Stakeholder meetings	Number of meetings	15	5	5	16	Excellent
			Number of participants	150	15	15	135	Good
		Training sessions	Number of training sessions	2	0	0	4	Good

Campaign	Period	Channel	Criteria	End of campaign target	31-1-2015	31-1-2016	31-1-2017	Status
		Presentations Press/media	Participants in training sessions	20	0	0	30	Good
			Number of presentations	5	0	2	5	Good
			Radio interviews	1	0	0	0	Poor
			Television performances	1	0	0	0	Poor
7 – Waternomics exploitation	M24 – M36	Stakeholder meetings Events	Number of stakeholders interviews	50	30	38	52	Excellent
			Number of fairs where Waternomics is represented	5	0	3	6	Excellent
			Number of flyers distributed at events	1000	400	750	1100	Excellent
			Number of demos/test with external stakeholders	5	0	4	7	Excellent
8 – Waternomics for scientists	M13 – M36	Publications	Number of articles in peer reviewed journals	5	0	0	3	Good
			Number of published academic papers	35	2	22	25	Good
		Presentations Ict4water	Number of presentations at conferences	30	10	28	37	Excellent
			Attended ict4water cluster meetings	90%	100% (3)	100% (6)	100% (9)	Excellent
			Sessions ict4water.eu	10.000	911	7.033	13.143	Excellent
			Unique visitors ict4water.eu	10.000	470	5.714	10.033	Excellent
			Page views ict4water.eu	18.000	1.293	8.819	19.807	Excellent
			Published ICT4Water newsletters	8	1	6	9	Excellent
			Subscribers ICT4Water newsletter	150	64	147	170	Excellent
			Opens ICT4Water newsletter	5000	518	3.215	4.240	Good
			Twitter followers of @ict4water_eu	250	No data	248	550	Excellent
			Tweets from @ict4water_eu	365	No data	261	1706	Excellent
9 – Waternomics results	M13 – M36	Website	Sessions waternomics.eu	10.000	1.630	7.538	12.896	Excellent
			Unique visitors waternomics.eu	10.000	818	5.632	9.586	Good
			Page views waternomics.eu	35.000	4.152	14.418	24.892	Good
			Sessions ict4water.eu	10.000	911	7.033	13.143	Excellent
			Unique visitors ict4water.eu	10.000	470	5.714	10.033	Excellent
			Page views ict4water.eu	18.000	1.293	8.819	19.807	Excellent
		Blog Social media	Number of blog posts waternomics.eu	50	10	25	61	Excellent
			Twitter followers of @waternomics_eu	250	78	199	649	Excellent
			Tweets from @waternomics_eu	550	68	231	632	Excellent
			Twitter followers of @ict4water_eu	250	No data	248	550	Excellent
			Tweets from @ict4water_eu	365	No data	261	1706	Excellent
			Number of presentations on Slideshare	15	3	9	41	Excellent
			Number of views on Slideshare	2.500	117	1.940	7.741	Excellent
		Newsletter	Number of articles on Flipboard	150	100	120	121	Good
			Number of viewers on Flipboard	400	281	394	579	Excellent
			Number of videos on Youtube	5	0	3	31	Excellent
			Number of views on Youtube	500	0	304	1.009	Excellent
			Published Waternomics electronic newsletters	6	1	2	3	Poor
			Subscribers Waternomics electronic newsletter	150	41	53	53	Poor
			Opens Waternomics electronic newsletter	1000	55	109	151	Poor
			Distributed paper newsletters	150	66	66	223	Excellent

11. Summary

Dissemination activity in Waternomics was manifold. In year one, we set up the technical architecture, social networks, created dissemination material and engaged in dissemination activities via conferences, participation at events and organization of round table sessions. In year two our goal was to promote and share Waternomics intermediate results and to involve end-users and other pilot stakeholders in the pilot design activities, letting them interact with the technical staff of the project. In the final year, our goal was to promote a select number of results that have high impact. In particular, the results of the four pilots and the exploitable results have been brought under the attention of the appropriate stakeholders, facilitating sustainable use of project results..

11.1 ICT4Water

The ICT4Water cluster is a collection of European research projects, co-funded by the European Commission, all conducting research in the area of smart water systems. The Waternomics project is member of this cluster and has put much effort into the development and maintenance of the ict4water website, the preparation and publication of the ict4water newsletter and the dissemination of the cluster activities. Waternomics has deliberately chosen to disseminate through the ICT4Water channels because it was expected that the impact of combined dissemination would be much larger than the impact of dissemination activities from Waternomics as an individual project. This has proven to be true by the participation of ICT4Water in the ICT2015 event, where the cluster was invited to showcase its work and results at the off-site pavilion, located at the Praça do Comércio.

11.2 Dissemination results

Overall, the Waternomics project has met, and sometimes exceeded, its targets, as can be seen in Table 22. Some highlights are:

- **Exploitation dissemination.** From the beginning, the project has actively engaged with representatives from industry and government. As a result, the number of post-project exploitation activities and follow-up business initiatives is relatively high.
- **Stakeholder involvement.** On all pilot sites events have been organised where a broad range of stakeholders could interact with the Waternomics platform and project members. These events provided valuable feedback for the project team which has been used to improve the Waternomics applications.
- **Online campaign.** The online presence of the Waternomics project has attracted a large audience. During the project, results were shared through various digital channels like Twitter, Flipboard, Slideshare, YouTube and the project website. Especially the presentations on Slideshare, which were viewed nearly 8.000 times, attracted more attention than expected.

Appendix A – Brochure



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Wateronomics Smart Water Management

The global water challenge

- 3% of the water on earth is freshwater
- 9 Billion People (2015)
- 1 billion people (2050)

Smart water systems save water

- Smart water systems enable new value added services
- Linking data results in meaningful water information
- Informed and enabled consumers value water more
- Smart water systems increase operational efficiency
- Real-time monitoring and control enables optimization of smart water systems
- Standards are required for more roll-out of smart water systems

Partners: IFC, The Guller, NUTRA, TU Delft, SIA, REM, VPEC, UNESCO-IHE, etc.

Website: www.wateronomics.eu



Appendix C – Waternomics.eu statistics



Figure 26 – Usage statistics waternomics.eu



Figure 27 – Geographical spread visitors waternomics.eu

Appendix D – Stakeholder interviews

Date	Stakeholder	Spoken with	Role
18-2-2014	HydroThane STP	A Mulder	Service Director
28-3-2014	Veolia Water Solutions and Technologies	D. Korthout	Business Developer
8-4-2014	MARS	B. Blom	Sustainability Manager Continental Europe and Eurasia
14-4-2014	Aviko	C. Bollen	Sustainability Manager
8-5-2014	Eindhoven Airport	G. Mols	Policy Officer Corporate Responsibility
14-5-2014	Theme park Efteling	I. Südmeijer	Beleidsmanager Ruimte en Duurzaamheid
20-5-2014	Family hotel	anonymous	Owner
4-6-2014	Irish Water	Kate Ganon	Water conservation strategy specialist
4-6-2014	Irish Water	Kate Gallagher	Water conservation strategy specialist
13-6-2014	Arrabawn Dairies	Shane Mulcahy	Environmental Technician
8-9-2014	Municipality of Roccarainola	Avv. Raffaele De Simone	Major
16-10-2014	MWP Engineering Consultants	Neilus Hunt -	Associate Director
22-10-2014	Waternet	JP vd Hoek	Executive Officer Strategic Centre
5-11-2014	CGI	E vd Laan,	business development manager
5-11-2014	Siemens	I Ljubenkovic	Consultant Communications
6-11-2014	Brabant Water	J. van Erp	Adviser Meter Department
12-11-2014	SOHO salon	W van Gool	Owner
13-11-2014	NUIG	Aodh Dalton -	CTO, NUIG, Engineering Building
17-11-2014	NUIG	Noel O'Connor -	Building Services Manager, NUIG
24-11-2014	Water Systems and Services Innovation Centre (WSIC)	Aoife Kyne -	Senior Research Engineer
3-12-2014	NUIG	Michael Curran -	Building services assistant Mgr., NUIG
12-12-2014	Arrabawn Dairies	Shane Mulcahy	Environmental Technician
19-12-2014	Boston Scientific	Noel Finnerty,	Global Facilities Manager
29-5-2014	Veolia Water	Martin Phelan	Managing Director
29-5-2014	Amgen Pharmaceuticals	Mike Corcoran -	Utilities Lead
29-5-2014	Renergise	Brendan O'Sullivan	CEO
29-5-2014	Larsen Water Management	David Smith -	CEO
29-5-2014	Shay Murtagh Ltd.	Raymond Smyth	Sales Manager
18-9-2014	PowerSavvy	Colm Rochford -	Founder and CEO
27-1-2015	Vitens Evides International	A. Mels	Regional Director
20-2-2015	Smart Homes	Ad van Berlo	Research Manager
24-2-2015	Smart Homes	Peter Brils	Project Manager
6-7-2015	Duneworks	Ruth Mourik	CEO
23-9-2015	Chematronics	B Arts	Business Developer
20-10-2015	Arkema		Manager
	Brabant Water		Manager
	Green Schools		Manager
19-2-2016	Yes Delft	M. Kreijns	Valorisation Manager
27-5-2016	Simaxx	W. van der Plas	Business Development Manager
26-9-2016	S-Clusiv	C. Custers	Locatie manager

Appendix E – Paper version of Waternomics newsletter



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