the smartH2O project

A European project on water sustainability

BUSINESS ECOSYSTEMS REPORT

SmartH2O

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Summary of this report:...............This deliverable provides a first attempt at the identification of the possible business models to be used in the exploitation of SmartH2O. The report builds on the market analysis provided by D8.1 and it outlines a set of business plans corresponding to the various implementation and exploitation alternatives.

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SEVENTH FRAMEWORK PROGRAMME

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Executive Summary

This document is the restricted part of Deliverable **D8.5, Business ecosystems report**, which completes the public part, and is submitted as D8.5.1. According to the DoW, D8.5 has the following goals.

D8.5) Business ecosystems report: This deliverable provides a first attempt at the identification of the possible business models to be used in the exploitation of SmartH20. The report builds on the market analysis provided by D8.1 and outlines a set of business plans corresponding to the various implementation and exploitation alternatives. An update of this deliverable will be produced at month 36, focussing on the various geographic areas of Europe, starting from the countries of the project partners.

where D8.1 was defined as follows.

D8.1) Early Exploitation plan: In this deliverable each partner describes its initial and expected plans to exploit the results and the foreground assets that will be produced during the project. This deliverable will include the identification of the project results and classify them according to their exploitation potential.

A major advantage of smart metering over traditional metering is the opportunity to create win-win situations both for utilities and for the start-ups that develop innovative demand management tools for these utilities. This deliverable explores the advantages for both sides, and its main findings (from both the public and restricted parts) are that:

- This deliverable presents a (confidential) return-on-investment analysis of smart metering.
- Its results suggest that switching from traditional metering to smart metering is cost-beneficial, but switching from no metering to smart metering is not in itself. Yet, benefits are expected to represent around 80% of the costs, which is not the case of supply-side investment, which usually yield no benefit in themselves.
- Demand-side management can markedly improve the benefits of smart metering, even when assuming its effects are modest. This deliverable considers two demand management strategies: the integration of the SmartH2O platform and dynamic pricing.
- This is a favourable context for the assets developed for commercial use in the SmartH2O project: 1) the SmartH2O platform, 2) the “Drop!” game and the online app, and 3) the smart meter data management component of the platform, which can also be sold a s a standalone solution.
- Business plans are outlined for these main assets. Figures given in that context should not be understood as commitments, but as the result of perspectives that have to be precised and confirmed in the third and final year of the project.
- Yet, the overall picture from these business plans and from other sections of the project is that SmartH2O assets, starting with the platform as its core asset, are well-positioned to take full advantage of the growing implementation of smart water metering by utilities.
- This deliverable has been the opportunity to develop a methodology that uses state-of-the-art business models and financial plans for SaaS (Software as a Service) in order to facilitate the future commercial development of the SmartH2O platform and its components.

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1. Introduction

This introductory section not only outlines the contents of D8.5.1, but also situates the confidential contributions to this document with respect to their public counterparts, found in D8.5.1.

Besides this introduction, the restricted part of deliverable D8.5.1 is organised into five main sections. For each section, there is a public part to be found in the public part of deliverable D8.5, and a confidential part (Sections 2 to 6). The deliverable explores business implications for the two types of actors that are to benefit most from smart metering: utilities and the IT companies that can propose them solutions to manage their data and engage their customers.

Section 2 of the public part of D8.5 puts in context the business ecosystem at the project-wide level. This includes updates to the technology and regulation watch, and documenting examples of successful startups in the sector and relating their strengths and weaknesses to those of the assets being built in the SmartH2O project. It also includes a list of business actors related to smart metering and / or assets that the SmartH2O project is building. The confidential part of that Section is Section 2, which enumerates the business contacts of the SmartH2O project and all its partners. It is confidential because some of this contacts are of strategic nature regarding the exploitation of SmartH2O assets; others are nominative.

Section 3, along with Section 3 from the public part of the deliverable, explores the implications of smart metering for utilities. This section devises a general methodology to compute the return on investment of smart metering. This ROI can be evaluated first without taking into account any demand management strategy. This basic cost-benefit analysis is completed by factoring in the consequences of integrating a technological solution such as the SmartH2O platform, and by outlining the financial implications of dynamic pricing. Section 3 is a confidential section because it implies computations that use sensible information for utilities, especially TWUL and EMIVASA. The public part recounts the experience of the three utilities involved in the project, namely TWUL, SES, and EMIVASA. These experiences outline the expected benefits but also the challenges associated with adopting smart metering.

Then, Sections 4 to 6 are the confidential quantitative projections for the three assets of the SmartH2O project. They complete the business plans outlines presented in Section 4 to 6 of the public part of D8.5. The figures given in Sections 4 to 6 should not be interpreted as a commitment from the project partners. Rather, they are merely indicative of what they expect can happen if they follow the strategy exposed in this deliverable. While they hope to not be held up by unpleasant surprises, unexpected adverse events happen routinely in the life of a business. Likewise, they hope their evaluations correspond to the market reality, but project partners and reviewers alike should keep in mind that evaluations that looked reasonable and justified beforehand sometimes prove to be overly optimistic *a posteriori.*

2. Business ecosystem context

This confidential part of the “Business ecosystem context” section lists the business ecosystem contacts that have been made in the context of SmartH2O. They are two lists, one of the contacts with whom actions have been undertaken, thus warranting a confidential status in some cases (Section 2.1); and one with names of professionals met at events (e;g. European Utility Week in Vienna; Section 2.2).

2.1 List of business ecosystem contacts with actions undertaken

For each contact, the following items are detailed:

- Name and origin (country) of entity;
- Nature (e.g. type of business or public sector institution);
- The project partner that contacted this entity;
- Reason of contact;
- Timeline (if applicable).

Table 1. List of business ecosystem contacts

Name and origin of entity	**Aquametro AG**, Switzerland
Nature	Smart meter supplier
Contacted by	SES
Reason for contact	Supply of the water meters and wifi dongle
Timeline	Sept 2014 – Dec 2015
Name and origin of entity	Azienda Comunale Acqua Potabile Pedemeonte, Switzerland
Nature	Public water utility
Contacted by	SES
Reason for contact	• Providing customers with data; • Water meter installation.
Timeline	Sept 2014 – ongoing
Name and origin of entity	Echelon Corp. (Europe)
Nature	Smart meter supplier
Contacted by	SES
Reason for contact	Supply of the electricity meters and concentrators
Timeline	Sept 2014 – ongoing

Name and origin of entity	Arqiva, UK
Nature	• Communication infrastructure; • Data capture and provision; • Service Management
Contacted by	TWUL
Reason for contact	15-year Framework Contract awarded through OJEU tender process. Provision of a fully functioning smart metering data capture system capable of handling 3 million meters with hourly data including meter readings and alarms.
Timeline	2015-2030
Name and origin of entity	Sensus, USA
Nature	Sub-contractor to Arqiva, specialized in: • Digital water meters; • Communication equipment; • Communication protocols;
Contacted by	TWUL
Reason for contact	Provision of a range of digital meters in sizes 15mm to 150mm and associated communication equipment that have a guaranteed 15-year life.
Timeline	2015-2030
Name and origin of entity	City of Milton Keynes, United Kingdom
Nature	Public authority
Contacted by	EIPCM
Reason for contact	CAPS project POWER, which seeks to build a digital social platform around water-related issues, including water efficiency. Transfer of knowledge and experience with knowledge visualization and gamification from Smart H2O. Engagement with citizens and civil workers to elicit needs and requirements, with Smart H2O ideas and requirements process as a basis.
Timeline	December 2015 onward
Name and origin of entity	Companyia D'aigues De Sabadell Sa., Spain
Nature	Water utility
Contacted by	EIPCM
Reason for contact	CAPS project POWER.

Timeline	December 2015 onward
Name and origin of entity	**Anglian Water**, United Kingdom
Nature	Water utility
Contacted by	EIPCM
Reason for contact	Requirements elicitation in CAPS project POWER.
Timeline	December 2015 onward
Name and origin of entity	**BASEFORM**, Portugal
Nature	Developer of water supply and wastewater/stormwater management systems
Contacted by	EIPCM
Reason for contact	CAPS project POWER.
Timeline	December 2015 onward
Name and origin of entity	City of Haßfurth, Germany
Nature	Public authority
Contacted by	EIPCM
Reason for contact	Follow-up H2020-proposal enCOMPASS, transferring knowledge in the water domain to energy behavior while integrating sensing and home automation technology.
Timeline	September 2015
Name and origin of entity	Hagihon, Israel
Nature	Water utility for Jerusalem
Contacted by	EIPCM
Reason for contact	CAPS project POWER.
Timeline	December 2015 onward
Name and origin of entity	Leicester City Council, United Kingdom
Nature	Public authority
Contacted by	EIPCM
Reason for contact	CAPS project POWER.
Timeline	December 2015 onward

Name and origin of entity	Climate Alliance, Europe
Nature	Network of European cities and municipalities
Contacted by	EIPCM
Reason for contact	CAPS project POWER.
Timeline	December 2015 onward
Name and origin of entity	Naturschutzbund Deutschland, Germany
Nature	Environmental association (NGO)
Contacted by	EIPCM
Reason for contact	Follow-up H2020-proposal enCOMPASS, transferring knowledge in the water domain to energy behavior while integrating sensing and home automation technology.
Timeline	September 2015
Name and origin of entity	Artlantis srl, Italy
Nature	Commercial Software house
Contacted by	Moonsubmarine
Reason for contact	Artlantis is a young and agile software house serving many clients in Italy. The company has many connection in the online business and may be interested in selling the white labeled version of our Drop! The game.
Timeline	November 2015 on
Name and origin of entity	Kalikantus srl, Italy
Nature	Commercial Software house
Contacted by	Moonsubmarine
Reason for contact	Kalikantus and his CEO Fabrizio Calì are leader in the Italian MMO game market with many games published across Europe. We will talk with them in order to design a distribution strategy for the mobile app.
Timeline	May 2016
Name and origin of entity	Fabio Gadina, Italy
Nature	Online Marketing Consultant
Contacted by	Moonsubmarine
Reason for contact	Fabio Gadina has a huge network of clients that may be interested in the white labeling of Drop! The Game. He will help us putting

	together a commercial strategy enabling us the exploitation towards private and public company in Italy.
Timeline	Jan 2016
Name and origin of entity	Kaleidos Publishing, Italy
Nature	Boardgame company
Contacted by	Moonsubmarine
Reason for contact	Kaleidos Publishing is a new and innovative company owned by the renown game designer Spartaco Albertarelli. He will be the key in reaching the Italian and European Distribution channel for board games.
Timeline	November 2015 on
Name and origin of entity	Sophisticated Games, UK
Nature	Board Games Company
Contacted by	Moonsubmarine
Reason for contact	Sophisticated Games is a Uk based company specialized in Board Games. They own right for J.R.R. Tolkien's The Lord of the Rings and will be our main distributor in the UK.
Timeline	Sept. 2016
Name and origin of entity	Dal Negro Spa, Italy
Nature	Card maker company
Contacted by	Moonsubmarine
Reason for contact	Dal Negro is the most important Italian and one of the historical card makers in the world. They are recently diversifying their production and revenues channels and a card game with a digital extension could be an add-on for them
Timeline	Sept. 2016
Name and origin of entity	**Itron**, United States
Nature	Water meters and communication infrastructure
Contacted by	EMIVASA
Reason for contact	EMIVASA installed several thousands of those meters
Timeline	N/A

Name and origin of entity	Contazara, Spain
Nature	Water meters and communication infrastructure
Contacted by	EMIVASA
Reason for contact	EMIVASA installed several thousands of those meters
Timeline	N/A
Name and origin of entity	Abering, Sapin
Nature	Water meters and communication infrastructure
Contacted by	EMIVASA
Reason for contact	EMIVASA installed several thousands of those meters
Timeline	N/A
Name and origin of entity	Sensus, United States
Nature	Water meters and communication infrastructure
Contacted by	EMIVASA
Reason for contact	EMIVASA installed several thousands of those meters
Timeline	N/A
Name and origin of entity	Sappel, Brazil
Nature	Water meters and communication infrastructure
Contacted by	EMIVASA
Reason for contact	EMIVASA installed several thousands of those meters
Timeline	N/A
Name and origin of entity	Elster, United States
Nature	Water meters and communication infrastructure
Contacted by	EMIVASA
Reason for contact	EMIVASA installed several thousands of those meters
Timeline	N/A

Name and origin of entity	Ikor, Spain
Nature	Water meters and communication infrastructure
Contacted by	EMIVASA
Reason for contact	EMIVASA installed several thousands of those meters
Timeline	N/A
Name and origin of entity	Arson, Peru
Nature	Water meters and communication infrastructure
Contacted by	EMIVASA
Reason for contact	EMIVASA uses their technology to read Sensus and Elster meters.
Timeline	N/A
Name and origin of entity	Vodafone, Spain
Nature	Communication solutions
Contacted by	EMIVASA
Reason for contact	Collaborating/seeking the development of M2M solutions
Timeline	N/A
Name and origin of entity	University of California Davis, United States
Nature	Public research and higher-education institution
Contacted by	POLIMI
Reason for contact	Platform presentations – Research collaboration – stay of Andrea Cominola as a visiting PhD (Dec 2015 to May 2016)
Timeline	2014-present
Name and origin of entity	Center for Water-Energy Effficiency, United States
Nature	Research centre at UC Davis
Contacted by	POLIMI
Reason for contact	Research collaboration on user modelling
Timeline	2014-present

Name and origin of entity	Environmental Defense Fund, United States
Nature	Non-profit environmental organisation (one of the world's largest)
Contacted by	POLIMI
Reason for contact	Possible research collaboration
Timeline	Upcoming
Name and origin of entity	**WaterSmart**, United States
Nature	Software company
Contacted by	POLIMI
Reason for contact	Opportunities for data and algorithm exchanges – Participation to the Summer School
Timeline	August 2016 (Summer school)
Name and origin of entity	Aquarimat,Israel
Nature	Hi-tech company specialised in smart water management and control
Contacted by	POLIMI
Reason for contact	Prospective collaboration
Timeline	N/A
Name and origin of entity	Public Utility Board, Singapore
Nature	National water agency
Contacted by	POLIMI
Reason for contact	Platform presentation in order to set up a more formal collaboration
Timeline	March 2016
Name and origin of entity	European Utility Week, Austria
Nature	Event for the utility sector (worldwide)
Contacted by	POLIMI
Reason for contact	Project presentation and networking
Timeline	3-5 November 2015 (Vienna)
Name and origin of entity	WaterWise, UK
Nature	Non-profit for water efficiency

Contacted by	UOM
Reason for contact	Organisation of the SmartH2O final dissemination event at the annual WaterWise conference in March 2017.
Timeline	March 2016 - present
Name and origin of entity	WATERNOMICS, Europe
Nature	Water Cluster FP7 project
Contacted by	SUPSI
Reason for contact	Prospective collaboration
Timeline	2016
Name and origin of entity	DAIAD, Europe
Nature	Water Cluster FP7 project
Contacted by	SUPSI
Reason for contact	Retrieval of information of Amphiro b1 devices to use as rewards on the Swiss case study / Participation at the SmartH2O summer school
Timeline	2015-present
Name and origin of entity	Amphiro, Switzerland
Nature	Water efficiency company (faucets)
Contacted by	SUPSI
Reason for contact	Purchase of Amphiro b1 devices to use as rewards on the Swiss case study.
Timeline	2015 - present
Name and origin of entity	ISS-EWATUS, Europe
Nature	Water Cluster FP7 project
Contacted by	SUPSI
Reason for contact	Participation at the SmartH2O summer school
Timeline	August 2016
Name and origin of entity	iWidget, Europe
Nature	Water Cluster FP7 project
Contacted by	SUPSI
Reason for contact	Participation at the SmartH2O summer

	school
Timeline	August 2016
Name and origin of entity	EFFINET, Europe
Nature	Water Cluster FP7 project
Contacted by	SUPSI
Reason for contact	Participation at the SmartH2O summer school
Timeline	August 2016
Name and origin of entity	Compania de Apa Oradea SA, Romania
Nature	Water Utility
Contacted by	SETMOB
Reason for contact	SmartH2O platform demo and evaluation
Timeline	Upcoming
Name and origin of entity	APA Nova SA Bucuresti, Romania
Nature	Water Utility
Contacted by	SETMOB
Reason for contact	SmartH2O platform demo and evaluation
Timeline	Upcoming
Name and origin of entity	ista ROMANIA SRL, Romania
Nature	Metering services for water utilities
Contacted by	SETMOB
Reason for contact	SmartH2O platform demo and evaluation
Timeline	April 2016 onward

2.2 Nominative business contacts

The Table below lists the names and companies of the people contacted in events such the European Water Utility Week, but with whom no formal action has been undertaken.

Name	Company	E-mail
Michele Pietrobon	WebRatio s.r.l.	michele.pietrobon@webratio.com
Mike J. Ballard **BSc (Hons)**	Oracle Corporation UK Ltd	mike.j.ballard@oracle.com
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Sotiris Efthimiou	Intelen, Inc	s.efthimiou@intelen.com
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Petru Hidis	Aquatim SA, Timisoara, Romania	office@aquatim.ro
Rob Costongs	C&H Maastricht, Nederlands	sales@stockmastereurope.nl

Ricki Korsholm	Kamstrup	rkk@kamstrup.com

Table 2. List of nominative business contacts

3. New utility business models

3.1 Introduction

This confidential section proposes a methodology to compute the return on investment (ROI) of smart metering. It builds on the analysis by Thames Water in Chapter 7 of their Water Resources Management Plan for the 2015-2040 period [Thames Water, 2014]. It considers the following two metering technologies:

- **Traditional Meter Reading**– a conventional meter is installed with a register dial. Meter reading is undertaken by a meter reader gaining physical access to the meter and visually recording the meter reading into an electronic meter reading data capture devices.
- **Smart Metering Infrastructure** – using a fixed network meter reading system (usually radio based), meters are read electronically and do not require a meter reader. Electronic readings are passed from the meter through to utility offices for billing and network management purposes. With these systems it is possible to collect more frequent data on consumption and alarm conditions which can be used to provide additional benefits.

The goal of this section is to compute the ROI of smart metering in three scenario types:

S1 Smart meters where there was no metering at all;

S2 Smart meters as a replacement of traditional meters;

S3 Results aggregating both current metering systems for TWUL.

S3 combines S1 and S2 and makes the ROI for all properties in the area of TWUL, because currently, there are both unmetered properties and properties with traditional metering (Table 35). Yet until Section 3.4.3, the computation of costs and benefits will only consider S1 and S2, and not S3.

The ROI calculation takes into account the benefits considered in [Thames Water, 2014], but gives a range rather than a single estimate. It then proceeds to add other potential benefits, not all of which can be evaluated precisely with the available data sources. Therefore, this analysis also points out which quantities water utilities would need to evaluate, should they wish to better evaluate the impacts of smart metering. Throughout this section, all monetary terms are given in euros (€) and should be interpreted as estimates, rather than as accurate figures to take at face value. This section is organized as follows

In addition to scenarios S1 to S3, four ROI calculations are proposed for each scenario, depending on whether smart metering is implemented alone or alongside other actions such as demand management. Demand management can be achieved through ICTs such as the SmartH2O platform, through dynamic pricing, or through the implementation of both schemes. Please keep in mind that the goal is not to provide an exact quantification, something that is extremely challenging to do *a priori* [Inman and Jeffrey, 2006]. Instead, the goal is twofold:

1) Provide a methodology for quantifying the benefits of engaging customers;
2) Understand how even minimal impacts on water consumption patterns can impact a utility's finances.

All in all, there are twelve calculations which are summarized in Table 3.

Table 3. ROI calculation scenarios considered in this analysis

	Smart metering alone (A)	Smart metering and platform (B)	Smart metering and pricing (C)	Smart metering, platform and pricing (D)
S1 No meter to smart meter	S1A	S1B	S1C	S1D
S2 Traditional meter to smart meter	S2A	S2B	S2C	S2D
S3 TWUL-wide (S1 + S2)	S3A	S3B	S3C	S3D

Scenarios also consider the growth of the urban area of the Greater London, and two annual growth rates are chosen. Both are derived from the Section 5 of [Thames Water, 2014] which tackles risk and uncertainty in future projections. The two growth scenarios are:

- An "average" scenario with a 0.6% annual population growth;
- A "high-end" scenario with a 1% annual population growth.

This analysis assumes that "population growth" is equivalent to "demand growth". This third type of scenario is designed with a suffix, respectively "-AV" and "-HE", for a grand total of 24 scenarios. For instance, scenario S1C-HE means that we are looking at:

- A transition from no metering to smart metering;
- The ROI calculations incorporates potential impact of dynamic pricing, but not those of the platform;
- A 1% annual population growth is considered.

The rest of the section is as follows. Sections 3.2 to 3.4 focus on the consequences of smart metering without the additional demand management options (this corresponds to type A scenarios). Thus, Section 3.2 and 3.3 enumerate the costs and benefits of smart metering, respectively. Section then, 3.4 makes the ROI calculations in type A scenarios (smart metering alone) for the Thames Water area. After that, financial implications of demand-side management policies are explored. On one hand, the expected costs and benefits of engaging customers through such a device as the SmartH2O platform are laid out, based partly on EMIVASA's current experience in Valencia, Spain (Section 3.5). On the other hand, possible benefits of dynamic pricing are enumerated, and some of them are quantified (Section 3.6). Finally, impacts of demand-side management policies on the ROI of smart metering are evaluated in Section 3.7.

3.2 Costs associated with smart metering

This section enumerates the costs of a smart metering infrastructure, for both S1 and S2 scenario types. This includes:

1) Smart meter installation costs;
2) Smart meter replacement costs;
3) Annual reading costs.

These costs are summarized in **Table 4** and Table 5.

Table 4. Costs in S1 type scenarios.

	Unit	Low	Median	High	Frequency
Installation	€ / property	400	450	500	once
Replacement	€ / property	200	250	300	every 15 years
Reading	€ / property	5	7.5	10	every year

Table 5. Costs in S2 type scenarios

	Unit	Low	Median	High	Frequency
Installation	€ / property	180	260	340	once
Replacement	€ / property	40	60	80	every 15 years
Reading	€ / property	-5	-7.5	-10	every year

3.2.1 Smart meter installation costs

Contrary to traditional metering, for which it is sufficient for the device to keep track of the quantities of water being consumed, smart metering installation costs include data transmission and storage at the level of the meter. In this analysis, the data management infrastructure at the utility level is also integrated in the capital cost associated to smart meter installation. These costs are one-time costs, and they are just committed when smart meters are installed for the first time at a property.

The difference between scenarios of type S1 and S2 is that in S2, we assume that smart meter installation happens instead of the replacement of a traditional meter by another. Therefore, in S2, the replacement cost of a traditional meter has to be deduced from installation costs. The range is particularly wide for the per-property cost of updating a traditional meter into a smart meter, depending on how much of the infrastructure present for traditional metering can be used for smart metering. For instance, if the smart meter cannot be encased in the same socket as the traditional meter, it is necessary to install a new socket, which is worth around 60 € (not counting installation costs).

3.2.2 Smart meter replacement costs

Meters, whether traditional or smart, are mechanical devices whose functioning is made less accurate as they age because of impurities present in the water. As a rule, they tend to underestimate consumption more and more if left unchecked. This is why they must be replaced regularly, and this document operates under the assumption that they are replaced every 15 years.

Replacement costs are cheaper than installation costs because the infrastructure to store, transmit, and manage the data is already present. In the case of meter installation at an unmetered location, it is also necessary to alter the pipes; this is not to be done again for meter replacement. Therefore, these costs mainly include the cost of the smart meter itself (S1) or the difference between the cost of a traditional and that of a smart meter (S2).

3.2.3 Annual reading costs

Traditional meters require two to four readings per year, depending on the water utility's policy. Each reading requires for an employee to manually check each individual meter. For smart metering, the reading strategy and the associated costs can vary widely depending on the technology that is used. Running costs of the data transmission, storage and management infrastructure are included in those costs. Smart meters typically don't require to be read by agents, but routine checks can be scheduled, for instance once a year.

Reading costs are smaller for smart meters than for traditional meters, this is why the cost is negative in S2 type scenarios.

3.3 Benefits of smart metering

This section first presents three of the four benefits of smart metering that are present in [WRMP14] by Thames Water:

1) Reduction in overall consumption (Section 3.3.1);
2) Better identification of customer-side leakage (CSL; Section 3.3.2);
3) Reduced amounts of customer calls (Section 3.3.3).

The fourth benefit is the replacement of mains, but this ROI calculation changes the way this benefit is calculated. This is due to 1) confidentiality concerns from Thames Water and 2) due to the fact that this different way of computing benefits brings in as least as much benefits. More details are given in Section 3.3.5, after the impact of reduced consumption and improved monitoring on peak water uses have been assessed (Section 3.3.4). Indeed, parameters related to peak water use are linked with network design.

3.3.1 Reduced consumption

The value of reduced water consumption is computed through the following formula:

“Benefit” = “Operational cost of water” x “Amount saved”

The first factor is the average cost of conveying water to and from a home, including treatment costs when applicable. This excludes the price of all the infrastructure built to abstract, treat and convey the water. The chosen range, from 0.4 to 0.6 euro per cubic meter, reflects current practice. In fact, taking the average cost of water is a likely underestimation, because water savings means in priority less abstraction from the most expensive water sources. And as demand rises or supply gets more variable, which may be the case for many cities in 21^{st}-century Europe, utilities may have to tap into more expensive supply sources, such as desalination. This would increase the benefit brought about by reduced consumption thanks to smart metering, but such benefits are difficult to forecast and evaluate, and ae therefore not included in this story.

Average per-property consumption reduction is derived from the data from [Thames Water, 2014], presented in Appendix A**Error! Reference source not found.**. These calculations lead to Table 6.

Table 6. Expected reduction in consumption as computed from [Thames Water, 2014] data.

	# properties	Avg. L/d/property	Reduction (%)	Post reduction Avg.
S1	2,314,587	355	13.5	307
S2	955,933	343	4.5	327

A range is then defined on these expected savings, where the values reported in Table 6 serve as a median scenario. We chose a wide range of 3% to 6% for scenarios of type S2, to express the uncertain effect that frequent personalized feedbacks may have on consumption. Then, the range for scenarios of type S1 can be expressed by compounding two uncertainty sources:

- Uncertainties in reductions in consumption associated with a switch from traditional metering to smart metering, which we set within a range of 3-6%. Using again data from Appendix A, these uncertainties alone lead to a range of 12% to 15% for reductions in water consumption.
- Uncertainties in reductions in consumption associated with a switch from no metering

to traditional metering. These correspond to the introduction of a volumetric charge, and are limited since **Table 36** relies also partly on observation of the behavioral modification for London household following the introduction of a volumetric charge. Therefore, we set the final range for reductions in consumption at 11% to 16%.

Ranges and their volumetric equivalent are summarized in Table 7.

Table 7. Reductions in consumption in both scenario types S1 and S2.

	Unit	Low	Median	High
S1	%	11	13.5	16
	L/day/property	39.0	47.9	56.7
S2	%	3.0	4.5	6.0
	L/day/property	10.3	15.4	20.6

3.3.2 Better identification of CSL

Metering allows for identifying abnormal consumption patterns as leaks. Traditional metering enables the discovery of only major leaks that cannot be accounted for by assuming that a property's residents are big water consumers. In comparison, smart metering enables the discovery of much smaller leaks, and more quickly: it is enough to record a minimal continuous consumption to suspect the existence of a leak only a few days after its inception. Therefore, smart metering has an influence on both the detection and the speed of detection of leaks. Evaluation of what that means in terms of volumes of water savings is difficult to do without previous experience with smart metering, so the ranges reported in Table 8 are the product of professional judgment. The operational value of water reported in that Table is the same as in Section 3.3.1.

Stopping a leak can either be paid by the property's owner or by the utility, depending on where the leak is situated (e.g. outside of a house) and on the utility's policy. There are two types of additional interventions due to smart metering:

- Those that concern pre-existing leaks that smart metering, and that the installation of smart meter enables to detect very quickly.
- Those that fix leaks as they happen.

Table 8. Data and their range for the benefits of CSL reduction.

		Unit	Low	Median	High
Opex value of water		€ / m3	.4	.5	.6
S1	Leakage reduction	L/d/property	60	80	100
	Initial Intervention Cost	€ / prop	10	15	20
	Annual Intervention Cost	€ / prop / yr	1	1	1
S2	Leakage reduction	L/d/property	45	60	75
	Initial Intervention Cost	€ / prop	6	10.5	15
	Annual Intervention Cost	€ / prop / yr	1	1	1

Even if the utility has to charge for CSL interventions, doing so is very cost-beneficial, as Figure 1 and Figure 2 illustrate, respectively, for S1 and S2 type scenarios. The range for benefits is large in both figures, because the calculation compounds a low (resp. high) value of water with a low (resp. high) amount of water saved from smart metering. Figures also show that high-cost, low-benefit cases would still constitute a strong incentive for utilities to intervene themselves as to reduce leakage.

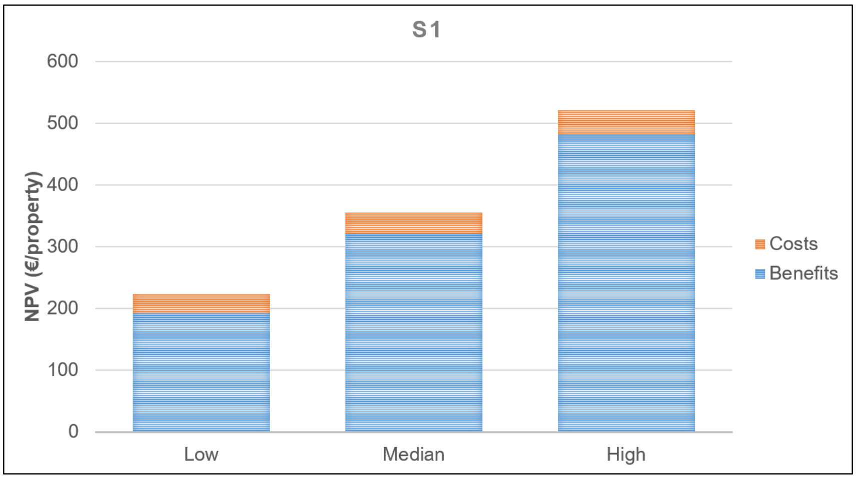

Figure 1. NPV of CSL in S1 type scenarios.

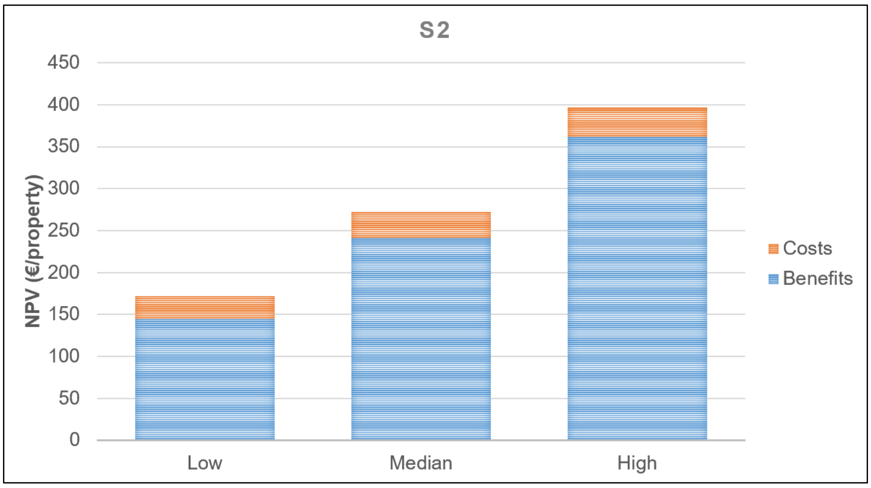

Figure 2. NPV of CSL in S2 type scenarios.

3.3.3 Reduced amount of customer calls / complaints

Customer service is computed through a proxy, the number of customer calls. Given a fixed average cost for a customer call, the difference between the number of calls before and after smart metering is evaluated for both S1 and S2. That value is then spread on a per-property basis to account for future population growth. Ranges for S1 and S2 are given in Table 9, based on the following observations / assumptions:

- Because volumetric charges associated to traditional metering are sometimes based on estimated consumption, traditional metering results in a rise in customer calls.
- Increased confidence in meter reading accuracy should lead to an eventual decrease in customer calls.

The computation of this benefit is an attempt at quantifying customer satisfaction, which leads to a long-term improvement of a utility's brand image which is difficult to evaluate in financial terms. It underscores a major advantage of smart metering with respect to traditional metering. With the latter technology, bills based on estimated consumption may be seen as an attempt to cheat customers (e.g., by making customers pay water they have not consumed yet).

Table 9. Benefits from increased customer satisfaction, in € / property / year.

	Low	Median	High
S1	0,5	1	1,5
S2	2	3	4

3.3.4 Reduced peak use

Peak hour parameters impact the way the network is designed, because it must be able to handle pressure at the peak periods. Different parameters exist in the literature, including peak day [Lucas et *al*., 2010; Gurung et *al*., 2014], peak week [Thames Water, 2014], or mean day maximum month [Gurung et *al*., 2014]. Regardless of the set of parameters being used for a given water network, these peak factors are expected to be influenced by smart metering because of:

- An overall decrease in water use;
- Vastly improved monitoring, allowing for a better evaluation.

It is difficult to tell how the latter item may impact these design parameters. If it underestimates them, then new pipes and pipe replacement may be more expensive, but money would eventually be saved by less pipe bursts and less leakage. Moreover, smart metering can cast light on overestimation of design parameters, a case reported in the literature [Gurung et *al*., 2014].

Because of these uncertainties, this study merely assumes a 1:1 ratio between an overall decrease in water use, and a decrease in peak design parameters.

Then, a reduction in design parameters has to be translated into savings for the water utility. This study focuses on two kinds of savings:

- Mains expansion in newly built areas;
- Mains replacements.

For both quantities, the savings are the result of the following calculation:

[Savings] = [Fraction saved on mains] x [Cost of mains per property] x

[Number of properties affected]

Lucas et al. [Lucas et *al*., 2010] explore the between lowered peak factors and the savings in mains investment for a suburb of Melbourne, Australia. A key finding is that a 1:1.2 relationship between design parameter reduction and relative financial savings is a rather conservative estimate. Therefore, the chosen range for the reduced investment is 1.2 times the range in reduced overall consumption, and 1.2 times the range in reduced peak design parameter (**Table 10**).

The base cost of mains per property is challenging to get, and three estimates within a range from 2,000 to 3,000 € were derived separately. This is the range that was adopted in **Table 10**. First, the data provided by [Lucas et *al*., 2010] was used to get a first estimate of 2,550 € / property. The two other estimates come from raw estimates by EMIVASA. On one hand, an average estimate of 300 € per metre of new mains, yields, given the number of properties in the TWUL area and the length of mains the company has (31,500 km according to [TWUL-Ofwat, 2012], 2,890 € / property. On the other hand, an average estimate of 400 € / property in a large block of 15-20 flats, has been extrapolated to other house types to yield a TWUL average of 2,085 € / property. The extrapolation method considers that the figure of 400 € per large block of 15-20 flats is equivalent to 6,000 € / standalone property. This total goes undivided for a detached property, divided by 2 for a semi-detached property, and divided by 5 for a small block where we assume 4-6 properties (Table 11). Finally, a terraced property is assumed to be on average the equivalent of two properties in a small block. One should bear in mind costs can vary dramatically depending on the many factors, e.g., habitat density, soil quality, etc.

Table 10. Parameters to compute benefits from reduced peak factors.

	Unit	Low	Median	High
Cost of mains	€ / property	2,600	3,300	4,000
Reduction in peak design parameter (S1)	%	11	13.5	16
Reduction in peak design parameter (S2)	%	3	4.5	6
Reduction in investment in mains (S1)	%	13.2	16.2	19.2
Reduction in investment in mains (S2)	%	3.6	5.4	7.2

Table 11. Breakdown of the cost of mains per property type (Number of properties from [Thames Water, 2014])

Property type	Cost of mains (€/property)	Number of properties
Detached	6,000	306,372
Semi-detached	3,000	564,601
Terraced	2,400	927,541
Flats – Large Block	1,200	882,115
Flats – Small Block	400	589,981
All properties	2,085	3,270,520

Then, benefits from network expansion are computed by multiplying the per-property average cost of new mains, by the amount of new properties that are built every year (given a growth scenario). Benefits from main replacement are computed assuming that every year, 1% of the network has to be replaced. This corresponds to 1% of all properties. This is a reasonable assumption in the case of London where the Victorian mains, many of which date back to the 19th century, are ageing and are being replaced or should be replaced in the decades to come. Throughout the EU, many cities present similarly old water distribution network.

Another potential benefit from reduced peak-hour consumption is in terms of energy savings. Indeed, the daily morning and evenings peaks in consumption correspond to time of peak-hour electricity tariffs. Therefore, if a utility does not have enough in-network storage, it must pay a steep price to on energy to deliver water during peak time, and reducing peak use can lead to substantial operational savings. Yet in the London case, Thames Water generally does not need to use peak electricity tariffs because it has sufficient in-network storage.

3.3.5 Benefits from mains replacement

In [Thames Water, 2014], the benefits from mains replacement come from a regulatory obligation of TWUL vis-à-vis OFWAT, the English regulator for the water sector. Indeed, TWUL must replace their Victorian mains enough to achieve their leakage reduction targets. Smart metering then provides a better capacity to locate leakages. Then, less work is necessary to achieve these targets, and this translates in substantial financial savings.

Yet our computation, despite the conservative choices that were made in Section 3.3.4, suggests that more benefits are to be gained from mains replacement by considering the reduction in peak parameters, than by the method put forward in [Thames Water, 2014]. Besides, it is not dependent on the regulatory context of London.

Under the methodology proposed in Section 3.3.4, smart metering enables to better target the leakiest mains, meaning that for the same amount of main replacements, there will be leakage savings. However, these additional savings, compared with determining mains' water balance with traditional meters, are 1) difficult to evaluate and 2) expected to be marginal in the ROI calculation. Therefore, they are not accounted for.

3.4 Results: ROI calculation for the greater London

This section gives the net present value (NPV) of costs and benefits of smart metering alone, without considering concomitant demand-side management strategies (scenarios of type A). NPVs are computed based on an interest rate of 3% over the 2016-2060 period (45 years). It is assumed that the initial roll-out of smart metering takes 15 years. Each year, 1 out of 15 properties that was initially unmetered (S1) or that has a traditional meter (S2) gets a smart meter installed instead. In both scenario types, smart meters are automatically installed on newly-built properties.

3.4.1 Transition from no metering to smart metering (S1)

This paragraph only accounts for the properties with no metering in 2016. The ROI computes the costs and benefits of smart metering against an alternative where properties keep being unmetered, and the number of unmetered properties grows by 0.6% per year (AV) or 1% per year (HE). The cost and benefit ranges for scenario S1A-AV are given in Figure 3. According to this computation, the median cost of smart metering for all currently unmetered properties is of 2,058 M€ (millions of euros), while the benefits are estimated at 1,606 M€, which corresponds to 78% of the costs. Similar to Section 7 of [Thames Water, 2014], smart metering is not cost-beneficial under this scenario, but this study finds a better cost-benefit ratio than the WRMP. This is to be expected, since it takes into account the sources of cost and benefits that where already included in [Thames Water, 2014], and adds the consequences of reducing the peak factors that help design the network.

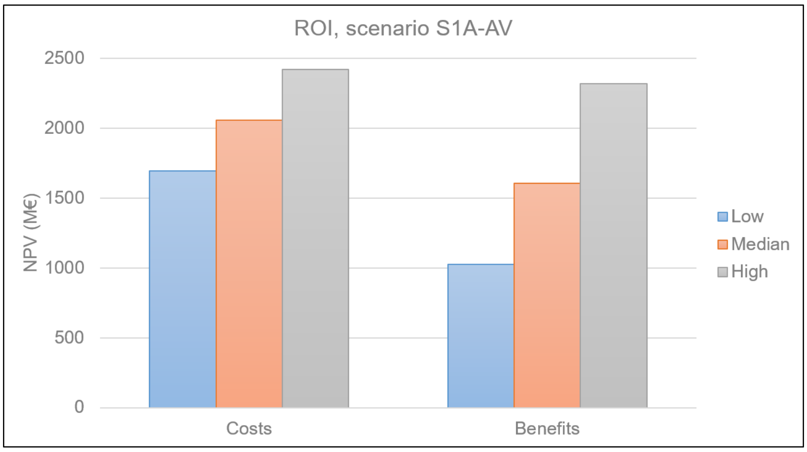

Figure 3. ROI calculation for scenario S1A-AV.

The range of costs is from 1,693 M€ to 2,453 M€, which approximately corresponds to 20% increase or decrease. It is relatively narrow compared with the computed range of benefits, from 1,026 M€ (just below half of the median cost) to 2,320 M€ (almost the high end of the range of costs). Thus benefits more than double from one end of the range to the other. These different ranges can be explained by looking at the repartition of costs and benefits (Figure 4). Costs are driven by the installation (50%) and replacement (27%) of smart meters, two figures for which the range is relatively narrow. Meanwhile, main benefits are reduction in CSL (45%) and in consumption (27%), where the ranges of reductions are compounded with the range for the operational value of water. Consideration of the peak factors through mains replacement and network expansion accounts for 25% of expected benefits.

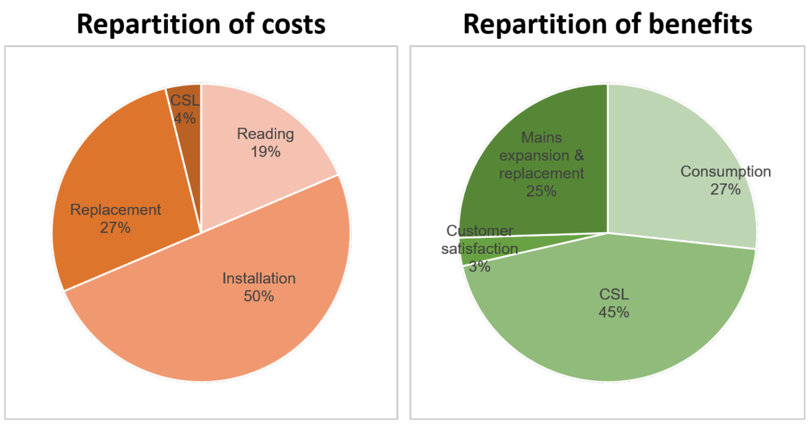

Figure 4. Repartition of costs and benefits for scenario S1A-AV, median case.

Considering population growth scenario HE instead of AV leads to an increase in costs and benefits. However, while all benefits are increased in the same proportions, replacement costs are irrelevant for newer houses, and therefore, a higher population growth makes smart metering most cost-beneficial benefits account for 86% of the costs in the median scenario, where costs increase by 233 M€ to 2,291 M€, while benefits increase by 274 M€ to 1,880 M€. The range for benefits remains considerable, but the high-end for costs and benefits is sensibly the same, with the benefits even outweighing the costs (2.713 M€ vs. 2.694 M€).

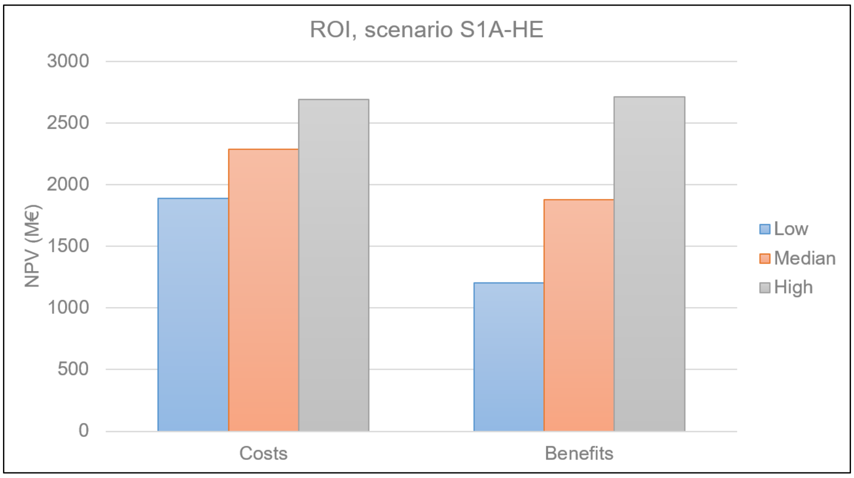

Figure 5. ROI calculation for scenario S1A-HE

3.4.2 Transition from traditional metering to smart metering (S2)

This paragraph only accounts for the properties with traditional metering in 2016. The ROI computes the costs and benefits of smart metering against an alternative where properties keep having traditional meters, and the number properties with a traditional meter grows by 0.6% per year (AV) or 1% per year (HE). The cost and benefit ranges for scenario S2A-AV are given in Figure 6. According to this computation, the median cost of smart metering for all properties with traditional meters is of 320 M€, while the benefits are estimated at 561 M€, which corresponds to 175% of the costs. This means that the transition from traditional metering to smart metering is largely cost-beneficial under this scenario. In fact, the low end of the benefit range is still 7.5% higher than the median cost, and the high end of the cost range is only 20% higher. The median benefit estimate is 36% higher than the high end cost estimate.

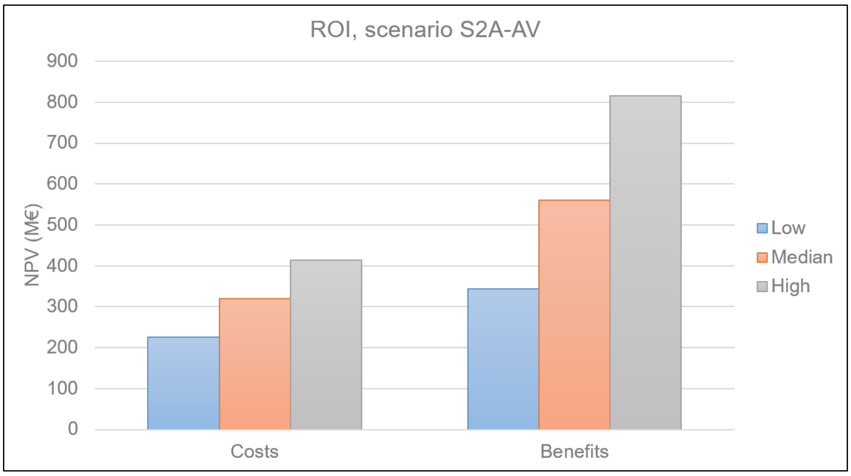

Figure 6. ROI calculation for scenario S2A-AV.

These different ranges can be explained by looking at the repartition of median cost and benefit estimates (Figure 7Figure 4). When switching from traditional metering to smart metering, reading costs decrease, and these decreased costs are a benefit of smart metering. Costs are mainly driven by the installation of smart meters and of the related infrastructure (77%). Reading is the second leading benefit (28%) behind CSL reduction (41%). Benefits related to reductions in consumption and in peak factor are relatively marginal (11% and 9%) compared to S1A-AV, but the benefits linked with improved customer satisfaction are more tangible (11%).

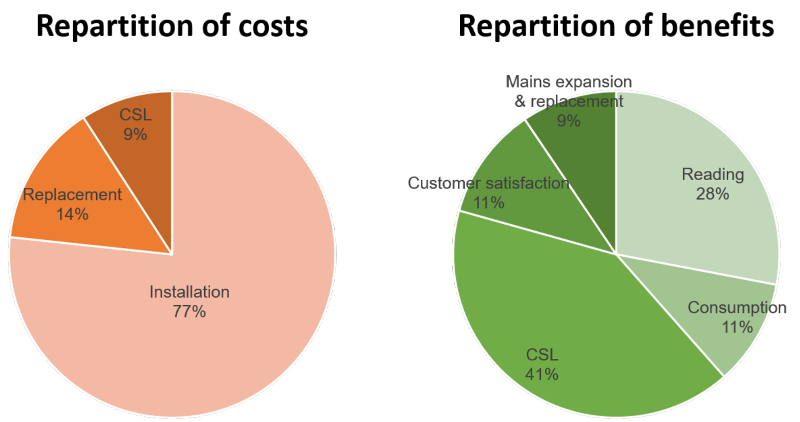

Figure 7. Repartition of costs and benefits for scenario S2A-AV, median case.

Considering population growth scenario HE instead of AV leads to an increase in costs and benefits. Similar to scenario S2A-AV, the median benefit estimate is 176% of the median cost estimate, but that translates into nearly 300 M€ in savings (634 M€ of benefits vs. 360 M€ in costs).

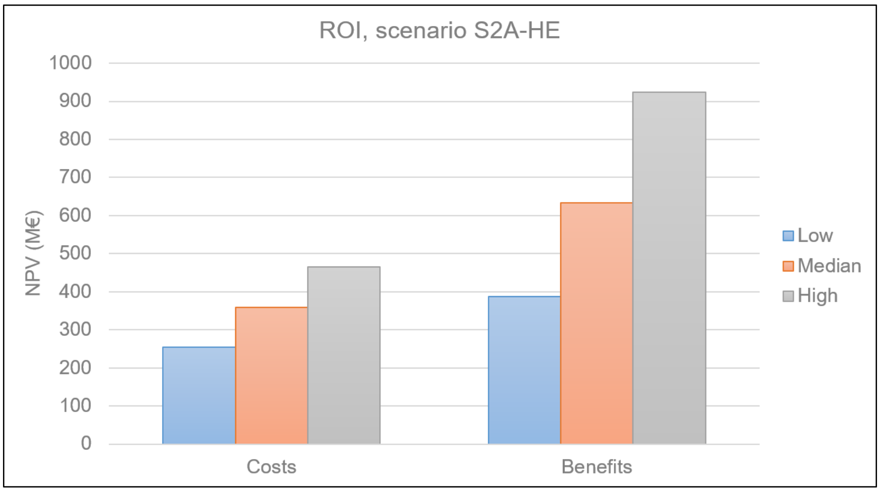

Figure 8. ROI calculation for scenario S2A-HE.

3.4.3 Totals: TWL-wide results (S3)

Until now, metering was evaluated for S1 and S2 as though they were two different cities. Since it aggregates S1 and S2 scenario types, the ROI calculation is made by assuming that the alternative to smart metering would be to keep the current proportion of properties that are unmetered and of properties that have a traditional meter.

The cost and benefit ranges for scenarios S3A-AV and S3A-HE are in Figure 9 and Figure 10, respectively. Since there are 2.4 times more unmetered properties than properties with smart meters, smart metering is not cost-beneficial in scenarios S3A, but it is relatively close. In S3A-AV, benefits represent 93% of costs (2,167 M€ vs. 2,378 M€) and in S3A-HE where population growth is higher, this ratio climbs to 95% (2,514 M€ vs. 2,651 M€). Yet, one must keep in mind the wide range associated to benefit estimates in both scenarios.

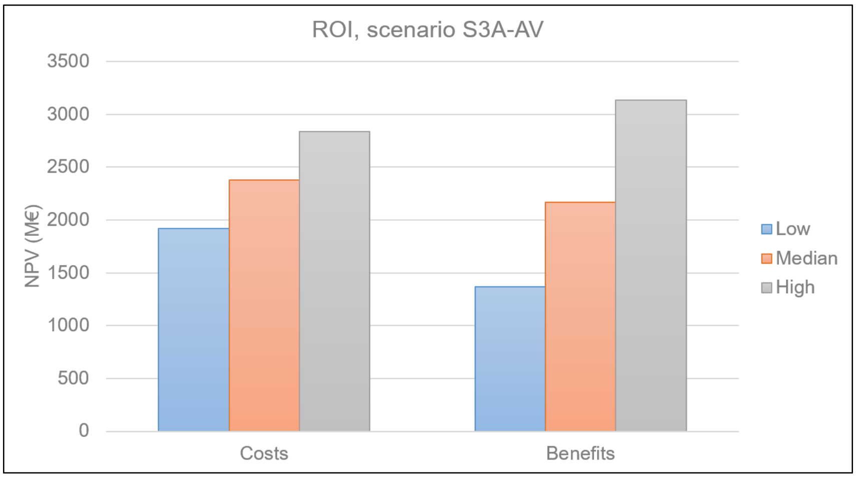

Figure 9. ROI calculation for scenario S3A-AV.

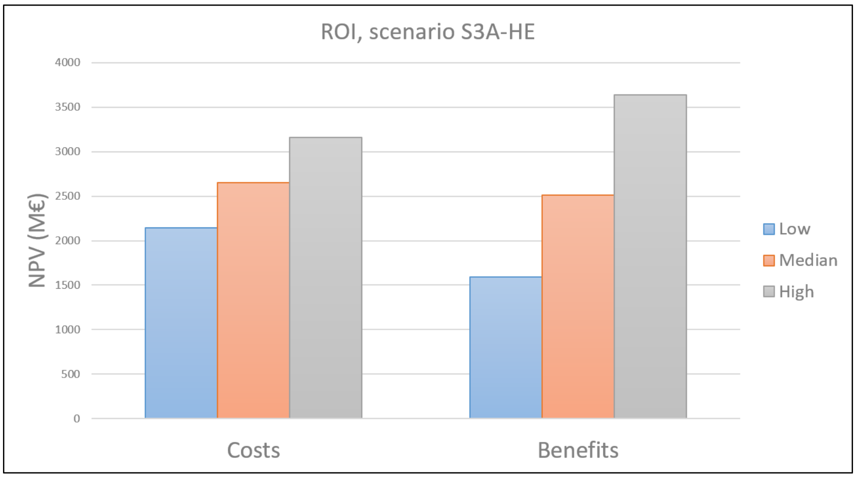

Figure 10. ROI calculation for scenario S3A-HE.

3.5 Financial aspects of SmartH2O platform integration

This section explores the financial implications of the integration of a customer engagement tool such as the SmartH2O platform. In order to do this, is starts by discussing EMIVASA's ongoing experience in implementing the platform in Valencia, Spain. The implementation of the SmartH2O platform is expected to bring significant benefits to EMIVASA.

3.5.1 Current costs

The following table (Table 12) lists key activities and estimates of associated costs. Given the orders of magnitude considered in Section 3.4, these costs have been deemed negligible in the ROI for scenario B. Note that this table is only a summary: it does not intend to be a comprehensive description of the activities that were carried out, or of their related costs. Key activities identified are those related to the process of integration. All other tasks related with the project but not directly with the installation of the platform have not been considered in the table. The cost of each activity has been obtained through the cost of the involved personnel. Besides, please note that these costs are considered in anticipation of the launch of the case study, while pre-alpha testing is still being carried out.

The deployment of the platform within EMIVASA's systems has required an important number of ad-hoc integration activities. Thus, the involvement of personnel from the IT department has been a key issue. More broadly, the experience in Valencia indicates that the cost of the integration process in further installations will vary depending on the complexity of the metering and data processing infrastructure (if any) of the water supplier considered. For example, the process in Valencia is characterised by the appearance of unpredictable issues that have to be solved as they arise. Another factor to be considered is the size of the project, as the rewards policy and the promotion campaign depend directly on the project's ambition.

Table 12 Estimated costs of platform integration in the Valencia case study

Group	Main Activities	Area	Cost (approx.)
Customer Portal	Translate the portal into Spanish and Valencian	R&D	3.531 €
	Adapting rules to the Valencia case study	R&D	

	Terms and Conditions in Valencia	R&D	
	Integration of the portal within EMIVASA's Virtual Office	IT	
	Debugging	IT/R&D	
	Testing	IT/R&D	
App	Provide localized questions	R&D	336 €
	Translate labels into Spanish and Valencian	R&D	
	Installation in EMIVASA's server	IT	
Smart Metering Data Provisioning Integration	Prepare a server with the characteristics required by the platform[1]	IT	3.712 €
	Creating and testing the different web-services to transfer metering data from EMIVASA's metering infrastructure to the Customer Portal	IT	
	Internal installation	IT	
Admin Portal	Configure external actions	IT	928 €
Marketing	Press releases	R&D Marketing	352€
	Dissemination activities to encourage engagement (foreseen)	CR Marketing R&D	
Marketing	Rewards for gamification		2.329 €
Marketing	Call center campaign	R&D	3.000 €
Marketing	Training Call Center	R&D	117 €
		TOTAL	14.305 €

3.5.2 *Expected Benefits*

The expected benefits from the platform integration are of different nature, and some of them might be difficult to quantify, especially *a priori*. A deeper cost-benefit analysis will be necessary after the end of the pilot period, in order to assess how advantageous implementation is for EMIVASA, while taking into account the real impact on the management and operation of the water supply service.

Nevertheless, the platform should be understood as a perfect complement to the already advanced smart metering infrastructure deployed in Valencia. An appropriate initial classification of benefits seems to be into 1) customer-relationship benefits and 2) operational benefits.

Improved customer relationship management

Some of the main impacts of the project may be on the **customer relationship management.** The following list gathers some of them:

- Improving the acknowledgement of the effort made by the company to provide a

[1] EMIVASA's Virtual Office is the area of the website where users can connect to their personal accounts.

good service.

- Enlarging the contact information database (phone, e-mail address, etc.) and thus improving the communication channels between the supplier and the customer.
- Improving the psycho-graphic information database of the company (so far the company does not have information about the characteristics of the household and its inhabitants).
- Creating new (innovative) bonds with the customer (different from the classic Virtual Office).
- Boosting the number of users registered in the Virtual Office (users access the portal through the Virtual Office) and their level of interaction.
- Knowing the willingness of households to participate in these kind of initiatives.
- Increasing the number of leaks notified by customers via APP.
- Improving the number of visitors of the company website.
- Increasing the number of users downloading company's APP.
- Increasing the number of users switching from paper invoice to e-invoice.

This aspect is difficult to quantify in monetary terms. In Section 3.3.3, smart metering was equated with a greater transparency in relating consumption with water bills, leading in theory to a decrease in phone calls from customers. In the case of platform integration, the relationship with customers is expected to improve, but this is through a greater level of interaction with the utility. In fact, this fundamentally changes the *nature* of the interaction between a utility and its customers, and the aspects and consequences of this change are impossible to evaluate beforehand. A first indication will be given by the following non-monetary indicators:

- Number of users registered on the Virtual Office
- Number of visitants to the company website
- Number of leaks notified through the Virtual Office (when this external action is configured)
- Number of downloads of the company APP
- Number of users switching from paper to e-invoice
- Number of e-mail addresses and phone numbers obtained after registration on the portal

Operational benefits

The information obtained from the portal is expected also to have a positive impact on the **operation** of the service:

- The characteristics of households, so far unknown, (e.g. number of people living in) can be considered as new criterion before planning actions on the network.
- An improved psycho-graphic information database can also enhance the accuracy of current studies of consumption patterns being currently carried out by the company.

More operational benefits may be attributed to the portal when implemented within water supply systems not having a smart metering infrastructure available. In those cases, the fact of making water consumption visible to customers may have an impact that will not be that spectacular in Valencia, where this feature is already available in the Virtual Office.

There has not been an attempt by EMIVASA to quantify environmental impacts related with the potential reduction of water consumption at this point. Therefore, this deliverable makes a first attempt at this quantification. As precised in Section 3.1, please keep in mind that the goal is not to provide an exact quantification, something that is extremely challenging to do *a priori*, but rather to understand how even minimal impacts on water consumption can impact a utility's finances.

In the calculation of the benefits from scenario A, overall consumption is assumed to be lower with smart metering than with traditional metering because customers receive frequent information about their consumption. This is, in fact, a form of consumer engagement, which the platform is merely taking further by integrating, among other things, gamification techniques, educational tips (videos, etc), and incentives for reducing consumption. Therefore, a choice is made to propose a conservative estimate of the potential for the platform to reduce overall consumption, by using a range from 1% to 2%. This reduction has repercussion on peak factors, and therefore on the cost of mains expansion and replacement (Table 13).

Table 13. Expected reductions / savings due to platform integration.

	Unit	Low	Median	High
Overall water consumption	%	1	1.5	2
Overall water consumption	L/prop./day	3.5	5.3	7.1
Peak factors	%	1	1.5	2
Investment in mains	%	1.2	1.8	2.4

The financial implications of platform integration are summarized in Figure 11. They are the same whatever the technological scenario (S1, S2 or S3), therefore they are expressed as a NPV in € per property. It is worth noting that the NPV of customer engagement grows by approximately 20% when annual population growth rises from an average projection of 0.6% to a high-end projection of 1%. Besides, even a minimal impact on consumption has wide financial implications for utilities, with a NPV ranging from 41.5 to 124.4 €/property in the AV scenario and from 51.3 to 153.9 €/property in the HE scenario.

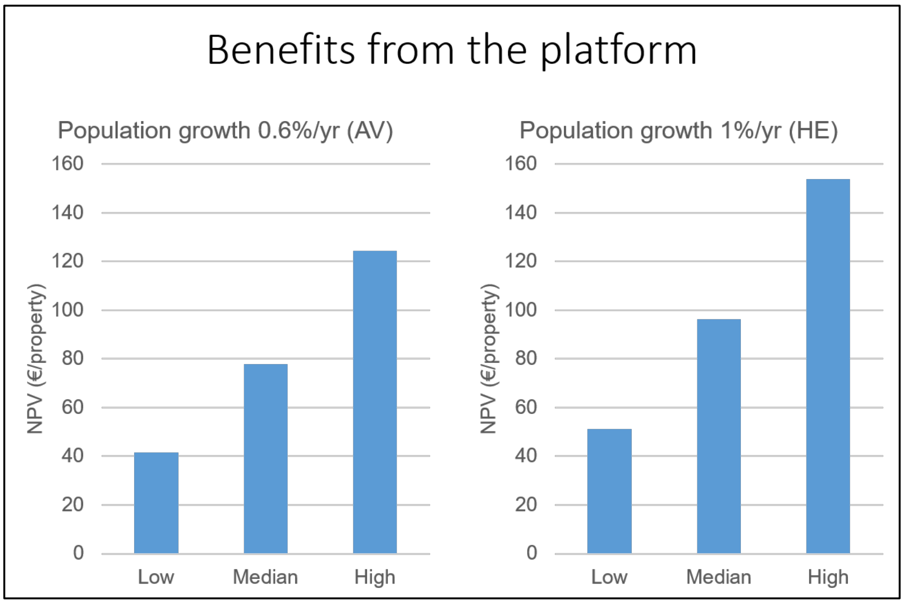

Figure 11. Benefits of the SmartH20 platform (scenario B).

3.6 Financial implications of dynamic pricing for utilities

This section considers the possible impacts on dynamic pricing on utility's finances. Similar to Section 3.5, the goal is to 1) set up a methodology for evaluating these impacts, and 2) evaluate how even minor alterations of residential water consumption patterns may financially benefit utilities. Please recall that nobody can carry out an *a priori* evaluation of how dynamic tariffs may impact consumption patterns, a fact that has been proved empirically by the drastically different reactions that can arise to the same tariffs [Inman and Jeffrey, 2006].

In this section, we distinguish between two kinds of dynamic pricing schemes:

1) **Peak pricing,** or Time-of-day pricing, specifically aimed at reducing peak factors so as to yield the benefits described in Section 3.3.4.
2) **Seasonal scarcity pricing** aimed at addressing the severity of drought conditions when they arise, especially in the (drier) summer season.

In both cases, the most direct impact on a utility's finances is through the tariffs themselves, since they directly influence how money is collected from residential customers. Yet, this work assumes that dynamic pricing must be designed so as to be **revenue neutral**, meaning that the revenue streams are unchanged. This way, neither utilities nor their customers are financially harmed by the new tariffs. In fact, dynamic pricing is expected to be implemented after smart metering, so that water bills and tariffs will have to adjust to the consumption in reduction that accompanies the new metering technology.

The rest of this section is as follows. First, the two types of dynamic tariffs are described separately (Sections 3.6.1 and 3.6.2), then their impact on the ROI calculation of smart metering is described in Section 3.6.3.

3.6.1 Peak pricing

The goal of peak pricing is to decrease peak usage rate, especially by encouraging customers to use some water-consuming appliances (e.g., dishwasher, washing machine) during off-peak periods rather than during peak periods. Compared with a flat volumetric rate, peak pricing proposes two kinds of tariffs:

1) A peak rate, more expensive than the flat rate, to decrease peak consumption;
2) An off-peak rate, less expensive than the flat rate.

The off-peak rate is needed to ensure revenue neutrality, because the application of the peak rate is expected to increase revenue during the periods defined as peak periods, and this extra revenue must be devolved to customers during off-peak periods. Besides, the off-peak rate provides an added incentive for switching the use of some water-consuming devices, from the peak period to the off-peak period, and therefore reduce consumption.

In principle, smart metering enables a wide flexibility in the definition of peak and off-peak periods. Yet, the experience of the electricity sector in setting ever-more-imaginative tariffs may serve as a warning to the water sector. Indeed, customers often have trouble understanding how to use complex tariffs to their advantage [Hubert and Grijalva, 2012]. Therefore, tariff complexity would thwart the avowed purpose of influencing consumption patterns.

3.6.2 Seasonal scarcity pricing

In article 9 of the Water Framework Directive [Directive 2000/60/EC], water-pricing policies are proposed with a double role: as an economic instrument in order to use water resources efficiently and as a financial instrument, to recover the costs of water services.

Efficient basin-wide scarcity-based water pricing policies are designed and tested through hydro-economic approaches. The objective is to confront water users with water economic values and the opportunity costs related to water scarcity. The cost of water is always equal to the cost of provision plus the opportunity cost. It has been stated that "efficient water use is fundamentally about the recognition of water's opportunity cost" [Griffin, 2006].

The proposed scarcity-based water pricing policies are pricing policies linked to water availability in the basin (typically represented by available storage), by integrating the marginal value of water at the source in selected locations (reservoirs). They are based on the marginal resource opportunity cost (MROC) at a specific location and time, which is defined as the system-wide benefit of having available one additional unit of resource at that location and time [Pulido-Velazquez et al. 2013] within a multi-sectorial environment (agricultural, urban and industrial users). MROC estimates are obtained through hydro-economic models, grouped according to storage intervals, and then, representative statistics of the MROC values for each storage interval are used to define storage-based step pricing function. By pricing marginal water opportunity costs, water would be reallocated to the highest-valued uses during water scarcity periods, significantly increasing the total net benefit of water use in the basin.

The pricing policy previously defined is based on the design of the right incentives for an efficient water use in the basin. Additionally, water pricing also performs to other functions [Hanemann, 1998]:

- Generate revenues: the proposed rate should produce sufficient revenues to allow the utility to cover its costs and meet its financial requirements, in both the short-run and long-run conditions (revenue sufficiency and neutrality). The provided revenues should be stable over time, considering any situation (normal conditions or drought events). The rate structure should be designed to accommodate price changes, and the administration of the pricing policy should be simple, stable and under a reasonable cost.
- Allocate costs: the total costs are allocated among the users under a certain rate structure. The water rate should be perceived as affordable, fair and equitable by the users.

Although the water pricing policy should be designed in theory as close as the marginal water value (marginal cost pricing, integrating opportunity costs), the condition of revenue sufficiency should meet the financial cost-recovery target, what is pricing at the average cost. Most current urban water tariffs are designed under the condition of revenue sufficiency, with additional efficiency and equity considerations. Current water rates do not bring any incentive to reduce water use in water scarcity periods, since they do not send any signal of water scarcity and the resource value.

The final rate to be charged to the users should be one hand incorporating the scarcity-based signal while meeting the revenue and equity conditions previously discussed. A pricing policy just based on the raw MROC values would introduce too much uncertainty in the final water price [Macian-Sorribes et al., 2015]. In consequence, the raw MROC values have to be post-processed and transformed into simpler a-priori scarcity-based pricing policies, so that the pricing charged to the utilities can be negotiated and approved in advance. And the corresponding water rate structure to be charged to the municipal users can be approved by the regulators and also be known beforehand by the final users.

3.6.3 Financial impacts for utilities

The benefits of dynamic pricing depend on the type of pricing scheme being considered:

1) Peak-pricing reduces peak consumption, and the objective is arguably to reduce it by at least a few percentage points to have a financial impact;
2) Seasonal scarcity pricing reduces overall consumption when water is expensive and therefore scarce in the basin. This corresponds to a sizeable reduction during a short period of time, and therefore reduces annual consumption in a limited but real way. Besides, since it is generally used in the period of the year where consumption is highest – because of outdoors use – it is also assumed to decrease peak factors.

These considerations lead to Table 14.

Table 14. Expected reductions due to dynamic pricing, plus cost of customer dissatisfaction.

	Unit	Low	Median	High
Overall water consumption	%	1	1.5	2
Overall water consumption	L/prop./day	3.5	5.3	7.1
Peak factors (peak pricing)	%	3	4	5
Peak factors (scarcity pricing)	%	1	1.5	2
Investment in mains (total)	%	4.8	6.6	8.4
Customer dissatisfaction cost	€/prop./year	2	3	4

As the Table 14 above also indicates, dynamic pricing can also have a negative impact on customer satisfaction. Indeed, regardless of the nature of the tariff – dynamic or not – a tariff change that is revenue neutral at the utility level is not neutral at the customer level (see e.g., [Thames Water, 2014]), Figure 7-6). Therefore, new tariffs produce winners and losers, and dynamic tariffs are no exception. Besides, experience from the electricity sector shows that dynamic tariffs can be deeply unpopular; for instance, time-of-day pricing would only be adopted by, at best, 20% to 30% of the population if it were voluntary [Fell et *al.*, 2015]. Therefore, dynamic pricing has a cost, at least in the initial stages of tariff implementation, in terms of brand image. Similar to Section 3.3.3, this cost is evaluated as an increased amount of complains. A conservative long-term estimate is that it would generate the same amount of complaints and confusion as the estimated bills do when volumes are estimated through traditional metering. Therefore, the "customer satisfaction" cost of dynamic pricing is the same as the benefit derived from switching from traditional metering to smart metering (S2) in Table 9.

Similar to the benefits of platform integration, the costs and benefits of dynamic pricing are the same for S1 and S2 scenarios and are therefore best expressed as a NPV per property (Figure 12). Benefits tend to outweigh the cost, but by a relatively narrow margin, and the ranges overlap. Similar to scenario B, a higher population growth makes the implementation of this type of demand management strategy more worthwhile.

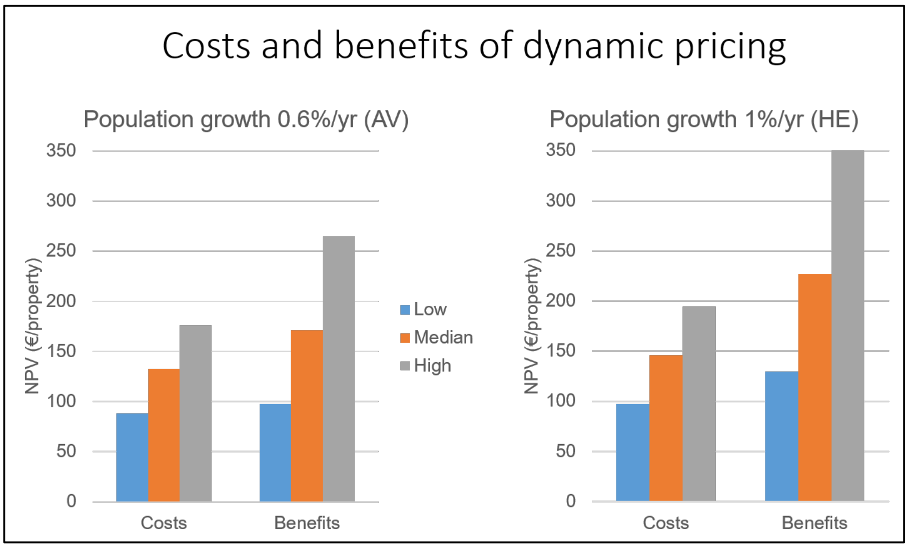

Figure 12. Costs and benefits of dynamic pricing (scenario C).

3.7 Impact of demand-side management strategies on the ROI calculation of smart metering

This section compares the NPV of smart metering for all the different scenarios, in the median case. When it comes to demand management scenarios, recall that scenarios B, C and D are based on scenario A and:

- In scenario B, the benefits of platform integration are added to the benefits of scenario A;
- In scenario C, the costs and benefits from dynamic pricing are added to the cost-benefit analysis of scenario A;
- In scenario D, the results on both platform integration and dynamic pricing are added to the analysis of scenario A. This calculation does not consider the possible interaction between the effect of platform integration and dynamic pricing, e.g. the platform's impact on the public perception of dynamic pricing. Indeed, there is no

basis for evaluating those interactions.

Please recall that conservative estimates for the potential benefits of both demand-side management strategies are used here. Therefore, if used in a way that is adapted to the context of a given utility, it is reasonable to assume that the benefits might be much greater. For the TWUL (including Greater London) area, the net benefits are given by Figure 13 in the case of an average population growth (AV scenario, 0.6% per year), and in Figure 14 in the case of a high-end population growth scenario (HE, 1%).

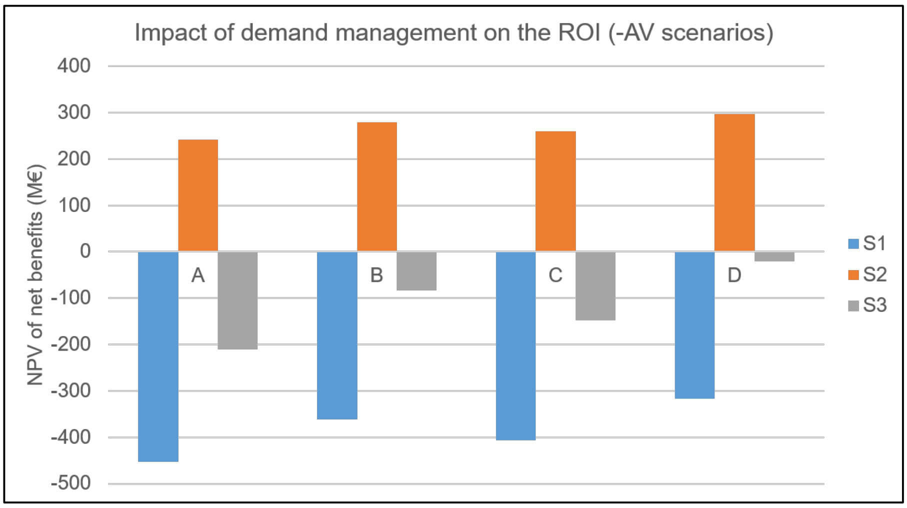

Figure 13. Net benefits (median case) associated with different '-AV" scenarios.

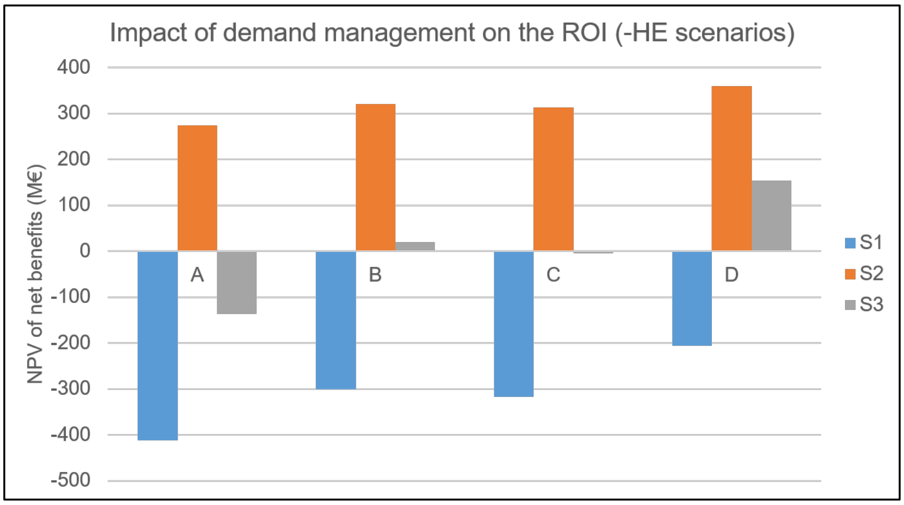

Figure 14. Net benefits (median case) associated with different '-HE" scenarios.

Even assuming only marginal benefits from each of the two demand management strategies considered in this ROI calculation, results show that such strategies can alter the cost vs. benefits outcome of smart metering in the TWUL area. In the case of a 0.6% per year population growth, both strategies taken together all but bridge the gap between costs and benefits, by dividing the deficit by more than 10, from 211 M€ to 20 M€. The latter figure represents only 0.7% of the total expected cost of smart metering in scenario D. In the case of a 1% per year population growth, smart metering is almost cost neutral when one of the two demand management strategies are implemented, and becomes cost beneficial in scenario D.

4. SmartH2O platform: financial plan

This section should be read as the confidential part of Section 4 of the public part of D8.5 It is an integral part of the business plan outlined in this deliverable for the SmartH2O platform.

4.1 Financial plan – Important Assumptions

It is assumed that the SmartH2O platform is offered for sale following the SaaS model [Fuse Financial Patners, 2014; Janz, 2016]. The analysis of the projected revenue streams is performed undergoing the following assumptions:

- The most of the SmartH2O platform sells will to be performed via its website.
- A single pricing plan is considered in the current financial model. The model allows adjustments for using more pricing level.
- The financial projections are made considering Set Mobile actual specific costs and regard mainly the Romanian and East European market. Other consortium partners engaged in business development (Politecnico Milano and Webratio – which acts as associated party) could use the financial model as-is or in an adjusted version in order to run own financial projections.
- A **30-day free trial signup** will be offered to signing up users.
- The trial signups will be converted into paying customers with reduced human interaction.
- **Organic signups** are signups that do not result from a payed marketing action. The most part of the SmartH2O platform signups will be obtained organically as the end-consumers are expected to follow the water utility recommendation for subscribing to SmartH2O platform.
- In a given month, conversions to **paying Customers** are calculated based on the Signups of the previous month (to reflect a free trial length of 30 days).
- The model considers that paying Customers are achieved from Signups at a conversion rate of 10% in the first year. A 20% conversion rate has been considered for the second year in the light of growing interest spread by “word of mounth”.
- It has been assumed that “late conversions” would happen with a time lag between the actual signup moment and the moment of conversion to a paying customer. “Late conversions” would take place at a reduced rate of 2,5% per month from the previous Signups in the first year and at 5% per month from the previous Signups in the second year.
- Beside organic Signups, the model considers to use online marketing for attracting signups and building brand awareness. Offline actions will be still performed (demos to industry events, dedicated events with the main industry representatives, onsite demos and sells actions).
- The model assumes a variable growth rate for organic Signups. It starts with a 5% monthly growth of organic signups for the first 6 months, then continues with a 10% growth for the 7th-12th month, then with a 20% growth for the 13th-18th month and with a 30% growth for the 19th-24th month.
- The model assumes a constant marketing costs per signup of 10 EUR per paid signup. This rather low marketing cost can be achieved considering a partnership with the water utilities that would promote SmartH2O platform on their web sites in addition to paid online marketing.
- The model assumes a linearly increasing amount spent on marketing and sales operations. The marketing expenses will grow with 250 EUR monthly.
- A churn rate (paying Customers leaving the SmartH2O platform) of 3% per month has been taken into consideration.
- The Average Revenue per User (ARPA) considered for calculations is of 2

EUR/Month/Customer.

- The calculations are done for the scenario specified by the business objective previously defined: *SmartH2O platform will be deployed to 7 water utilities and* ***5,.000 end-consumers*** *from Romania and Eastern-Europe* ***in the next two years from its launch on the market****.*
- The financial model of the SmartH2O platform is based on [Fuse Financial Patners, 2014; Janz, 2016], and is a fully reproducible document. This document, *SmartH2OPlatform_FinancialPlan_SETMOB.xlsx,* is available on demand from the reviewers.

Table 15 presents the variables characterizing the signup assumptions.

Table 15. Values used for the financial analysis

Signups beginning of 1st month:	5,000
New signups in month 0	500
Organic signups 1st month:	1,000
Marketing cost per paid signup (EUR)	10.00
Marketing spending 1st month (EUR)	0
Marketing spending increase per month (EUR)	250
No. of Customers at beginning of 1st month	0
Conversion rate of previous month's trial signup (Year 1)	10.00%
Conversion rate of previous month's trial signup (Year 2)	20.00%
Conversion rate of all older trial signups (Year 1)	2.50%
Conversion rate of all older trial signups (Year 2)	5.00%
Churn rate per month	3.00%
ARPA - Average Revenue per Account (EUR)	2.00
(the price paid monthly by the user)	

4.2 Break-even analysis

As for every business, calculation of break-even point is important when performing financial analysis because the break-even point provides the critical idea of how much sales are needed to cover all the expenses of running the SmartH2O platform or the sales volume after which the selling of the platform will start generating profit.

The Break-point analysis is performed on projected Revenues vs projected Costs and considers the following parameter calculation:

- <u>for Revenues</u>: number of Signups, number of paying Customers as a percentage of the Signups, the Average Revenue per User (the monthly price to pe paid by the Customers)
- <u>for Costs</u>: the structure of expenses (General and Administrative, Research and Development, Sales and Marketing, Other costs - marketing expenses, server infrastructure, travel, office rent, service providers)

The projected number of Signups and Customers based are presented in the following tables (Table 16 to **Table 19**), both for Year 1 and for Year 2:

Table 16. Estimated number of signups in Year 1

	Month1	Month2	Month3	Month4	Month5	Month6	Month7	Month8	Month9	Month10	Month11	Month12	Total Year1
Signups beginning of the month	5.000	6.000	7.075	8.228	9.460	10.776	12.177	13.731	15.450	17.349	19.442	21.748	
New signups:													
Organic signups growth per month	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	
New organic signups	1,000	1,050	1,103	1,158	1,216	1,276	1,404	1,544	1,699	1,869	2,055	2,261	17,634
Marketing spending (EUR)	0	250	500	750	1,000	1,250	1,500	1,750	2,000	2,250	2,500	2,750	16,500
Costs per paid signup (EUR)	10	10	10	10	10	10	10	10	10	10	10	10	
New paid signups	0	25	50	75	100	125	150	175	200	225	250	275	1,650
Total new signups	1,000	1,075	1,153	1,233	1,316	1,401	1,554	1,719	1,899	2,094	2,305	2,536	19,284
Total signups at end of month	6,000	7,075	8,228	9,460	10,776	12,177	13,731	15,450	17,349	19,442	21,748	24,284	24,284

In real world conditions, the number of end-consumers of the water utility using the SmartH2O platform is affected by conditions as **late conversion** (end-consumers converting from trial users to paying users later than immediately after the 30 days trial is finished) and **churn** (end-consumers leaving the platform). The following tables present the projected number of the real users of the platform after this adjustment is applied:

Table 17. Estimated number of customers in Year 1.

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Total Year1
[redacted]													
Customers													
Customers beginning of the month	0	175	420	692	992	1,322	1,683	2,077	2,513	2,996	3,530	4,119	
New customers:													
Conversions from previous month's signups	50	100	108	115	123	132	140	155	172	190	209	231	1,725
Conversions from older signups	125	150	177	206	237	269	304	343	386	434	486	544	3,661
Total new customers	175	250	285	321	360	401	444	498	558	624	695	775	5,386
Lost customers (churn)	0	5	13	21	30	40	50	62	75	90	106	124	616
Customers end of the month	175	420	692	992	1,322	1,683	2,077	2,513	2,996	3,530	4,119	4,770	4,770

As for the second year, the estimated number of Signups and Customers is modelled in the following tables:

Table 18. Estimated number of signups in Year 2

	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Total Year2
[redacted]													
Signups beginning of the month	24.284	27.297	30.878	35.135	40.198	46.225	53.401	62.628	74.512	89.845	109.653	135.270	
New signups:													
Organic signups growth per month	20%	20%	20%	20%	20%	20%	30%	30%	30%	30%	30%	30%	
New organic signups	2,713	3,256	3,907	4,688	5,626	6,751	8,777	11,410	14,833	19,283	25,067	32,587	138,898
Marketing spending (EUR)	3,000	3,250	3,500	3,750	4,000	4,250	4,500	4,750	5,000	5,250	5,500	5,750	52,500
Costs per paid signup (EUR)	10	10	10	10	10	10	10	10	10	10	10	10	
New paid signups	300	325	350	375	400	425	450	475	500	525	550	575	5,250
Total new signups	3,013	3,581	4,257	5,063	6,026	7,176	9,227	11,885	15,333	19,808	25,617	33,162	144,148
Total signups at end of month	27,297	30,878	35,135	40,198	46,225	53,401	62,628	74,512	89,845	109,653	135,270	168,432	168,432

Table 19. Estimated number of customers in Year 2

	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Total Year2
[redacted]													
Customers													
Customers beginning of the month	4,770	6,348	8,126	10,142	12,446	15,096	18,159	21,719	26,043	31,365	37,983	46,289	
New customers:													
Conversions from previous month's signups	507	603	716	851	1,013	1,205	1,435	1,845	2,377	3,067	3,962	5,123	22,704
Conversions from older signups	1,214	1,365	1,544	1,757	2,010	2,311	2,670	3,131	3,726	4,492	5,483	6,763	36,466
Total new customers	1,721	1,968	2,260	2,608	3,023	3,516	4,105	4,976	6,103	7,559	9,445	11,886	59,170
Lost customers (churn)	143	190	244	304	373	453	545	652	781	941	1,139	1,389	7,154
Customers end of the month	6,348	8,126	10,142	12,446	15,096	18,159	21,719	26,043	31,365	37,983	46,289	56,786	56,786

Figure 15 shows a chart representation of the Signups vs Customer projected evolution during the first two years:

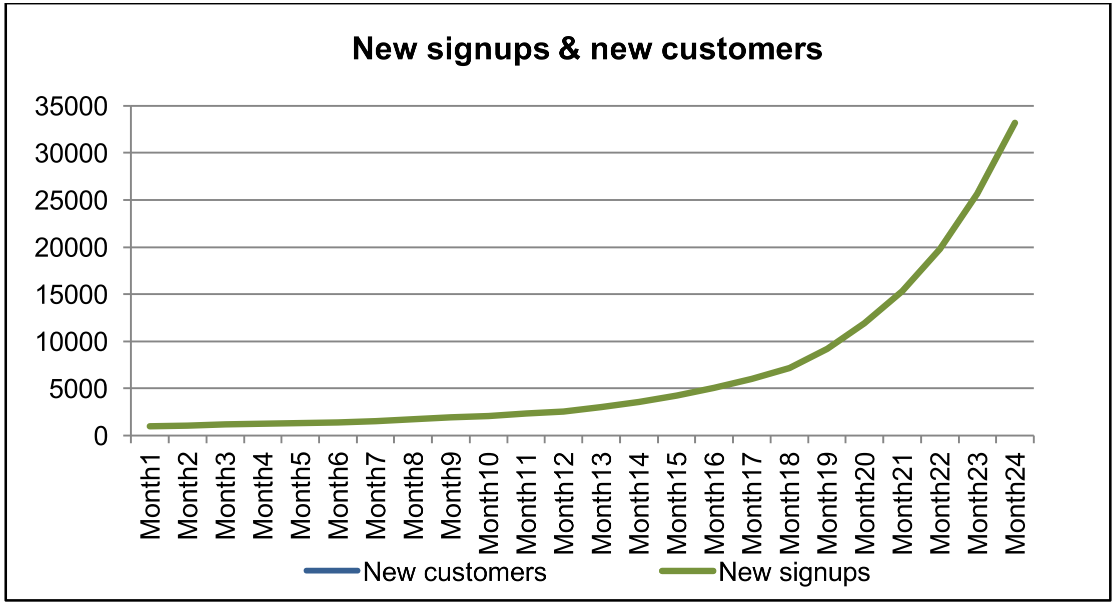

Figure 15. Estimated projection of signups vs. customers for the first two years.

Monthly Recurring Revenue (MRR) is calculated based on projected number of paying Customers and projected Average Revenue per Account (ARPA) for year 1 and year 2:

Table 20. Estimated MRR in Year 1.

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Total Year1
[redacted]													
ARPA (Average Revenue Per User) (EUR)	2	2	2	2	2	2	2	2	2	2	2	2	
MRR beginning of the month (EUR)	0	350	840	1,384	1,984	2,644	3,366	4,154	5,026	5,992	7,060	8,238	
New MRR from new customers (EUR)	350	500	570	642	720	802	888	996	1,116	1,248	1,390	1,550	10,772
Lost MRR (churn) (EUR)	0	10	26	42	60	80	100	124	150	180	212	248	1,232
Net new MRR (EUR)	350	490	544	600	660	722	788	872	966	1,068	1,178	1,302	9,540
MRR beginning of the month (EUR)	350	840	1,384	1,984	2,644	3,366	4,154	5,026	5,992	7,060	8,238	9,540	9,540

Table 21. Estimated MRR in Year 2.

	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Total Year2
[redacted]													
ARPA (Average Revenue Per User) (EUR)	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	
MRR beginning of the month (EUR)	9,540	12,696	16,252	20,284	24,892	30,192	36,318	43,438	52,086	62,730	75,966	92,578	
New MRR from new customers (EUR)	3,442	3,936	4,520	5,216	6,046	7,032	8,210	9,952	12,206	15,118	18,890	23,772	118,340
Lost MRR (churn) (EUR)	286	380	488	608	746	906	1,090	1,304	1,562	1,882	2,278	2,778	14,308
Net new MRR (EUR)	3,156	3,556	4,032	4,608	5,300	6,126	7,120	8,648	10,644	13,236	16,612	20,994	104,032
MRR beginning of the month (EUR)	12,696	16,252	20,284	24,892	30,192	36,318	43,438	52,086	62,730	75,966	92,578	113,572	113,572

The total projected Cash inflow is presented in the following tables:

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Total Year1
[redacted]													
Cash inflow from Basic customers (EUR)	350	840	1,384	1,984	2,644	3,366	4,154	5,026	5,992	7,060	8,238	9,540	50,578
Total cash inflow	350	840	1,384	1,984	2,644	3,366	4,154	5,026	5,992	7,060	8,238	9,540	50,578

Table 22. Estimated cash inflow in Year 1.

As from the previous table, the total Cash inflow estimated for the first year is 50.578 EUR.

	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Total Year2
[redacted]													
Cash inflow from Basic customers (EUR)	12,696	16,252	20,284	24,892	30,192	36,318	43,438	52,086	62,730	75,966	92,578	113,572	581,004
Total cash inflow	12,696	16,252	20,284	24,892	30,192	36,318	43,438	52,086	62,730	75,966	92,578	113,572	581,004

Table 23. Estimated cash inflow in Year 2.

Total Cash inflow estimated for the first year is 581,004 EUR. The exponential increase of the revenues projected for the second year is due to recurrent base of monthly paying customers. It is in line with Soft as a Service (SaaS) financial models already operating in the software industry and it represents a critical argument that favours the SaaS business model adoption for the SmartH2O platform.

The Costs according to projected structure is presented in the following tables, for both year 1 and year 2:

Table 24. Cost structure in Year 1.

		Month1	Month2	Month3	Month4	Month5	Month6	Month7	Month8	Month9	Month10	Month11	Month12	Total Year1
[redacted]														
General and Administrative (G&A)														
Managing Director		2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	24,000
Total G&A Salaries	G&A	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	24,000
Thereof bonuses (incl. payroll taxes)		0	0	0	0	0	0	182	182	182	182	182	182	1,091
G&A Headcount		1	1	1	1	1	1	1	1	1	1	1	1	
Research and Development (R&D)														
Sr. Analyst Programmer (CTO)		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	30,000
Jr. Developer		1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	14,400
QA Engineer		1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	12,000
Total R&D Salaries	R&D	4,700	4,700	4,700	4,700	4,700	4,700	4,700	4,700	4,700	4,700	4,700	4,700	56,400
Thereof bonuses (incl. payroll taxes)		0	0	0	0	0	0	427	427	427	427	427	427	2,564
R&D Headcount		3	3	3	3	3	3	3	3	3	3	3	3	
Sales and Marketing														
Sales and Manager Manager		2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	26,400
Pre Sales Assistant		800	800	800	800	800	800	800	800	800	800	800	800	9,600
Total Sales Salaries	S&M	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	36,000
Thereof bonuses (incl. payroll taxes)		0	0	0	0	0	0	580	580	580	580	580	580	3,483
Sales Headcount		2	2	2	2	2	2	2	2	2	2	2	2	

Table 25. Cost structure in Year 2.

		Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Total Year2
General and Administrative (G&A)														
Managing Director		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	30,000
Total G&A Salaries	G&A	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	30,000
Thereof bonuses (incl. payroll taxes)		227	227	227	227	227	227	227	227	227	227	227	227	2,727
G&A Headcount		1	1	1	1	1	1	1	1	1	1	1	1	
Research and Development (R&D)														
Sr. Analyst Programmer (CTO)		3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	42,000
Jr. Developer		1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	19,200
QA Engineer		1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	14,400
Total R&D Salaries	R&D	6,300	6,300	6,300	6,300	6,300	6,300	6,300	6,300	6,300	6,300	6,300	6,300	75,600
Thereof bonuses (incl. payroll taxes)		573	573	573	573	573	573	573	573	573	573	573	573	6,873
R&D Headcount		3	3	3	3	3	3	3	3	3	3	3	3	
Sales and Marketing														
Sales and Manager Manager		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	30,000
Pre Sales Assistant		800	800	800	800	800	800	800	800	800	800	800	800	9,600
Total Sales Salaries	S&M	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300	39,600
Thereof bonuses (incl. payroll taxes)		650	650	650	650	650	650	650	650	650	650	650	650	7,796
Sales Headcount		2	2	2	2	2	2	2	2	2	2	2	2	

The Cash outflow is summed-up in the following tables.

Table 26. Cash outflow in Year 1.

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Total Year1
[redacted]													
Salaries	9,700	9,700	9,700	9,700	9,700	9,700	9,700	9,700	9,700	9,700	9,700	9,700	116,400
Bonuses (Sales Team)	0	0	0	0	0	0	0	0	1,741	0	0	1,741	3,483
Bonuses (G&A, R&D)	0	0	0	0	0	0	0	0	0	0	0	3,655	3,655
Other costs	4,000	4,250	4,500	5,250	5,500	5,750	6,500	6,750	7,000	7,750	8,000	8,250	73,500
Total cash outflow	13,700	13,950	14,200	14,950	15,200	15,450	16,200	16,450	18,441	17,450	17,700	23,346	197,037

Total Cash outflow estimated for the first year is 197,037 EUR. The main cost type is represented by Salaries (R&D, sales, G&A) followed by the Other costs (marketing, server infrastructure, rent, office supplies, subscription, phones, travel).

Table 27. Cash outflow in Year 2.

	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Total Year2
[redacted]													
Salaries	12,100	12,100	12,100	12,100	12,100	12,100	12,100	12,100	12,100	12,100	12,100	12,100	145,200
Bonuses (Sales Team)	0	0	1,949	0	0	1,949	0	0	1,949	0	0	1,949	7,796
Bonuses (G&A, R&D)	0	0	0	0	0	0	0	0	0	0	0	9,600	9,600
Other costs	10,000	10,250	10,500	10,750	11,000	11,250	12,000	12,250	12,500	12,750	13,000	13,250	139,500
Total cash outflow	22,100	22,350	24,549	22,850	23,100	25,299	24,100	24,350	26,549	24,850	25,100	36,899	302,096

Total Cash outflow estimated for the second year is 302,096 EUR. Again, the main cost type is represented by Salaries, but for this period of time an important increase is given by Other costs that include the marketing spending which in projected to grow at a linear pace every month.

The combined cash flows are presented in the following chart:

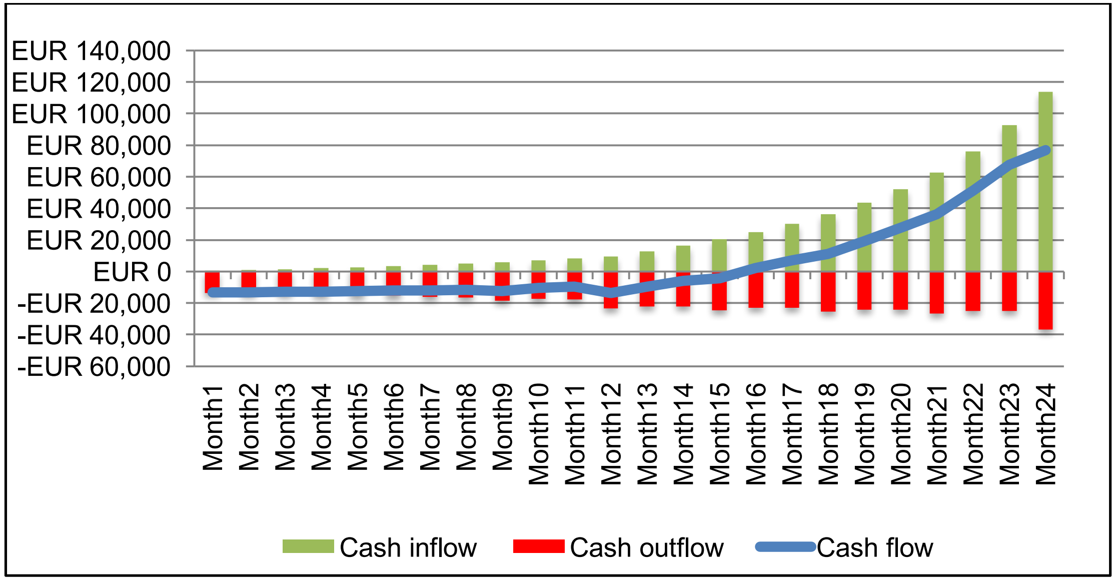

Figure 16. Operating cash flows.

4.3 Break-even analysis

According to cross-projections of the Cash inflow and Cash outflow, SmartH2O platform break-even (the level of turnover required to cover overhead costs [Harvard Business School]) occurs during the fourth month of the second year (Month 16 from beginning of the business operations), as shown in the following figure:

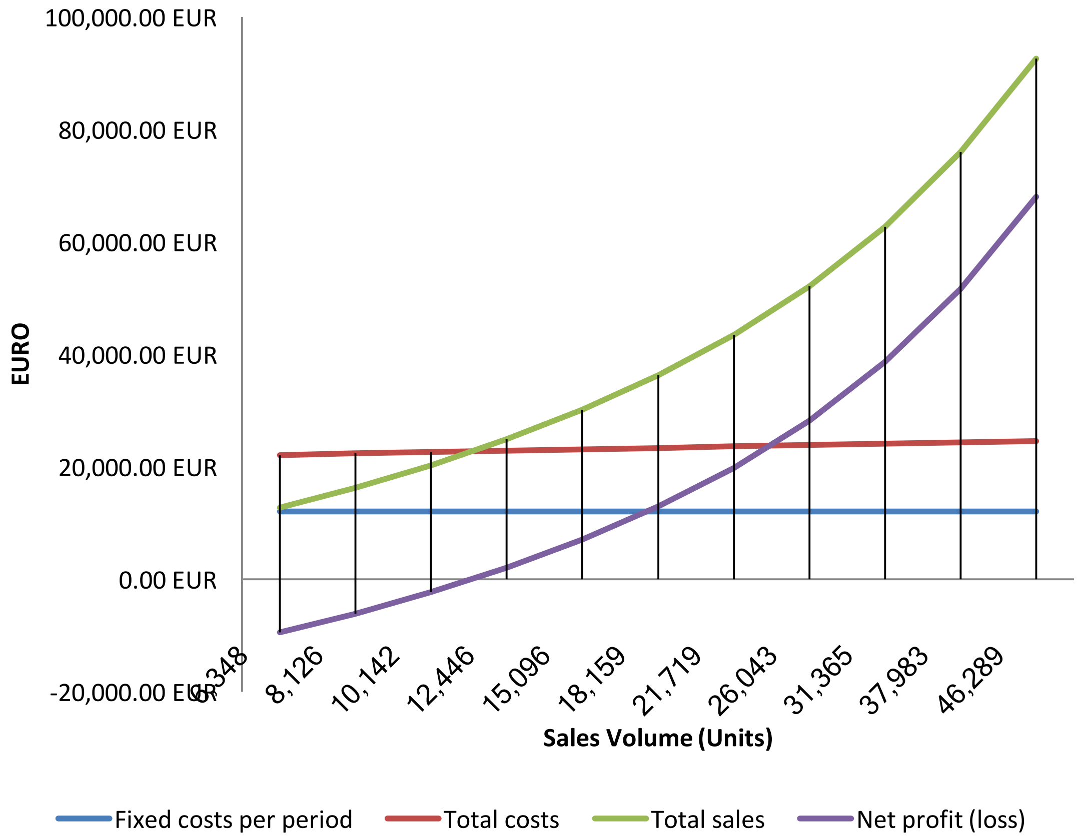

Figure 17. Break-even analysis.

4.4 Projected Profit and Loss

The projected P&L on major revenue and cost elements is presented in the following tables.

Table 28. P&L for Year 1.

	Month1	Month2	Month3	Month4	Month5	Month6	Month7	Month8	Month9	Month10	Month11	Month12	Total Year1
[redacted]													
Revenues	350	840	1,384	1,984	2,644	3,366	4,154	5,026	5,992	7,060	8,238	9,540	50,578
CoGS	500	500	500	1,000	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	12,000
% of revenues	143%	60%	36%	50%	38%	30%	24%	20%	17%	21%	18%	16%	24%
Gross Profit	-150	340	884	984	1,644	2,366	3,154	4,026	4,992	5,560	6,738	8,040	38,578
% of revenues	-43%	40%	64%	50%	62%	70%	76%	80%	83%	79%	82%	84%	76%
Operating Costs													
R&D	4,900	4,900	4,900	4,900	4,900	4,900	4,900	4,900	4,900	4,900	4,900	4,900	58,800
% of revenues	1400%	583%	354%	247%	185%	146%	118%	97%	82%	69%	59%	51%	116%
S&M	3,750	4,000	4,250	4,500	4,750	5,000	5,750	6,000	6,250	6,500	6,750	7,000	64,500
% of revenues	1071%	476%	307%	227%	180%	149%	138%	119%	104%	92%	82%	73%	128%
G&A	4,550	4,550	4,550	4,550	4,550	4,550	4,550	4,550	4,550	4,550	4,550	4,550	54,600
% of revenues	1300%	542%	329%	229%	172%	135%	110%	91%	76%	64%	55%	48%	108%
Total Operating Costs	13,200	13,450	13,700	13,950	14,200	14,450	15,200	15,450	15,700	15,950	16,200	16,450	177,900
% of revenues	3771%	1601%	990%	703%	537%	429%	366%	307%	262%	226%	197%	172%	352%
EBIT	- 13,350	- 13,110	- 12,816	- 12,966	- 12,556	- 12,084	- 12,046	- 11,424	- 10,708	-10,390	-9,462	-8,410	- 139,322

Table 29. P&L for Year 2.

	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Total Year2
[redacted]													
Revenues	12,696	16,252	20,284	24,892	30,192	36,318	43,438	52,086	62,730	75,966	92,578	113,572	581,004
CoGS	2,000	2,000	2,000	2,000	2,000	2,000	2,500	2,500	2,500	2,500	2,500	2,500	27,000
% of revenues	16%	12%	10%	8%	7%	6%	6%	5%	4%	3%	3%	2%	5%
Gross Profit	10,696	14,252	18,284	22,892	28,192	34,318	40,938	49,586	60,230	73,466	90,078	111,072	554,004
% of revenues	84%	88%	90%	92%	93%	94%	94%	95%	96%	97%	97%	98%	95%
Operating Costs													
R&D	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	78,000
% of revenues	51%	40%	32%	26%	22%	18%	15%	12%	10%	9%	7%	6%	13%
S&M	7,550	7,800	8,050	8,300	8,550	8,800	9,050	9,300	9,550	9,800	10,050	10,300	107,100
% of revenues	59%	48%	40%	33%	28%	24%	21%	18%	15%	13%	11%	9%	18%
G&A	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	72,600
% of revenues	48%	37%	30%	24%	20%	17%	14%	12%	10%	8%	7%	5%	12%
Total Operating Costs	20,100	20,350	20,600	20,850	21,100	21,350	21,600	21,850	22,100	22,350	22,600	22,850	257,700
% of revenues	158%	125%	102%	84%	70%	59%	50%	42%	35%	29%	24%	20%	44%
EBIT	-9,404	-6,098	-2,316	2,042	7,092	12,968	19,338	27,736	38,130	51,116	67,478	88,222	296,304

4.5 Financial Ratios

As specified in section 4.1.6 Financial Plan – Important assumptions, based on the working hypothesis, it will take 16 months from release for SmartH2O platform to payback the initial investment. The aggregate profit at the end of Year 2 is of **156,982 EUR** (EBIT Year 1 + EBIT Year2) was obtained by incurring total costs of **499,133 EUR** (Costs Year 1 + Costs Year 2) and represents a return of **31.45%** on the whole investment.

Given that the revenue model is a subscription one while subject to churn, this should result in a sustainable business model for the next few years. However, at this point a significant additional effort is required to analyze the market. Further risks assessment need to be conducted to understand the potential impact of a change in price or a difference in demand to our initial assumptions. Once these relationships are better understood, further financial analysis will need to be completed to ensure the decision to proceed is based on the most realistic evaluation.

5. Drop! game: financial plan

This should be read as the direct sequel to the business plan section for the board game “Drop!” and its online extension (Section 5 of the public part of D8.5). Per choice of Moonsubmarine, the financial plan is kept confidential, and it is exposed thereafter.

5.1 Financial plan – Description of scenarios

Moonsubmarine envisions to have a peculiar approach to the market for the physical card game. The core plan is linked to the ability to sell on the retail market, while the white labelling opportunity is on top. The retail market in the area of the physical games, especially if approached at a pan-European level, needs strong networking, distribution and marketing capabilities.

This being said, the plan at first is to license the game to one or several more expert companies already operating into the described segment. In 2016 we have already stipulated an initial licensing deal with Kaleidos Games based on a special mark-up of 1,5 euro per copy for 2000 copies. This will allow us to test the game appeal and to make experience on the distribution channels. The following years the deal with KG is set for a more sustainable 0,7 euro/copy of mark-up, but for higher volumes.

The retail channel sees a better margin in general (1,5 euro/copy on batches of 3000 printed copies) but it is, as mentioned in Section 5, more risky and complicated. Indeed, a certain number of copies have to be printed and stored in advance for it to be efficient. This is why the retail channel will only be used starting in 2017, after having tested the end-user appeal for the game. Within this channel, revenues will come from acquisition cost from the distributor or from a dealer. Moonsubmarine’s marketing research has identified that 7 euro/copy is the actual market average in that case.

Finally, sales through the White labelling is more profitable per copy sold (an estimated 9 euros). Yet, it needs dedicated personnel business developers) and an extra cost for the customization of the game (set to 5,000 euro per white label).

All these figures have been produced assuming a price of fourteen euro for the game at the shelf of shops. This is in line with the market perception for the quality and type of game we have produced.

Moonsubmarine had produced two plans: a baseline scenario and an exploited one. The main difference between the two scenarios is the level of investment in sales and marketing personnel from 2017, where we will progressively allocate more time to try to exploit the white label channel and the retail one. This can be seen as a more risky scenario in the allocation of resources. Nevertheless, this might also produce better economic returns thanks to the reduced costs of printing.

5.2 Baseline scenario

Table 30. Baseline scenario for the financial plan

MSM Drop!	2015	2016	growth	2017	growth	2018	growth
Copies							
Licensing	0	2000	N/A	6000	200%	12000	100%
Retail	0	0	N/A	1000	N/A	5000	400%
White labeling	0	0	N/A	3000	N/A	6000	100%
Totals	0	2000		10000		23000	
Value of sold €							
Licensing	0	1,5	N/A	0,7	-53%	0,7	0%
Retail	0	7	N/A	7	0%	7	0%
White Labeling	0	9	N/A	9	0%	9	0%
Totals	0	17,5		16,7		16,7	
Revenues		3000	N/A	38200	1173%	97400	155%
Costs							
Distribution Licensing	0	0	N/A	0	0%	0	0%
Printing Licensing	0	0	N/A	0	0%	0	0%
Distribution Retail	0	0	N/A	2	0%	2	0%
Printing Retail	0	0	N/A	3,5	0%	3,5	0%
Setup WL	0	0	N/A	5000	N/A	5000	0%
Printing WL	0	0	N/A	3,5	N/A	3,5	0%
Personel							
Sales & Marketing	0	0	N/A	4500		4500	0%
Totals	0	0		25500		58000	
Gross profit							
Licensing	0	3000	N/A	4200	40%	8400	100%
Retail	0	0	N/A	3498	N/A	17498	400%
White Labeling	0	0	N/A	11500	N/A	28000	143%
Total Gross Profit	0	3000	N/A	19198	540%	53898	181%
Gross Margin		8,6%	N/A	19,2%	124%	26,9%	40%
EBITDA	0	3000	N/A	14698	390%	49398	236%

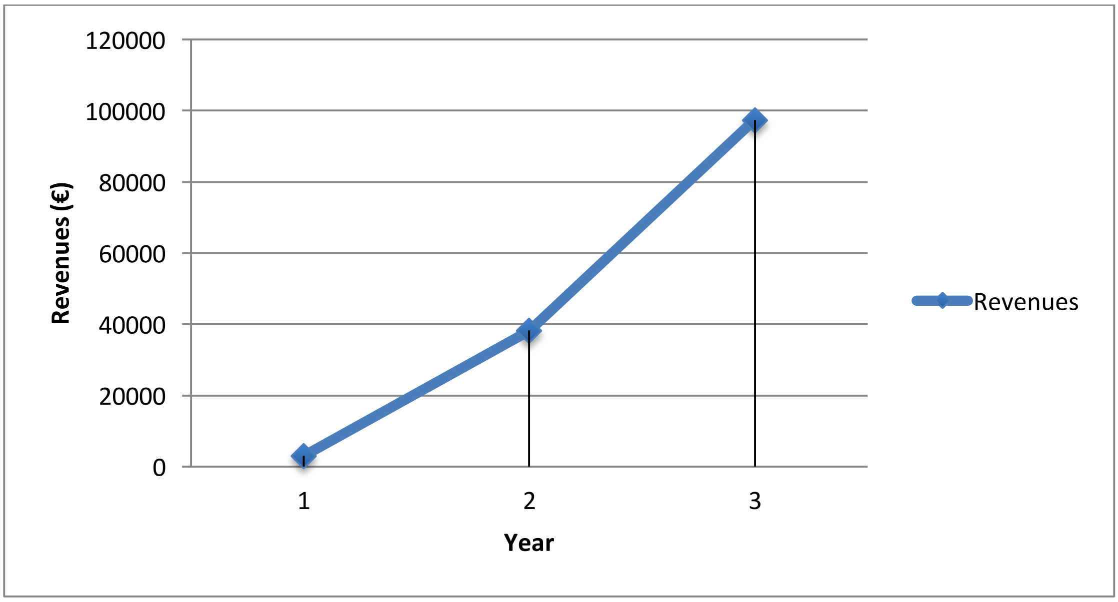

Figure 18. Revenues for the baseline scenario (year 1 is 2016).

In the base scenario (Table 30 and Figure 18), Moonsubmarine will start up its activity in selling the card game during the year 2016 only using the soft approach of the retailing model. This approach will allow the company to test the retail market without risking to print and store many games boxes. In the following two years the company will start investing in marketing and sales in order to address the retail market directly and trying to deal with B2B partners for tailored made (custom) version of the game.

The current business plan sees a **small profit in 2016 as well as the gross margin, the profit will grow steeply in both 2017 and 2018 thanks to the sales and marketing investments (up to 53k€ EBITDA at the end of the third year)**. The initial main drivers for the business growth will be the licensing, while in a second stage the high margin retailing activities will generate the core value for the company. Not having proper loss in 2016 thanks to the model used for the Go-To-Market, there is no need for loss coverage directly by the founders' investments. The personnel costs will remain constant between the second and the third year (10% of a FTE).

5.3 Expected scenario

Table 31. Expected scenario for the financial plan.

MSM Drop!	2015	2016	growth	2017	growth	2018	growth
Copies							
Licensing	0	2000	N/A	6000	200%	12000	100%
Retail	0	0	N/A	1000	N/A	5000	400%
White Labeling	0	0	N/A	9000	N/A	18000	100%
Totals	0	2000		16000		35000	
Value of sold €							
Licensing	0	1,5	N/A	0,7	-53%	0,7	0%
Retail	0	7	N/A	7	0%	7	0%
White Labeling	0	9	N/A	9	0%	9	0%
Totals	0	17,5		16,7		16,7	
Revenues		3000	N/A	92200	2973%	205400	123%
Costs							
Distribution Licensing	0	0	N/A	0	0%	0	0%
Printing Licensing	0	0	N/A	0	0%	0	0%
Distribution Retail	0	0	N/A	2	0%	2	0%
Printing Retail	0	0	N/A	3,5	0%	3,5	0%
Setup WL	0	0	N/A	10000	N/A	15000	0%
Printing WL	0	0	N/A	3,5	N/A	3,5	0%
Personel							
Sales & Marketing	0	0	N/A	9000		13500	0%
Totals	0	0		56000		119000	
Gross profit							
Licensing	0	3000	N/A	4200	100%	8400	100%
Retail	0	0	N/A	3498	N/A	17498	400%
White Labeling	0	0	N/A	39500	N/A	84000	113%
Total Gross Profit	0	3000	N/A	47198	1473%	109898	133%
Gross Margin		8,6%	N/A	47,1%	450%	54,8%	16%
EBITDA	0	3000	N/A	38198	1173%	96398	152%

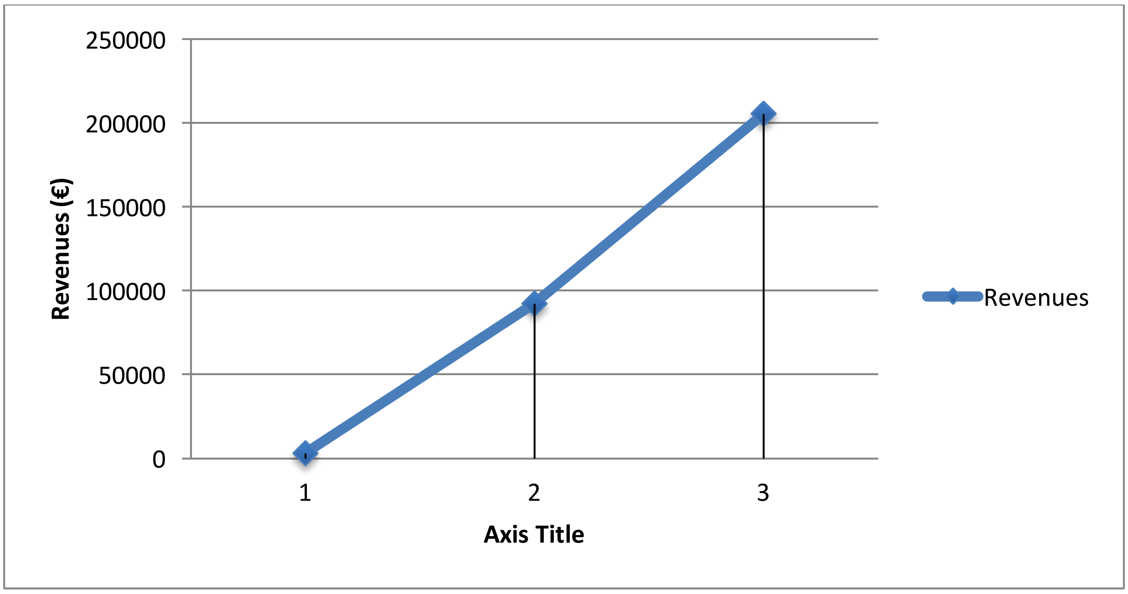

Figure 19. Revenues for the exploited scenario (year 1 is 2016).

In the Exploited Scenario (Table 31 and Figure 19), Moonsubmarine will use the same initial approach of the Baseline Scenario, but it will change on the second and third year where a heavier investment in personnel (from 20% to a progressive 30% of a year of a FTE) will boost the B2B business.

This scenario will show a better Gross Margin and an almost doubled EBITDA, but it will be applicable only if the first year will show high market interest in the game concept.

6. Smart meter data management component – SMDM: financial plan

This section should be read as the confidential part of Section 6 of the public part of D8.5. It is an integral part of the business plan outlined in this deliverable for the SMDM.

6.1 Financial Plan – important assumptions

As for the first period of time, running SMDM business operations will rigorously follow the business operations of SmartH2O platform as detailed in Section 4. In this section the following assumptions have been made in the context of financial planning.

Table 32. Figures used for the financial plan.

No.of water utilities buying SmartH2O platform in two years	7
Total no.of end-users of water utilities	56786
Total operational costs of SmartH2O platform for two years (EUR)	499133
Cost to acquire 1 water utility (EUR)	71304.71
Average no. of end-users per water utility (EUR)	8112
Cost to acquire 1 end-user of water utility (EUR)	8.79
Churn per month (average % of last month's customers that drop out)	3%
Fraction of SMDM operational cost from SmartH2O platform operational cost	30%
Monthly SmartH2O platform charge per end-user (EUR)	2
SMDM revenue share from SmartH2O platform ARPA	25%

6.2 Results

The result of SMDM business operations on the base of projected revenue streams and cost structure is presented in the following tables. The result is decomposed on the months of Year1 and Year 2.

Table 33. Result of business operations for SMDM in Year 1.

RESULTS OF BUSINESS OPERATIONS IN YEAR 1	YEAR 1											
	Month1	Month2	Month3	Month4	Month5	Month6	Month7	Month8	Month9	Month10	Month11	Month12
Number of new end-users	175	250	285	321	360	401	444	498	558	624	695	775
Number of end-users that drop service	0	5	7	8	9	11	12	13	15	16	18	20
Net new end-users	175	245	278	313	351	390	432	485	543	608	677	755
Total active end-users	175	420	697	1010	1361	1751	2183	2668	3212	3820	4496	5251
Monthly Revenue from SaaS (EUR)	87.50	209.88	348.70	505.04	680.35	875.59	1091.73	1334.25	1605.97	1909.82	2248.21	2625.55
Total SmartH2O platform operational costs (sales, marketing, delivery, support) (EUR)	-13700.00	-13950.00	-14200.00	-14950.00	-15200.00	-15450.00	-16200.00	-16450.00	-18441.00	-17450.00	-17700.00	-23346.00
Total SMDM operational costs a fraction of SmartH2O platform operational costs (EUR)	-4110.00	-4185.00	-4260.00	-4485.00	-4560.00	-4635.00	-4860.00	-4935.00	-5532.30	-5235.00	-5310.00	-7003.80
Monthly Net Cash Benefit (EUR)	-4022.50	-3975.13	-3911.30	-3979.96	-3879.65	-3759.41	-3768.27	-3600.75	-3926.33	-3325.18	-3061.79	-4378.25

Table 34. Result of business operations for SMDM in Year 2

RESULTS OF BUSINESS OPERATIONS IN YEAR 2	YEAR 1											
	Month13	Month14	Month15	Month16	Month17	Month18	Month19	Month20	Month21	Month22	Month23	Month24
Number of new end-users	1721	1968	2260	2608	3023	3516	4105	4976	6103	7559	9445	11886
Number of end-users that drop service	23	51	58	66	76	88	103	120	146	179	221	277
Net new end-users	1698	1917	2202	2542	2947	3428	4002	4856	5957	7380	9224	11609
Total active end-users	6949	8867	11069	13611	16558	19985	23987	28843	34801	42181	51405	63014
Monthly Revenue from SaaS (EUR)	3474.73	4433.26	5534.50	6805.46	8278.84	9992.63	11993.72	14421.69	17400.35	21090.49	25702.29	31506.93
Total SmartH2O platform operational costs (sales, marketing, delivery, support) (EUR)	-22100.00	-22350.00	-24549.00	-22850.00	-23100.00	-25299.00	-24100.00	-24350.00	-26549.00	-24850.00	-25100.00	-36899.00
Total SMDM operational costs a fraction of SmartH2O platform operational costs (EUR)	-6630.00	-6705.00	-7364.70	-6855.00	-6930.00	-7589.70	-7230.00	-7305.00	-7964.70	-7455.00	-7530.00	-11069.70
Monthly Net Cash Benefit (EUR)	-3155.27	-2271.74	-1830.20	-49.54	1348.84	2402.93	4763.72	7116.69	9435.65	13635.49	18172.29	20437.23

The projected total net cash benefit of SMDM after two years is 24,417.58 EUR

6.3 Break-Even analysis

As from the Break-even occurs during the fifth month of the second year (Month 17 from beginning of the business operations), as shown in Figure 20.

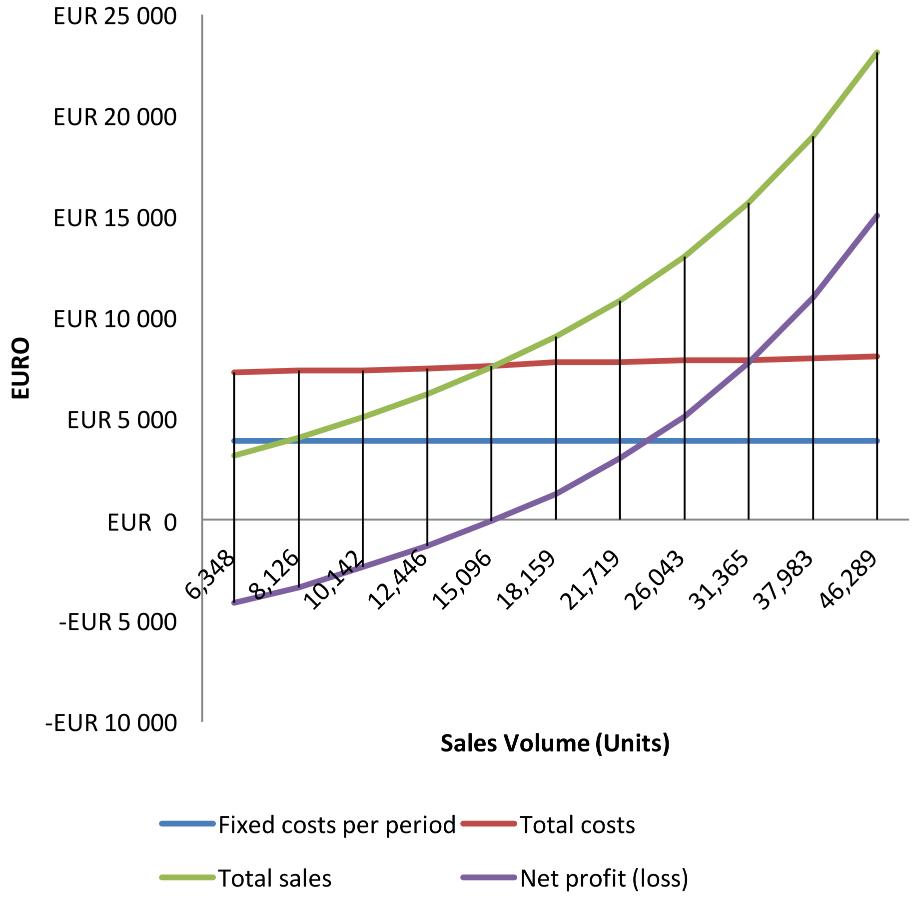

Figure 20. Break-even analysis chart.

6.4 Financial Ratios

As specified in the Financial Plan – Important assumptions, based on the working hypothesis, it will take 17 months from release for SMDM solution to return the investment. The aggregate profit at the end of Year 2 is of **24,417,.58 EUR** (Year 1 + Year 2) is projected to be reached by employing total costs of **149,739.90 EUR** (Costs Year 1 + Costs Year 2) and represents a return of **16.36%** on the investment.

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8. Appendix A. Computation of the present-day quantity of water saved.

This impacts details how the data presented in Table 6 was obtained.

In [Thames Water, 2014], impacts of metering, and therefore financial implications for utilities, are different for different profiles of water consumers. It is very difficult to establish these profiles without appropriate data, which only smart metering could adequately provide. Therefore, one must use a proxy. Property type is one such proxy. The presence of a garden indicates that residents may use water for lawn watering. Besides, owning certain types of houses are signs of wealth, in a context where wealthy users are expected to be less sensitive to the introduction of volumetric pricing of water. Property types include:

- Detached houses;
- Semi-detached houses;
- Terraced houses;
- Small blocks of flats: flat in a small block or converted house;
- Large blocks of flats.

Contrary to [Thames Water, 2014], this document assumes that all flats within a block are metered individually, so that reductions in consumption apply to them. Repartition of metered and non-metered houses in the area where Thames Water operates is given by Table 35. Even though this is 2012-2013 data, it is used as present data for the 2016-2060 ROI calculation. Besides, growth scenarios "-AV" and "-HE" assume a uniform annual growth of all property types.

Table 35. 2012-2013 repartition of houses in the Thames Water area. From [Thames Water, 2014], Table 7-13.

Property type	No metering	Traditional metering	Total
Detached	119,880	186,492	306,372
Semi-detached	382,446	182,155	564,601
Terraced	652,440	275,101	927,541
Flats – Large Block	678,181	203,934	882,115
Flats – Small Block	481,640	108,251	589,891
Total	2,314,587	955,933	3,270,520

[Thames Water, 2014] then evaluates the average demand reduction associated with the introduction of metering, traditional or smart (see **Table 36**).

Table 36. Reduction in consumption by property type and meter reading technology.

Property type	Traditional metering	Smart metering
Detached	10.9%	14.9%
Semi-detached	14.8%	18.8%
Terraced	8.8%	12.8%
Flats – Large Block	9.1%	13.1%
Flats – Small Block	4.3%	8.3%
Average	13.5%	10.2%

From [Thames Water, 2014], Table 7-14

This data was used in conjunction with average consumption data per property type (Thames Water confidential data), to get the data reported in Table 6.