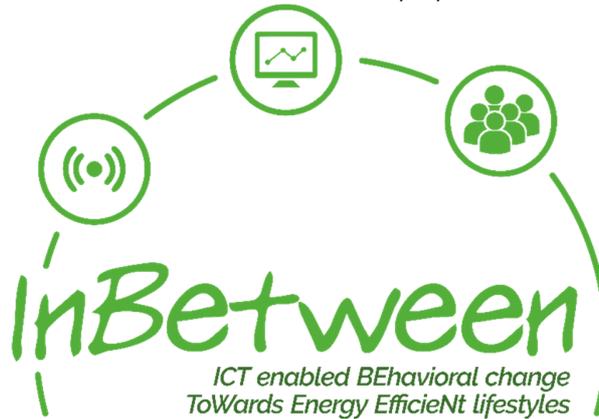




## D6.1–MARKET ANALYSIS

Due date of deliverable: 31/05/2019  
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**LEADER: RINA-C**

### DISSEMINATION LEVEL

PU	Public	X
CO	Confidential, only for members of the consortium (including the Commission Services)	

### HISTORY

Version	Description	Lead author	Date
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V2	Draft Final Version	Manuela Gussoni- RINA-C	May 2019
V3	Version submitted as requested in the GA	Elenia Duce – RINA-C	May 2019
V4	Revision after the comments received in the Review meeting	Francesca Zappia, Claudia Portulano, Manuela Gussoni, Elenia Duce RINA-C	August 2019

### DISCLAIMER

The work presented in this document has been conducted in the context of the H2020 of the European community project InBetween (n° 768776). The partners in the project are: Rina Consulting S.p.A., Acciona Construcción S.A., AIT Austrian Institute of Technology GmbH, Develco Products, The Interdisciplinary Center Herzliya, Institute Mihajlo Pupin, Vilogia S.A, Sonnenplatz Großschönau GmbH. The content of this report does not reflect the official opinion of the European Union. Responsibility for the information and views expressed in the therein lies entirely with the author(s).



## EXECUTIVE SUMMARY

The present document constitutes Deliverable 6.1 “Market Analysis”. It has been developed within WP6, in the framework of Task 6.1 “Flexible INBETWEEN Supporting Business Model”.

The document presents a technology market analysis with the scope of understanding the evolving opportunities and threats related to the strengths and weaknesses of the INBETWEEN platform, positioning them on the market and assessing their market potential.

This market analysis provides an actual, accurate and objective picture of current patterns and trends, and an understanding of the factors contributing to the success of Information and Communication Technology (ICT) tools for increasing energy efficiency in buildings through changes of the end user behaviour and lifestyle.

The INBETWEEN platform could be used by technology providers, governments/policy makers, social housing associations and municipalities, Energy Service Companies (ESCOs), scientific communities and all companies involved in the development of ICT solutions on Energy Efficiency domain.

Since the above-mentioned target groups are possible customers of the ICT platform developed by the project, their needs and expectations are investigated.

How to read this document:

- Chapter 1 introduces the whole document.
- Chapter 2 describes the methodology of all process of market analysis.
- Chapter 3 reports the analysis of the INBETWEEN reference market. It describes the ICT market for energy efficiency in buildings focusing on smart home solutions. The Chapter shows also how INBETWEEN influences other markets: for each project result, a target market is identified and described in detail with the aim to understand if the single modules could be commercialized separately from the INBETWEEN integrated platform.
- Chapter 4 classifies the target groups and the stakeholders’ expectations.
- Chapter 5 analyses opportunities and threats related to the strengths and weaknesses of the INBETWEEN platform.
- Chapter 6 describes the potential barriers for the INBETWEEN project through the PESTLE analysis.
- Chapter 7 analyses the competitive solutions available on the market.
- Chapter 8 reports the conclusion of this document; it is a summing-up of the whole market analysis.



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## 1 INTRODUCTION

The present document constitutes Deliverable 6.1 “Market Analysis”. It has been developed within WP6, in the framework of Task 6.1 “Flexible INBETWEEN Supporting Business Model”.

The document presents a technology market analysis with the scope of understanding the evolving opportunities and threats related to the strengths and weaknesses of the INBETWEEN platform, positioning them on the market and assessing their market potential.

This document highlights that ICT for energy efficiency market is not saturated. The market provides many technological solutions each one with its own peculiarity and therefore the end users are forced to use multiple programs to achieve their purpose. Therefore, INBETWEEN aims at entering into this market and gaining a competitive advantage by proposing a new ICT platform able to assist simultaneously users to identify energy wastes, learn how they can conserve energy and motivate them to act.

How to read this document:

- Chapter 1 introduces the whole document
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## 2 METHODOLOGICAL ASPECTS

### 2.1 MARKET ANALYSIS

This analysis provides an accurate overview of current patterns and market trends, and an understanding of the factors contributing to the success of Information and Communication Technology (ICT) tools for increasing energy efficiency in buildings through changes of the end user behaviour and lifestyle.

The Market Analysis helps to guide strategic decision-making process starting with the choice of specific market segment and what resources will be necessary to gain market share.

Initially, we considered the sector of energy efficiency (EE) and, based on this initial analysis, the domain of ICT for energy efficiency in buildings, in particular, related to smart homes that has been identified as the INBETWEEN reference market. Furthermore, in the market analysis it has been highlighted how the ICT platform for energy efficiency will have a positive impact also on other markets, such as construction, renewable technologies and energy retrofit solutions.

In particular, based on the list of Exploitable Results identified, additional target markets have been identified. They are the potential market in which the single modules constituting the INBETWEEN integrated platform could be commercialized.

Barriers and opportunities to entry into the market related to ICT software tools for energy efficiency in buildings have been investigated.

Tools available on the market that provide comparable functionalities of INBETWEEN have been taken into account. The business and research domain have been investigated in order to evaluate all solutions available on the markets.

### 2.2 STAKEHOLDERS' EXPECTATIONS

The INBETWEEN platform could be used by technology providers, governments/policy makers, social housing associations and municipalities, Energy Service Companies (ESCOs), scientific communities and all companies involved in the development of ICT solutions on Energy Efficiency domain.

Since the above-mentioned target groups are possible customers of the ICT platform developed by the project, their needs and expectations are investigated.

### 3 MARKET ANALYSIS

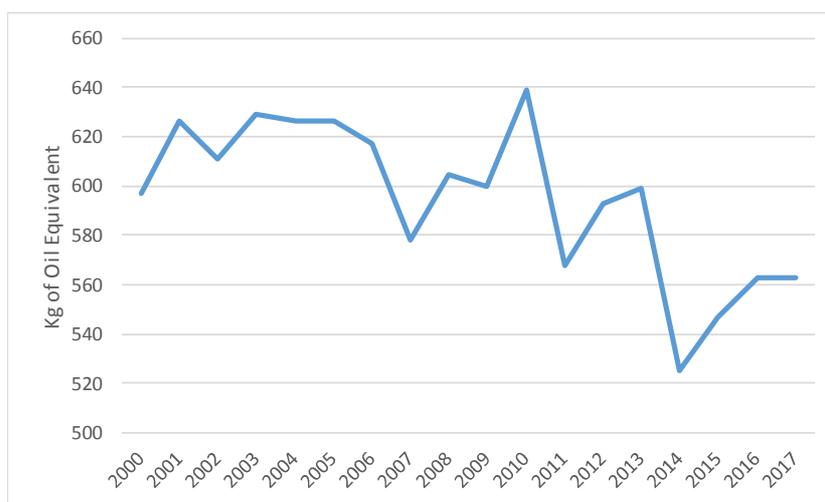
In 2016, the EU28 energy consumption reaches 1.6 billion tons of oil equivalent (TOE) (see Table 1). Total petroleum products are the most consumed for a total of 567 millions TOE, followed by the consumption of Gas and solid fuels. The consumption of Renewable energies, energy from wastes and Electrical Energy is about the 14% of the total in 2016.

**Table 1: EU28 Simplified energy balance – Gross inland Consumption (000 TOE)**

Product	2014	2015	2016
<b>Total petroleum product</b>	551,801	560,910	567,143
<b>Gas</b>	343,548	357,943	382,970
<b>Solid fuel</b>	268,776	262,747	240,724
<b>Nuclear heat</b>	226,141	221,202	216,703
<b>Renewable energies</b>	203,686	211,673	216,618
<b>Waste (non-renewable)</b>	13,128	13,613	14,893
<b>Electrical Energy</b>	1,333	1,226	1,564
<b>TOTAL EU28 ENERGY CONSUMPTION (000 TOE)</b>	<b>1,608,412</b>	<b>1,629,314</b>	<b>1,640,614</b>

Source: Rina Elaboration on the bases of Eurostat Data

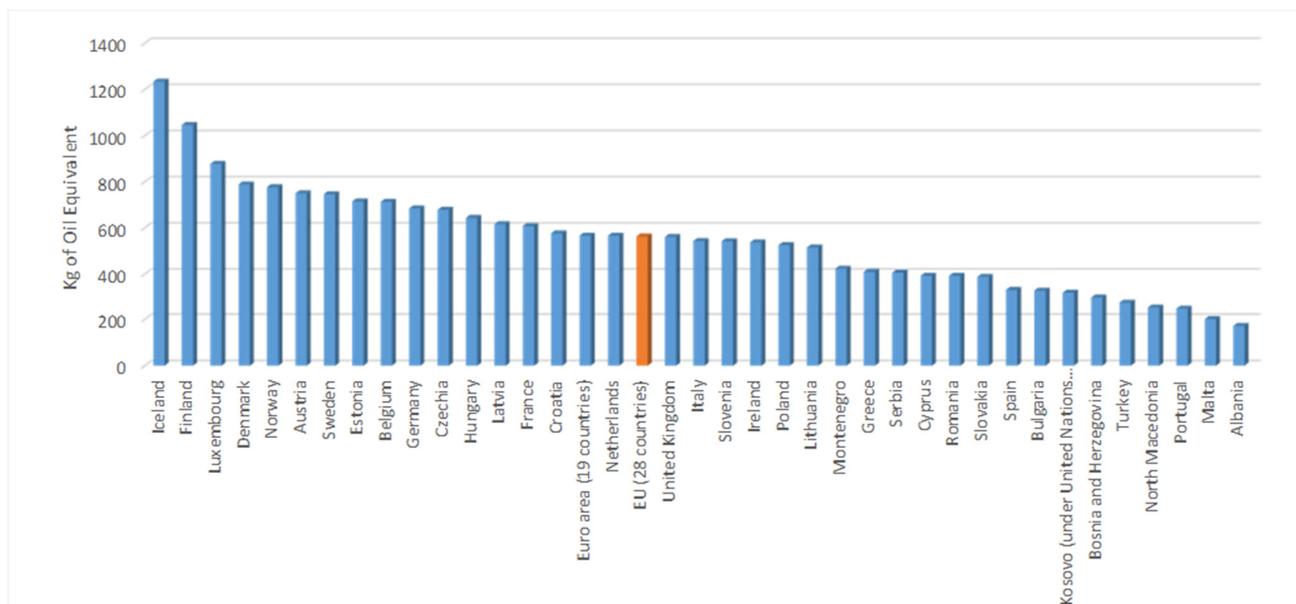
In 2017, the final energy consumption in EU28 household per capita was equal to 563 Kg of Oil Equivalent and shows a decreasing trend since 2009 (Figure 1).



**Figure 1: EU 28 Final Energy Consumption in household per capita**

Source: Rina Elaboration on the base of Eurostat Data

Notes: The indicator measures how much electricity and heat every citizen consumes at home excluding energy used for transportation. Since the indicator refers to final energy consumption, only energy used by end consumers is considered. The related consumption of the energy sector itself is excluded.



**Figure 2: Final Energy Consumption in household per capita, by country- year 2017**

Source: Rina Elaboration on the base of Eurostat Data

Notes: The indicator measures how much electricity and heat every citizen consumes at home excluding energy used for transportation. Since the indicator refers to final energy consumption, only energy used by end consumers is considered. The related consumption of the energy sector itself is excluded.

The first countries, in terms of energy consumption in household per capita, are Iceland, Finland. Luxembourg is the first EU28 country, with an average per capita consumption in household of 877 kg of oil equivalent, but it emerges a high variability among these consumption levels by countries. For example, in 2017, Italy and Spain, even though they present similar climatic and economic conditions, present also very different levels of electricity and heat every citizen consumes at home. Italy presents a level equal to 543 kg of Oil equivalent, while Spain presents a level of 331 kg of Oil Equivalent. This could mean that there is room for interventions aimed at reducing consumption, energy efficiency and energy saving, even by a citizen behavioral change.

The energy sector collects large amounts of data on a continuous basis.

With the applications of sensors, wireless transmission, network communication, and cloud computing technologies, the way to generate, transmit, distribute and use energy is changing and this will have a major impact on every segment of European society.

According to a recent Survey on more than 1.400 developers actively creating new applications with the latest technologies, the utility/energy sector is in the 12<sup>th</sup> position among the industries mainly targeted by big data analytics applications in 2016.<sup>1</sup> Data shows how, in recent years, utilities and energy efficiency providers have used new data tools (home energy reports, web portals, and mobile apps) to unlock cost and energy savings for customers.

<sup>1</sup> Source: Forbes

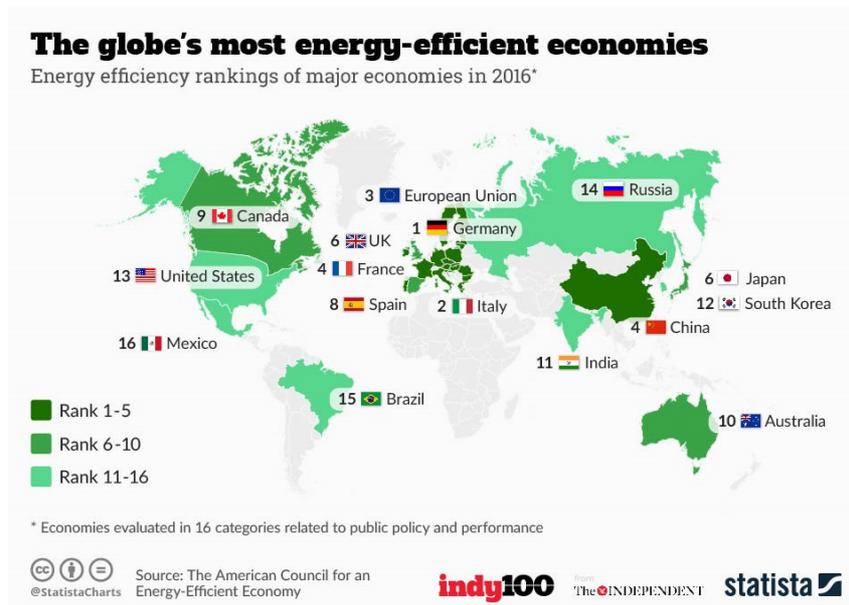
### 3.1 THE ENERGY EFFICIENCY MARKET

The European Union (EU) has committed itself to a 20 % reduction of energy consumption by the year 2020 compared to baseline projections. This objective is also known as the 20 % energy efficiency target.

Energy efficiency is the catchphrase of the early 21st century. Since the energy demand around the world is rising, concerns about traditional sources and increasing environmental awareness, saving energy, improving transmission and distribution and generating power from renewable sources have become priorities for Europe<sup>2</sup>. Improving energy efficiency will save money, help protect the environment, create new jobs, spur economic growth and improve security of supply by reducing Europe's dependency on imported fossil fuels.

According to the American Council for an Energy-Efficient Economy (ACEEE), Germany is the most energy-efficient country<sup>3</sup> worldwide (Figure 3).

Germany is also the first country in terms of annual per capita public spending on energy efficiency. In 2014, per capita government spending on energy efficiency was 31.3 US dollars in Germany, followed by Italy (25 USD) and Canada (24.54 USD) (Figure 4).

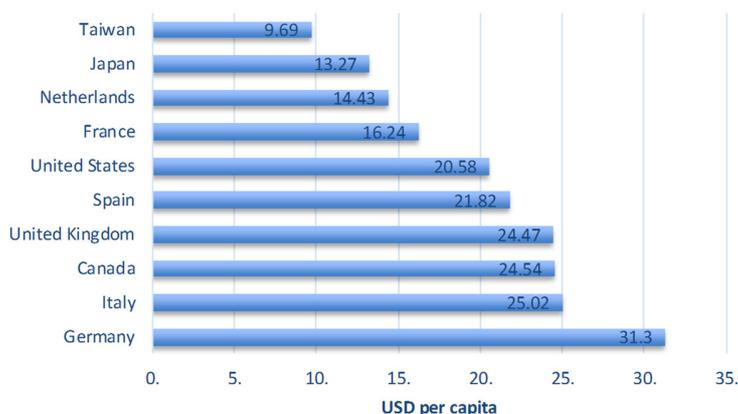


**Figure 3: The globe's most energy-efficient economies**

Source: The American Council for an energy efficiency Economy

<sup>2</sup> <https://ec.europa.eu/digital-single-market/en/news/smart-ict-energy-efficiency>

<sup>3</sup> This analysis looked at 16 different economies, taking fuel efficiency standards for cars, power efficiency standards for household appliances and energy consumed to heat a square foot of a building all into account.



**Figure 4: Global per capita public spending on energy efficiency by key country 2014**

Source: ACEEE; IEA; World Bank; Expert(s) (Janeiro et al. 2016)

ICT has an important role to play in reducing the energy intensity<sup>4</sup> and increasing the energy efficiency in the EU economy. A bulk of innovative firms is rising in order to provide ICT services with the aim of improving energy efficiency through, among the other, the prediction of energy needs, storing power services and monitoring systems.

Analyzing the offering of more than 100 international startups and players in the energy sector<sup>5</sup>, we have identified for the Energy Efficiency aimed ICT tool services, four main target segments (Table 2):

- Renewables
- The Building Energy Management Sector
- The Private Household Consumers
- Cities and Local authorities

**Table 2: Innovative ICT Services for Energy Efficiency**

TARGET SEGMENT	ENERGY EFFICIENCY/ DATA ANALYTICS SERVICE	SERVICE VALUE PROPOSITION	NEW PLAYERS/STARTUPS
<b>Renewables sector and renewables end-users</b>	SaaS for the Prediction of energy needs and storing power	The use of sensors on wind and solar facilities that gather real-time data on wind and sun levels, transmitting the information and combining it with satellite, radar, and weather station data, accurately predicts energy needs, improving the efficiency in storing the excess of energy production when there are some, and providing some energy back when needed. This secure the energy supply.	<b>Sylfen (FR)</b> <a href="http://sylfen.com/en/home/">http://sylfen.com/en/home/</a> <b>Caban Systems Inc (US)</b> ( <a href="http://www.cabansystems.com/">http://www.cabansystems.com/</a> )

<sup>4</sup> Energy intensity is defined as the amount of energy necessary to produce a unit of Gross domestic product (GDP) (in COM(2008))

<sup>5</sup> See the report “Startup energy transition- the top 100 startup of 2019” provided by the German Energy Agency in cooperation with the World Energy Council

TARGET SEGMENT	ENERGY EFFICIENCY/ DATA ANALYTICS SERVICE	SERVICE VALUE PROPOSITION	NEW PLAYERS/STARTUPS
<b>Building Energy management</b>	SaaS for improving energy efficiency	Through the automation of data collection from energy meters, to IoT and building automation systems and even utility companies it improves energy efficiency in commercial and public buildings	<p><b>NUUKA Solutions (FI)</b> <a href="https://www.nuukasolutions.com/home">https://www.nuukasolutions.com/home</a></p> <p><b>EcoSync (UK)</b> <a href="https://www.ecosync.energy/">https://www.ecosync.energy/</a></p> <p><b>Enerbrain srl (IT)</b> <a href="https://www.enerbrain.com/">https://www.enerbrain.com/</a></p> <p><b>KOGU Home GmbH (DE)</b> <a href="https://www.kugu-home.com/home-en/">https://www.kugu-home.com/home-en/</a></p> <p><b>Leaftech GmbH (DE)</b> <a href="https://leaftech.eu/">https://leaftech.eu/</a></p>
<b>Household Energy consumers</b>	Smart Homes - energy monitoring systems	<p>Energy saving systems combining a utility switch and energy monitoring to reduce utility bills.</p> <p>Monitoring the user behavior the system has the capacity to detect whether solar panels can keep up with energy needs while additionally giving tips on how to save money.</p>	<p><b>Ecoisme (UK)</b> <a href="https://ecoisme.com/">https://ecoisme.com/</a></p> <p><b>Hygge Power (US)</b> <a href="https://www.hyggepower.com/">https://www.hyggepower.com/</a></p>
<b>Cities and local authorities</b>	Smart Cities - energy monitoring systems	Public lighting expenses reduction through a solution that modulates lighting according to the weather, the time of day, the neighborhood, and maintenance needs.	<p><b>Bouygues Energies &amp; Services (Multinational company)- Citybox</b> ® <a href="https://www.bouygues-construction.com">https://www.bouygues-construction.com</a></p>

Source: RINA-C Elaborations

In the following chapters, we will focus on the Smart Home segment, since it has been identified by the INBETWEEN project's partners as the most interesting for the INBETWEEN innovations. This segment will be analyzed from a global point of view, in order to identify possible opportunities for INBETWEEN, in the smart applications market.

### 3.2 The Smart Home industry

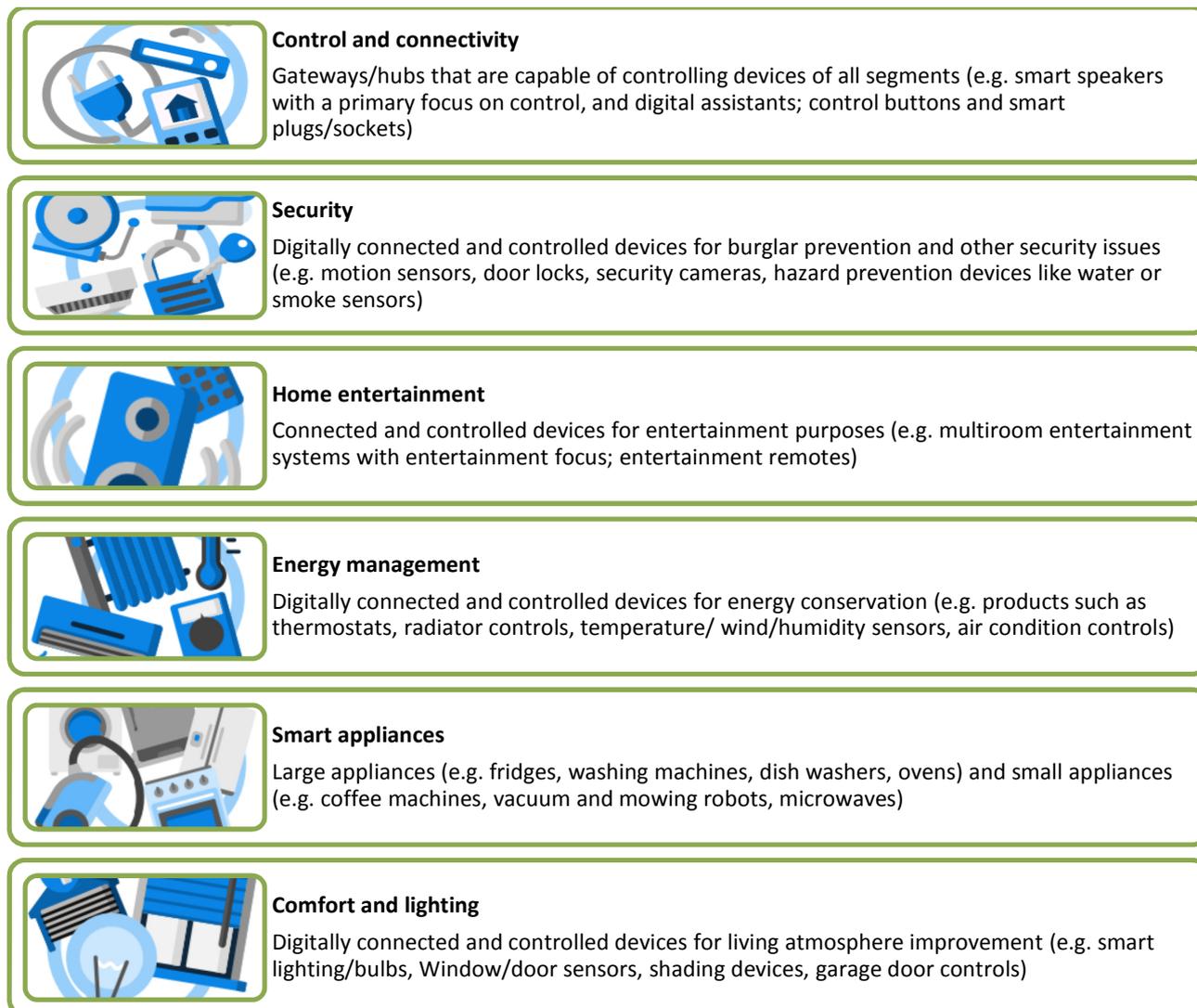
The Smart Home market constitutes the sale of networked devices and related services that enable home automation for private end users (B2C). Considered are devices that are connected directly or indirectly to the Internet. Their main purposes are the control, monitoring and regulation of functions in a private household.

Homes become smart when they allow the remote control and monitoring of individual devices and, if applicable, their direct communication with one another (Internet of Things), as an essential component of intelligent home automation. Therefore, services, which are necessary for the maintenance or control of the household network, are also considered part of the smart sector, e.g. subscription fees for control apps or external monitoring services.

Devices whose primary function is not the automation or remote control of household equipment, e.g. smartphones and

tablets, are not included. Similarly, devices that relate to household connection and remote control only to a limited extent, such as smart TVs, are not included either.

Given the above definition, the Smart Home market can roughly be divided into six segments primarily based on use cases, as reported in the following Figure 5.



**Figure 5: Smart Home market segments**

INBETWEEN will integrate a Home Automation platform (empowering user to engage) with a set of cloud based energy services among which is the User profiling and categorization and Performance evaluation and benchmarking (collaborative approach).

The worldwide revenue in the Smart Home market amounted to US\$56 billion in 2018. Revenue is expected to show an annual growth rate (CAGR 2018-2023) of 22.3%, resulting in a market volume of US\$153 billion by 2023 (see Figure 6). Household penetration<sup>6</sup> is 7.7% in 2019 and is expected to hit 18.1% by 2023.

<sup>6</sup> Share of households

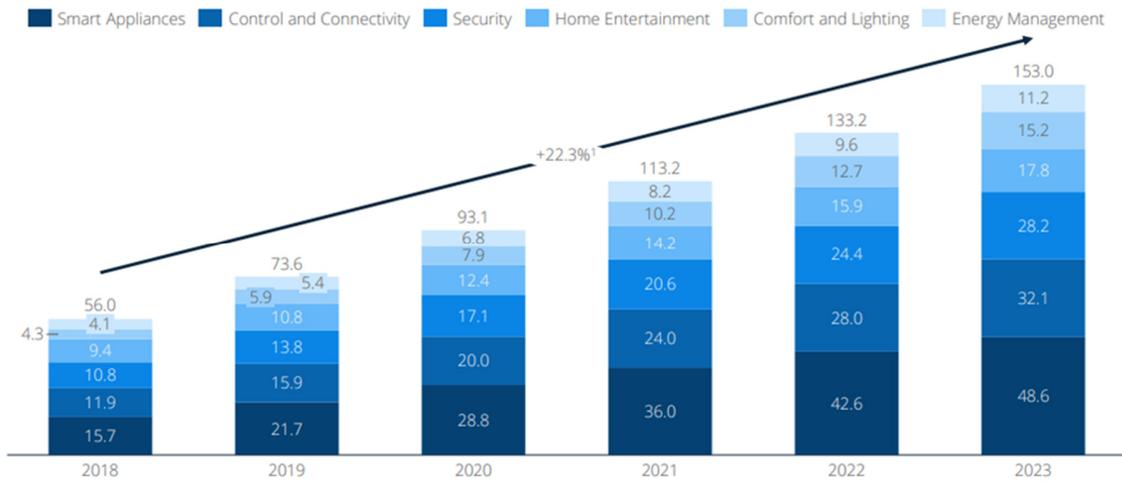


Figure 6: Global revenue forecast in billion US\$

Source: Statista

The biggest Smart Home market in 2018 is the U.S. with revenues of US\$24.0 billion. Although the prospects are positive, growth rates are expected to be significantly lower than in China, with 12.7% annually. This will lead to revenues of US\$43.7 billion by 2023.

The European market is worth US\$13.0 billion in 2018, with Control and Connectivity as the second biggest segment behind Smart Appliances, corresponding to 19.7% of the regional market share. Sales are expected to grow at a CAGR of 22.7% up to 2023 and result in revenues of US\$36.2 billion.

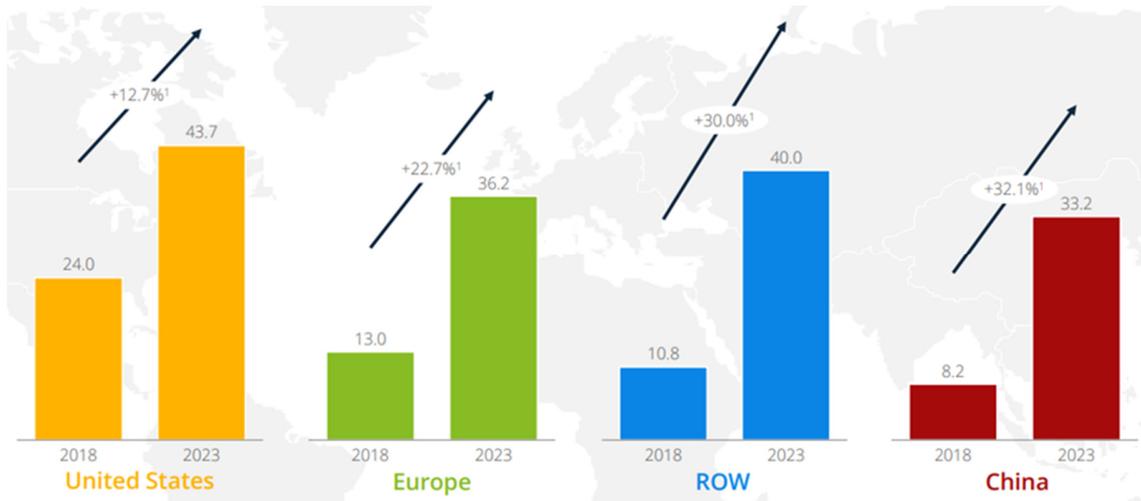


Figure 7: Total Smart Home revenue forecast in billion US\$ by country

Source: Statista

In the following subchapters, the Smart Home market segments defined as primary markets for the INBETWEEN project have been analysed in detail. The primary markets are **Energy Management** and **Comfort and lighting**. The **Security** segment is not a primary market for the INBETWEEN solutions but it could be reach considering an adaptation of the platform in terms of extension of their services. Therefore, the analysis of this segment is provided too.

### 3.2.1 Energy Management

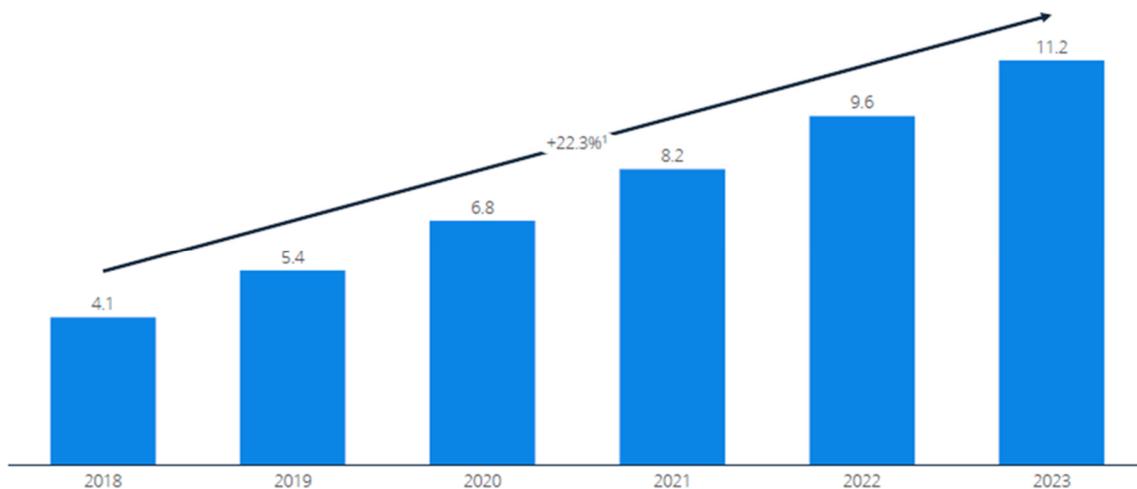
The Smart Home Energy Management segment covers the sale of products and services for the control and reduction of energy consumption. These include:

- automated heating control and timers (e.g. thermostats, radiator controls, air condition controls)
- weather forecast services with connection to a broader smart home
- connected sensors (e.g. temperature, wind, humidity, sunlight and precipitation sensors)

As electricity prices are predicted to rise, consumers are looking at ways to save costs and one of the best way to make these savings is to invest in an energy management system. By setting up a system, which is programmed to know the family's schedule and their preferred settings, as well as monitoring the temperature, users report significant bill reductions. The energy savings aspect is mostly addressed by automated heater controls connected to systems capable of automatically adapting to outside and indoor temperature (e.g. when combined with sensors or external services).

This also partly tackles the need for additional comfort. Since the heating system adjusts to manual settings and individual preferences, the level of comfort is increased. Additionally, the residents are able to remotely turn off (e.g. when forgotten) or turn on the heating when returning from a longer absence.

The global Smart Home Energy Management market segment has a size of US\$4.09 billion in 2018 and revenues are expected to reach US\$11.2 billion in 2023 with a CAGR of 22,3% between 2018 and 2023 (see Figure 8). Growth has been driven by tech companies like Nest, Google Home or Samsung SmartThings.



**Figure 8: Global revenue forecast in billion US \$ - Smart Home Energy Management segment**

Source: Statista

With revenues of US\$1.62 billion in 2018, Europe is the biggest market for the Energy Management segment, followed by the U.S. Energy Management solutions that generate revenues of about US\$1.42 billion in 2018. As the market in the U.S. is driven by expensive thermostats (e.g. Nest) and AC-controls, we see growth rates shrinking to an overall CAGR of 12% up to 2023, reaching a total market volume of US\$2.54 billion. Revenues in China are by far the smallest with US\$0.25 billion in 2018. In China, the segment itself is still quite small but due to strong growth, it is a driver of the whole Smart Home market. The market will face the strongest average growth rate of 33% p.a. and will reach US\$1.03 billion by 2023 (see Figure 9).

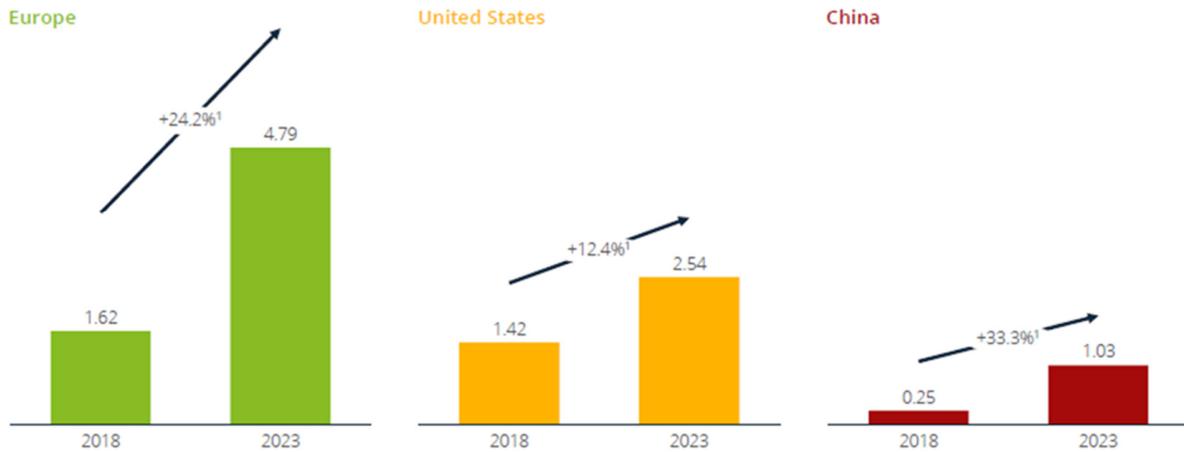


Figure 9: Revenue forecast in billion US\$ by country - Smart Home Energy Management segment

Source: Statista

Within Europe, Germany is the leading force in terms of Energy Management revenues pulling the whole region to an average annual growth rate of more than 22% and a total market size of US\$1.26 billion by 2023. This development is due to high trust in solutions by utility companies entering the segment (Figure 10). Germany is followed by UK with a CAGR of 19,7% between 2018 and 2023, France (25%), Italy (32,9%) and Spain (31,7%).

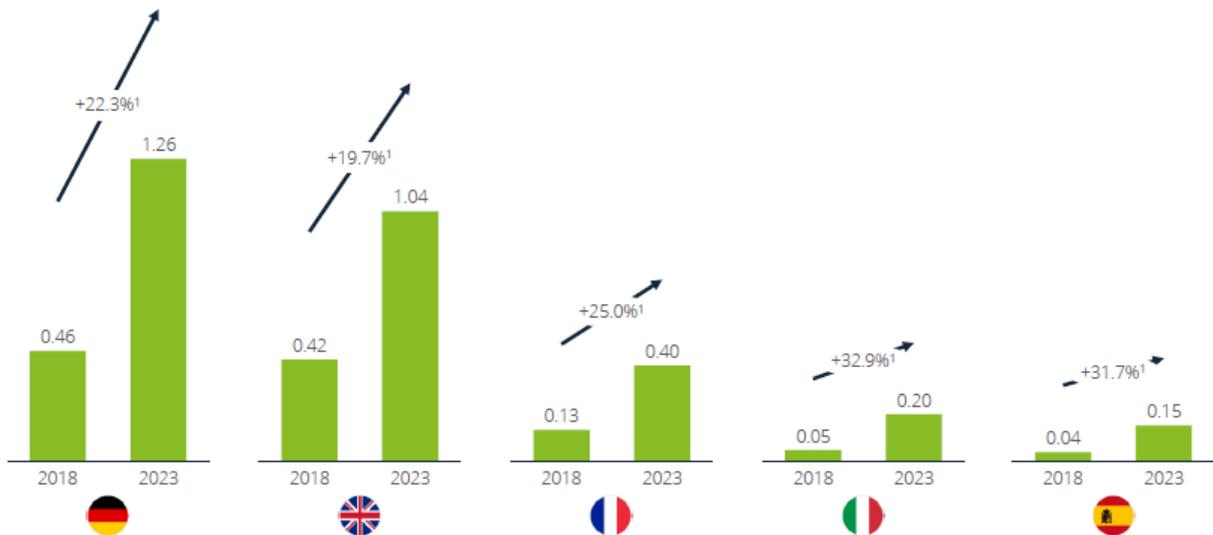
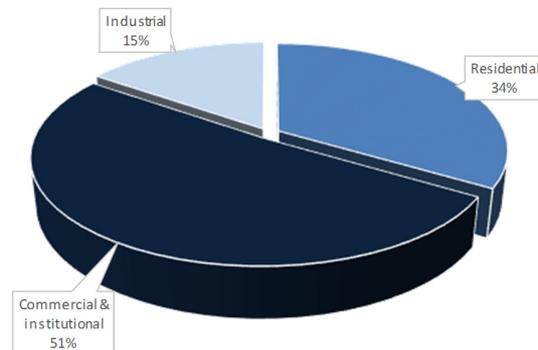


Figure 10: EU revenue forecast in billion US\$ - Smart Home Energy Management segment

Source: Statista

Analyzing the Energy Management segment in 2016 by end-user, it emerges that the energy management systems for the residential sector represent 34% of the Global market size and it is worth 1.5 billion U.S. dollars (See Figure 11) and it is forecast to reach almost 3 billion dollars in 2023.



**Figure 11: Market size of energy management systems worldwide in 2016, broken down by end-user market**

Source: Statista. RINA-C Elaborations

Residential buildings account for 74% of global building energy use. Service buildings – mostly commercial ones - are responsible for 26%. Both types of buildings face challenges in reaching their energy efficiency potentials<sup>7</sup>, however here we will focus on the residential **Smart Home segment**, since it has been identified by the INBETWEEN partners as the most interesting for the service proposed.

ICT-based applications in buildings Energy management activities are, in particular, applied to the following segments:

- Heating Ventilation Air Conditioning (HVAC) Systems: The HVAC systems are analyzed considering the efficiency gains enables by ICT control and monitoring systems;
- Lighting Systems: LD lighting and Occupancy and daylight sensors.

In the following table, the main player of the Smart Home Energy Management segment is reported. The table illustrates key facts, products, company strategy and revenue data (when available).

<sup>7</sup> ESMAP <http://esmap.org/node/71174>

**CENTRICA GROUP - HIVE**



**Revenue:** £42 million (2017) (Connected Home group)  
**CAGR:** 27% (16-17) (Connected Home group)  
**Net profit:** N.A.  
**Employees:** 33,138 (2017)  
**Headquarters:** Windsor, UK (Hive in London)  
**Founded:** 2013

**Products**

The main devices offered by Hive include a smart thermostat, lightbulbs, motion sensors, and smart plugs, all of which operate on an interconnected system that links to a central hub. The smart thermostat allows customers to control heating and hot water in their homes via the company's website or app. It is possible to set up to 6 time slots for heating and hot water to fit with daily routines. With the help of geolocation, the Hive thermostat knows if the customer has gone out and left the heating on. It can then send a reminder to turn it off. Hive is the only UK-based connected homes company that provides an end-to-end service, including the creation and installation of devices.

**Strategy**

Centrica is a British multinational energy and services company and supplies consumers and businesses in the UK, Ireland and North America with electricity and gas. Centrica owns British Gas and is therefore the largest supplier of gas to domestic customers. In 2013, Centrica established Hive as part of its Connected Home offering, building on its remote heating control service provided through British Gas. In 2015, Centrica also acquired AlertMe, another UK-based home tech company. AlertMe provided the platform for connected homes. The acquisition gave British Gas ownership and control over a tech platform, development capability, data analytics and a patent portfolio.

**Revenue in million US\$**

**N.A.**

### 3.2.2 Comfort and lighting

The Smart Home Comfort and Lighting segment includes devices for the improvement of the living atmosphere and lighting in a smart home. These are devices such as sensors and actuators (e.g. door and window sensors, shutters and shading devices, garage door controls) as well as connected and remote controllable light sources (smart bulbs).

Many of these devices can be integrated into use cases from other segments:

- Window- and door-sensors can shut down heating as soon as windows are opened, in order to save energy, or they send a still open-message to the owner’s smartphone when he or she leaves the house
- Smart bulbs can be used to simulate presence on longer journeys or they automatically shut off when nobody is at home in order to save energy.

In particular, smart lighting has effects on home security and energy management. Motion detectors can automatically switch the light on or the lighting system can simulate presence for example during the holiday season. Accidents are also easier to avoid if the lights always switch on automatically as soon as someone enters a dark room. With rising electricity prices, energy efficiency is also becoming increasingly important. In a smart home, the energy consumption induced by lighting can be managed even more efficiently. Automatic switching off or dimming at certain times of the day prevents energy from being wasted if enough free daylight is available. With the help of sensors, lamps can even dynamically generate only as much light as necessary to supplement natural solar radiation.

Because almost all devices in this segment are relatively cheap and especially smart bulbs are easy to install, the products from this segment are used as a market entry by many customers. According to experts, especially European and Chinese customers purchase lighting solutions as their first smart home products to get familiar with the general technology of IoT devices.

The global market size will be more than triple from 2018 to US\$15.2 billion by 2023 (see Figure 12). While products such as sensors or garage door controllers are expected to show small growth rates, smart bulbs and lighting in general will drive the market. With global revenues of US\$4.27 billion in 2018, Comfort and Lighting is one of the smaller segments within the Smart Home market. The regional revenue distribution in 2018 is lead by the U.S. with revenues of US\$1.68 billion, corresponding to a global market share of 39.4%, followed by Europe with US\$1.04 billion (24.4%) and China with US\$0.66 billion (15.4%). The largest growth is expected to take place in China with a CAGR of 40% between 2018 and 2023. Europe and the U.S. will see CAGRs ranging between about 28% and 19%, respectively (see Figure 13). Focusing on European revenues, the UK and Germany have the highest revenues in the Comfort and lighting segment with a CAGR of 23,7% and 22,6% between 2018 and 2023 respectively, followed by France (27,4%), Italy (34,5%) and Spain (33,4%) (see Figure 14).

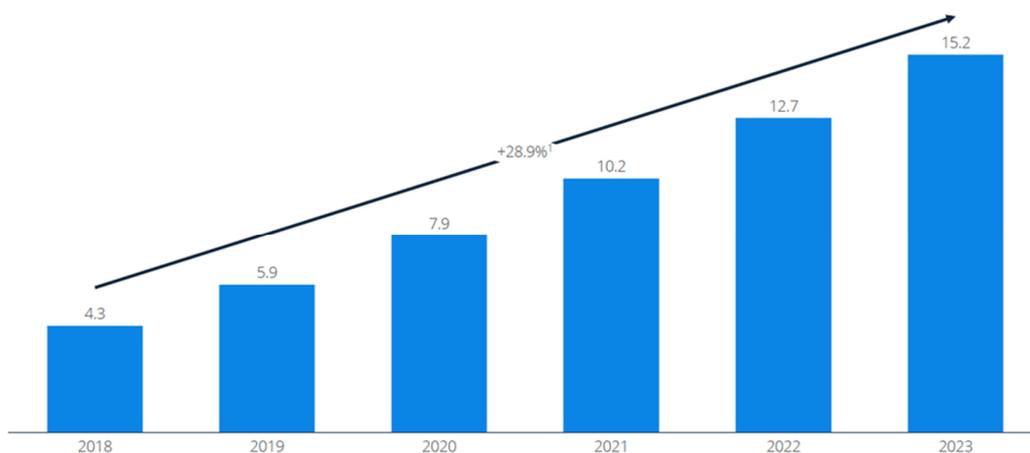


Figure 12: Global revenue forecast in billion US\$ - Smart Home Comfort and lighting segment

Source: Statista

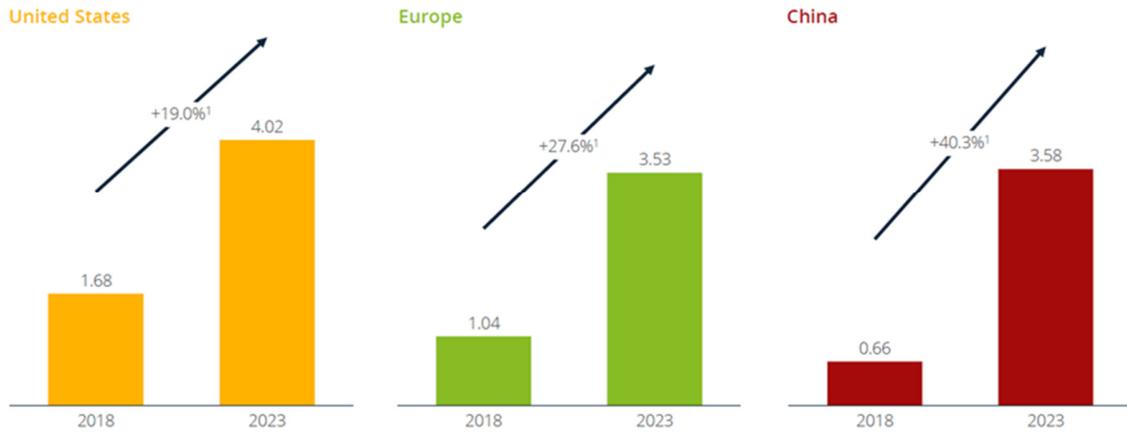


Figure 13: Revenue forecast in billion US\$ by country - Smart Home Comfort and lighting segment

Source: Statista

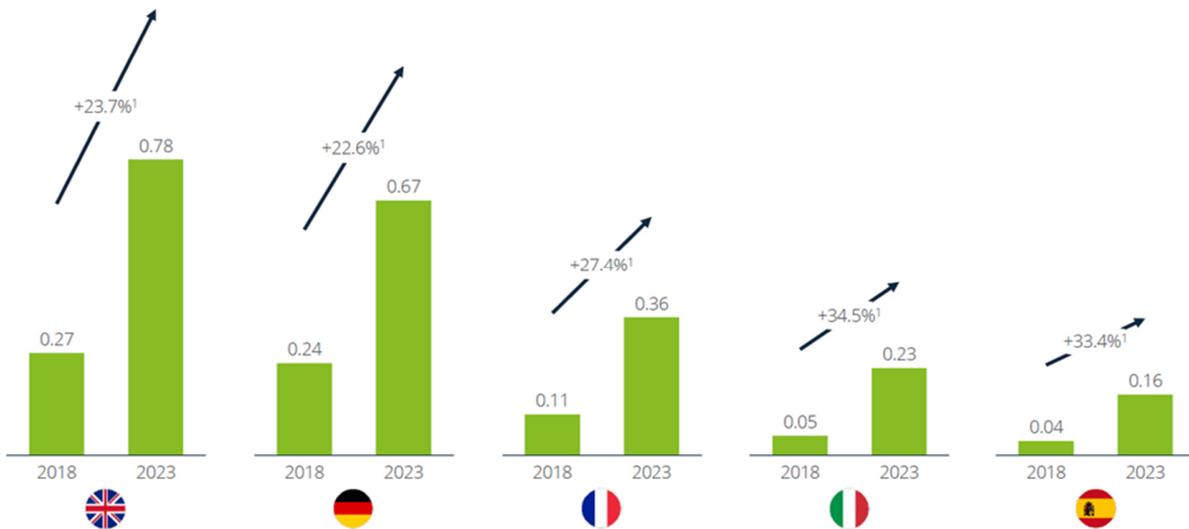


Figure 14: EU Revenue forecast in US\$ - Smart Home Comfort and lighting segment

Source: Statista

Depending on the specific product, several companies dominate the market. In the field of smart bulbs, key players to be mentioned are Philips Hue, TP-Link, Lifi Labs or IKEA with Tradfri. For the other product categories, there is no overall dominating company.

In the following tables, the main players of the Smart Home Security segment are reported. For each of them, key facts, products, the company strategy and revenue data (when available) are illustrated.

SOMFY	
	<p><b>Revenue:</b> €1.25 billion (2017)  <b>CAGR:</b> 10.2% (16-17)  <b>Net profit:</b> €159.9 million (2017)  <b>Employees:</b> 5,170 (2017)  <b>Headquarters:</b> Cluses, FRA  <b>Founded:</b> 1969</p>
<b>Products</b>	
<p>Somfy develops and sells drive and control technology for roller shutters, sun blinds, garage doors and yard gates. The Somfy Smart Home integrates front doors, tilt windows, lift and slide doors, swing windows, window handles, heating, lighting, cameras, smoke detectors, sun sensors, energy consumption sensors and temperature sensors. In addition to the complete TaHoma control system, the Somfy Smart Home is divided into three independent apps: Connexoon windows (roller shutters, windows), Connexoon access (garage door, alarm, exterior lighting), Connexoon terrace (awning, lighting).</p>	
<b>Strategy</b>	
<p>Somfy is a French company composed by 76 subsidiaries and 51 agencies in 60 countries with a total of around 5170 employees. With 300 employees, the German Somfy GmbH is the largest subsidiary. Somfy is now the world leader in door and window automation, for the home and building industry, with over 100 million motors sold worldwide. Somfy's target groups are end consumers, craftsmen, manufacturers of carrier products as well as architects and planners. 400 Somfy engineers are inventing new ways to experience comfort and safety in the home. Each year, approximately 400 patents are registered.</p>	
<b>Revenue in million US\$</b>	
<p><b>N.A.</b></p>	

OSRAM



**Revenue:** €4 billion (2017)  
**CAGR:** 9.1% (16-17)  
**Net income:** €224 million (2017)  
**Employees:** 25,934 (2017)  
**Headquarters:** Munich, DEU  
**Founded:** 1919

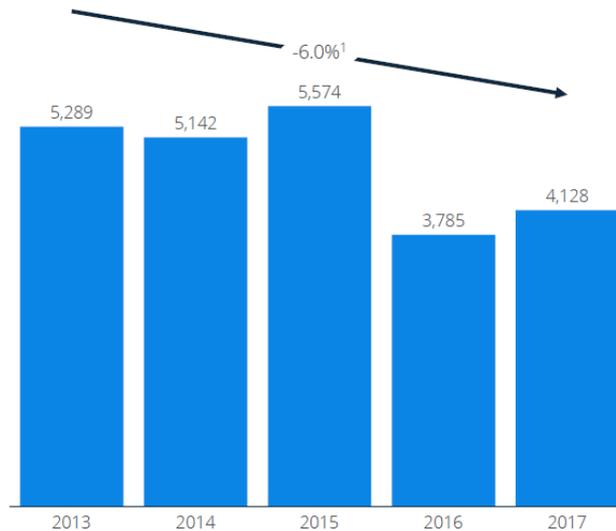
**Products**

The Osram Opto Semiconductors GmbH produces LEDs for car and stage headlights, office or street lighting, tiny LEDs for mobile terminals, semiconductor lasers, detectors and infrared diodes (IRED), e.g. for use in iris scanners or fitness wristbands. The infrared sensors from Osram Opto Semiconductors are used in safety applications in vehicles. There are two major divisions, the Lighting Solutions and the Digital Systems divisions. Digital Systems offers components for intelligent lighting solutions such as LED drivers, LED modules and lighting management systems that form the basis for efficient and networked LED solutions for smart homes.

**Strategy**

The Osram group is one of the leading lighting manufacturers. It is a globally active German company headquartered in Munich. The company focuses on the areas of automotive and specialty lighting, opto semiconductors, luminaires, lighting systems and solutions. In 2016, Osram sold their LED department to a Chinese consortium. This divestment affected most of the smart home products and around 9,000 employees. It also led to a drawback in revenues in 2016. Ledvance will continue selling under the Osram/Sylvania brand.

**Revenue in million €**



### 3.2.3 Security

The Smart Home segment for connected Security devices targets the need for security at home. It includes the sale of devices and services for networked access control and management for buildings and premises. This includes:

- digitally connected and controlled devices for burglar prevention/detection and other security issues (e.g. security cameras and related data storage and transmission services, motion sensors, door locks, surveillance services with connection to a broader smart home)
- hazard prevention devices like water (humidity) or smoke sensors

Smart home security devices can be remotely controlled via the internet. Like other smart devices, these products come with mobile apps for wireless access and information about the device status. Data can be gathered for example when someone enters or leaves through the door. This is valuable information for devices from the energy management segment as well, which can then automatically adjust the heating accordingly.

The global market size of the Security segment is about US\$10.75 billion in 2018, which makes it the second biggest Smart Home segment (see Figure 15). Its development is mainly driven by the replacement of traditional devices with connected ones. Across all regions, we see customers entering the market through stand-alone solutions and slowly upgrading to integrated smart homes, where devices from multiple segments communicate with each other.

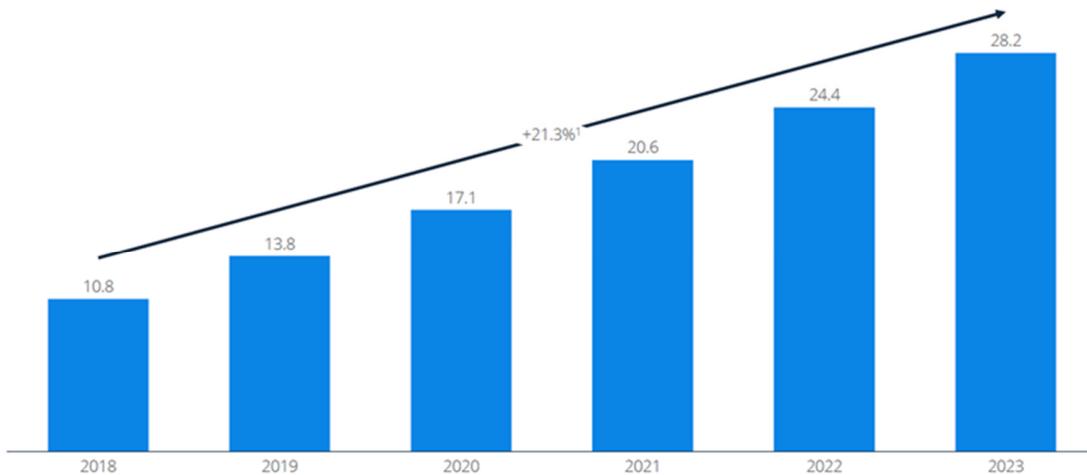


Figure 15: Global revenue forecast in billion US\$ - Smart Home Security segment

Source: Statista

The leading country is the U.S. with a total revenue of US\$5.47 billion in 2018, which represents about 50% of the whole market. The large market size stems from the already relatively big security industry in the U.S. and its leading role internationally in terms of technological advancement. The U.S. market will grow at a CAGR of 15% and will reach revenues of US\$11.17 billion by 2023 (see Figure 16).

Europe comes second after the U.S. with US\$2.38 billion in revenue and 9.3 million households in 2018. The market is expected to grow by 21% annually. In particular, UK has the highest revenues in the Security segment with a CAGR of 20,8% between 2018 and 2023, followed by Germany (16,5%), France (20,2%), Italy (24%) and Spain (24,2%) (see Figure 17).

The smallest region in this comparison is China with a 2018 revenue of US\$1.11 billion. Growth in China is highest across all regions with almost 32% per year. A comparison of household counts and revenue numbers shows that device prices in China are significantly lower and service revenues hardly exist.

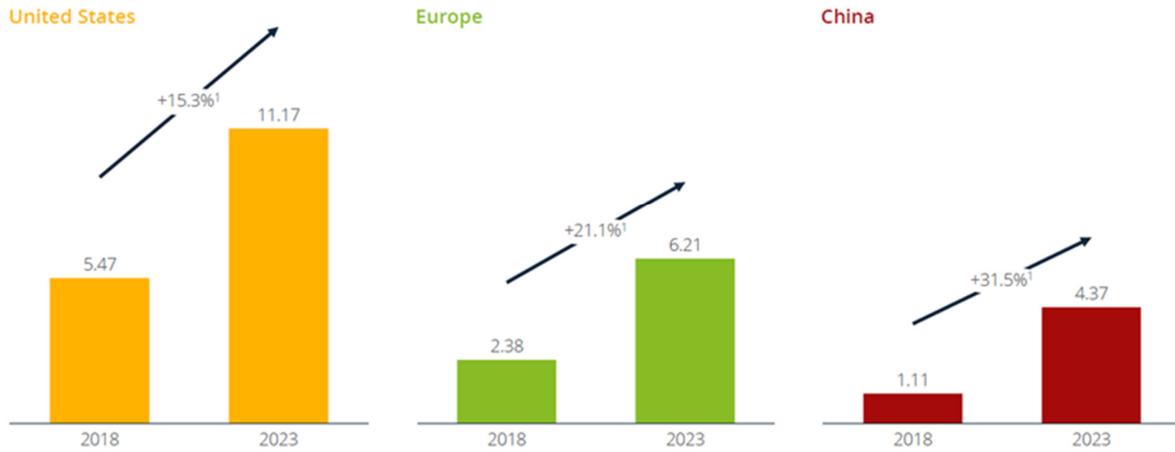


Figure 16: Revenue forecast in billion US\$ by country - Smart Home Security segment

Source: Statista

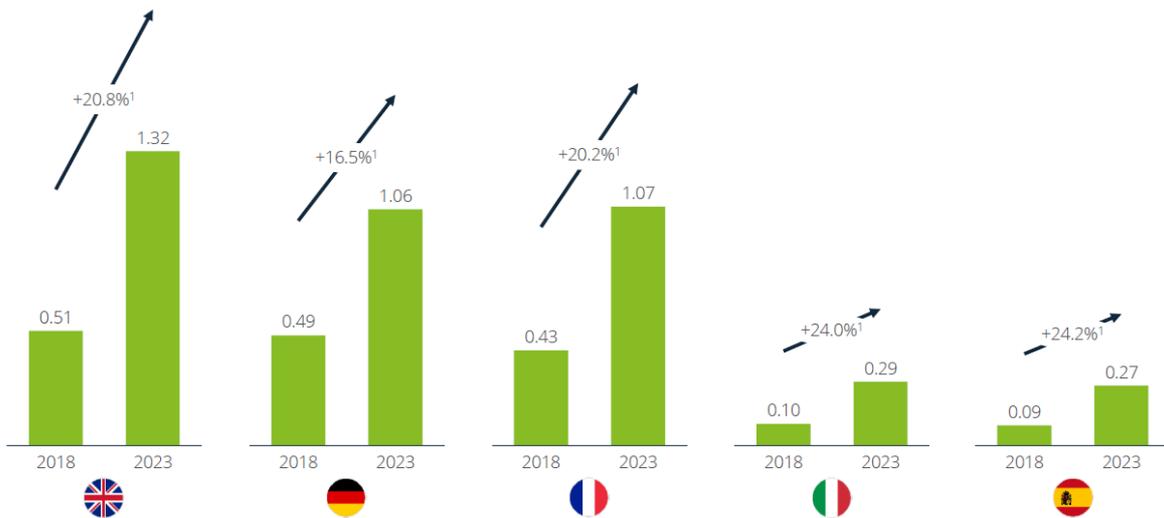


Figure 17: EU Revenue forecast in US\$ - Smart Home Security segment

Source: Statista

In the following tables, the main players of the Smart Home Security segment are reported. For each of them, key facts, products, the company strategy and revenue data (when available) are illustrated.

**ALARM.COM**



**Revenue:** US\$338.9 million (2017)  
**CAGR:** 29.8% (16-17)  
**Net Income:** US\$29,251 million (2017)  
**Employees:** 607 (2017)  
**Headquarters:** Vienna, Virginia, USA  
**Founded:** 2000

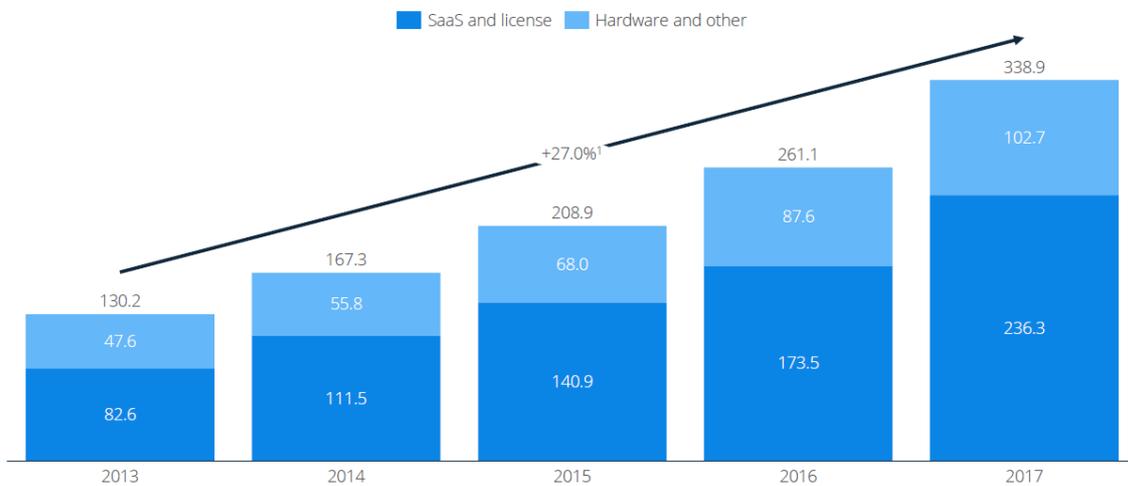
**Products**

Alarm.com is a security-oriented service provider of about 1 million smart homes in North America. It provides home and business security solutions based on wireless, web and mobile technologies. In particular, they offer cloud-based solutions including interactive security, video monitoring, intelligent automation and energy management. Each system can be customized to a home’s unique configuration and be controlled via different apps. Alarm.com systems can communicate even if the phone or cable line is cut, power is out or the internet or broadband is down.

**Strategy**

Alarm.com was founded in 2000, launching a security solution that enabled remote monitoring. The company has since expanded its platform to offer integrated smart home and business solutions that include video monitoring, energy management and other home automation functions. Their solutions are delivered by over 6,000 service providers in 29 markets with a focus on North America. Revenue is primarily generated through SaaS, and license revenue through the service providers.

**Revenue by product group in million US\$**



ASSA ABLOY



**Revenue:** US\$8.85 billion (2017)  
**CAGR:** 6.8% (16-17)  
**Operating Income:** US\$1.31 billion (2017)  
**Employees:** 47,500 (2017)  
**Headquarters:** Stockholm, SWE  
**Founded:** 1994

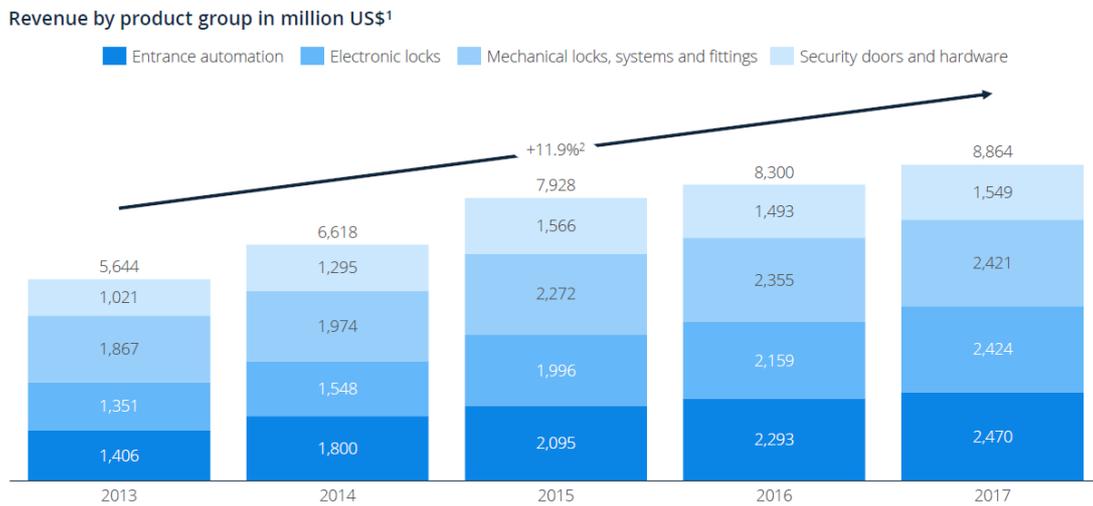
**Products**

In the fast-growing smart security segment, the group has activities in areas such as access control, identification technology, entrance automation and hotel security. One example is the Yale Keyless Connected smart door lock. Through the touch panel control the door can be locked with one simple tap and prevent unauthorized access. The lock works with the Z-Wave Module 2, which also allows a connection to Samsung SmartThings and is battery powered. Centering around the smart lock, Yale also offers a whole security ecosystem with CCTV, IP cameras and home alarms under one single point of access – the Yale Home App.

**Strategy**

Assa Abloy is a global supplier of door opening solutions that are not limited to the smart home business. The group is represented in both mature and emerging markets worldwide, with leading positions in Europe, North America and Asia Pacific. The group was founded in 1994 when ASSA AB separated from the Swedish security company Securitas AB. Shortly afterwards, the Finnish manufacturer of security locks, Abloy Oy was taken over. In the same year, the Assa Abloy Group was listed on the Stockholm Stock Exchange. Important for smart home solutions was the acquisition of Yale in 2000 and August Home in 2017. Forbes ranks Assa Abloy 78th among the most innovative companies globally.

**Revenue by product group in million US\$**



### 3.3 ADDITIONAL MARKETS

The previous chapter has been aimed to analyse the target market for the INBETWEEN integrated platform, considering that it could be commercialized as an integrated tool. However, the INBETWEEN integrated platform is composed by different modules and algorithms that could be exploited separately from the platform and commercialized by the single partners that develop them.

For this reason, in this chapter it has been identified if additional markets, different from that already analyzed above, exist for each of the single exploitable results. The Table 3 below reports the INBETWEEN exploitable results and the corresponding reference market.

**Table 3: Exploitable Results Target market**

#	Exploitable Results	Target market
1	inBETWEEN solution	Energy Efficiency Market Smart Home Industry
2	Performance Evaluator and Benchmarking	Energy efficiency services
3	Consumption profiler and classifier	Energy consultancy
4	Energy consumption predictor	Data Analytics
5	Integration Middleware	ICT platform and Cloud Computing market
6	Integrated energy demand optimizer	Energy efficiency
7	RES production models	Energy management
8	Web-based dashboard	Web-platform Building maintenance
9	Mobile Application	Energy management Home automation
10	Semantic information model (ontology)	Building Management
11	Consumption analytics module (Non-Intrusive Load Monitoring - NILM)	Energy and demand side management
12	Method of installation and implementation of wireless sensor equipment in buildings	Building maintenance
13	Commissioning tool	Smart Home Energy Management Healthcare Building Management
14	Integration of devices for energy optimization and increased comfort	Smart Home industry Energy Management
15	Common data model	Enterprise Application Software Development Market
16	Squid Smart App	Energy Management Home automation Healthcare Building Management
17	Demo feedback for continuous product portfolio improvements	Smart Home Smart Energy Healthcare Building Management

In the following paragraphs all the additional markets, different from that already analyzed in the previous paragraph, will be analyzed. In particular, from the analysis of Table 3, the following additional markets have arisen:

- Data Analytics Market
- ICT Platform and Cloud Computing Market
- Enterprise Application Software Development market
- Building Management and Building Maintenance
- Healthcare.

### 3.3.1 Data Analytics Market

The size of the global analytics market is expected to increase nearly USD 106 billion between 2019-2023, accelerating at a CAGR of approximately 15% during the forecast period. This growth is attributed to numerous factors including the need to improve business efficiency and to the increase use of big data analytics, IoT analytics and SaaS-based analytics in several end-user industries including BFSI (Banking, financial services and insurance), retail, sports and healthcare. End-user are adopting advanced analytical tools such as descriptive analytics and predictive analytics to execute analytical modeling rather than doing conventional manual calculations and spreadsheet modeling.

One analytics segment poised for strong growth in the coming years is the market for web analytics, which is seeing major use in sectors like retail, BFSI and healthcare. Web analytics in the healthcare sector helps measure information such as exchange of content consumption, claim submissions and customer log-ins, which ultimately helps the objective of converting website users into customers. Due to these factors, the web-analytics market share for healthcare end-users is expected to grow through 2020. Some of the key emerging trends in this market expected to gain traction are the growing demand for predictive analytics and the growth of internet connectivity<sup>8</sup>.

This is a perfect target market where the **energy consumer predictor** of the INBETWEEN project, may be profitably placed due to its structure that can be exploited both in the energy efficiency sector, for which it was in fact designed, but also in all those sectors in which there is the need to make forecast based on past data or behavior.

For these reasons, is important to underline that the global predictive analytics market, one of the numerous segment of the analytics market, will grow at a CAGR 21%, generating a market value of USD 13 billion by 2023 (see Figure 18)<sup>9</sup>.

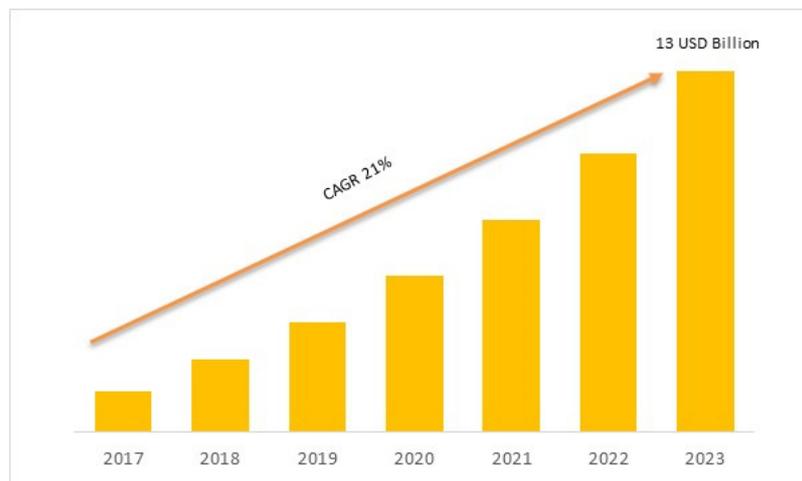


Figure 18 Global Predictive Analytics Market forecast, 2017-2023 (USD billion)

Source: Market research future

<sup>8</sup> <https://www.technavio.com/research/analytics-market-share>

<sup>9</sup> <https://www.marketresearchfuture.com/reports/predictive-analytics-market-6845>



The proliferation of advanced technologies, AI, and IoT is positively impacting predictive analytics market growth. There is a growing acceptance of advanced technologies including block chain, virtual assistants, machine learning, and IoT among enterprises. Organizations in both the private and industrial sectors are making huge investments towards R&D in these technologies. This is subsequently driving the need for predictive analytics to extract insights from complex historical data. The emergence of smart technologies and devices will increase the volume of data generated. This will drive the need for advanced technologies such as big data, which will further drive predictive analytics market growth<sup>10</sup>.

### 3.3.2 ICT Platform and Cloud Computing market analysis

The cloud computing market can be divided into big categories: Software as a Service market (SaaS), Infrastructure as a service market (IaaS), Platform as a Service market (PaaS), Desktop as a Service (DaaS), Mobile Backend as a Service (MBaaS) and Information Technology Management as a Service (ITMaaS).

In particular, **SaaS** is a software distribution model in which a third-party provider hosts applications and makes them available to customers over the Internet<sup>11</sup>. SaaS is one of three main categories of cloud computing, alongside **Infrastructure as a Service (IaaS)** and **Platform as a Service (PaaS)**. The first one refers to a service model that delivers computer infrastructure on an outsourced basis to support enterprise operations. Typically, IaaS provides hardware, storage, servers and data center space or network components; it may also include software<sup>12</sup>. PaaS is a cloud-computing model in which a third-party provider delivers hardware and software tools -- usually those needed for application development -- to users over the internet<sup>13</sup>. In this context the **web-based dashboard** of the INBETWEEN project can be placed since it allows the remote monitoring, follow up and analysis of any type of parameter that, in the specific case of the INBETWEEN project relate to buildings, construction sites etc.. However, it can be applied in any other installation or environment where there is a need for remote check of any measurable physical variable.

According to the research center IDC<sup>14</sup>, the cloud computing market is projected to overcome 370 USD billion dollars by 2022. In 2019, more than the half will be invested in Software as a Service segment (SaaS), followed by Infrastructure as a Service (IaaS) and Platform as a Service (PaaS) segments. The last one, in particular, shows a growth rate of 28,9%<sup>15</sup> compared with the previous year and, according to the Gartner's research on the sector, the market is projected to double in size by 2022. The PaaS market contains more than 360 vendors offering more than 550 cloud services in 21 categories.

It is important to mention a branch of the PaaS market segment that is the Integration Platform as a Service (iPaaS) market trend. iPaaS consists of cloud technologies such as cloud storage, cloud computing, and other internet technologies that are associated with shared devices and converged infrastructure for enterprises. It is precisely in this context that, the **Integration Middleware** of the INBETWEEN project is placed, because it will be responsible for orchestration and management of all the INBETWEEN platform components and services by supporting their data exchange and connectivity towards the external data providers and so it can be able to do the same activities for any platform components.

The Global Integration Platform as a Service market is estimated to generate revenue of approximately USD 2 Billion by 2023 growing at a CAGR of 22% between 2016 and 2023 (see Figure 19)<sup>16</sup>.

<sup>10</sup> <https://www.technavio.com/report/global-predictive-analytics-market-analysis-share>

<sup>11</sup> <https://searchcloudcomputing.techtarget.com/definition/Software-as-a-Service>

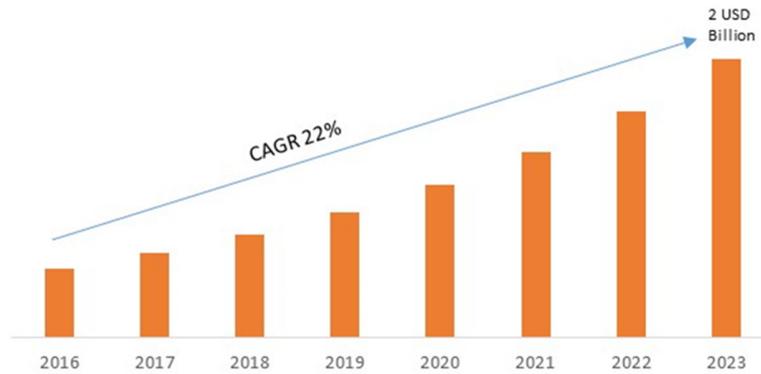
<sup>12</sup> <https://www.techopedia.com/definition/141/infrastructure-as-a-service-iaas>

<sup>13</sup> <https://searchcloudcomputing.techtarget.com/definition/Platform-as-a-Service-PaaS>

<sup>14</sup> [https://edge9.hwupgrade.it/news/cloud/il-mercato-del-cloud-nel-2020-varra-370-miliardi-di-dollar\\_82114.html](https://edge9.hwupgrade.it/news/cloud/il-mercato-del-cloud-nel-2020-varra-370-miliardi-di-dollar_82114.html)

<sup>15</sup> <https://www.gartner.com/en/newsroom/press-releases/2019-04-29-gartner-identifies-key-trends-in-paas-and-platform-ar>

<sup>16</sup> <https://www.reuters.com/brandfeatures/venture-capital/article?id=60028>



**Figure 19: Global iPaaS market size, forecast 2023 (USD Billion Dollars)**

Source: RINA-C Elaborations based on Reuters.com data

At regional level, North America is anticipated to hold the largest share of the market, whereas Asia Pacific is projected to grow at the highest rate by 2023. The growth in the North America region is attributed to the technological advancement along with increased adoption of integration platform as a service application across various vertical industries. Large investments in research & development, early adoption of new emerging technologies, coupled with the presence of a large number of players in this region also leave a colossal impact on the market.

The key reasons for the high growth rate in Asia-Pacific are increased spending on IT infrastructure, rising cloud-based applications and the growing demand for automation of processes. Apart from these factors, growing BYOD (Bring your own device<sup>17</sup>) trend, rising awareness about iPaaS among enterprises along with growing focus towards reducing the ownership costs are other factors responsible for the humungous growth observed in this region. Moreover, the growing focus of companies towards data security and prevention coupled with the growing government support in various Asia-Pacific countries drive the iPaaS market.

### 3.3.3 Enterprise Application Software Development Market

In a scenario where organizations have tens of applications with different functions, one of the big challenges is integration. The share data model is the solution for integrate applications isolating them from the changes in other applications. The Common Data Model (CDM) is a place to keep all common data to be shared between applications and data sources. It ensures the application integrity and consistency<sup>18</sup>. CDM is used and extended by Individual Software Vendors and Software market in general to create various services adapted for the specific market of application.

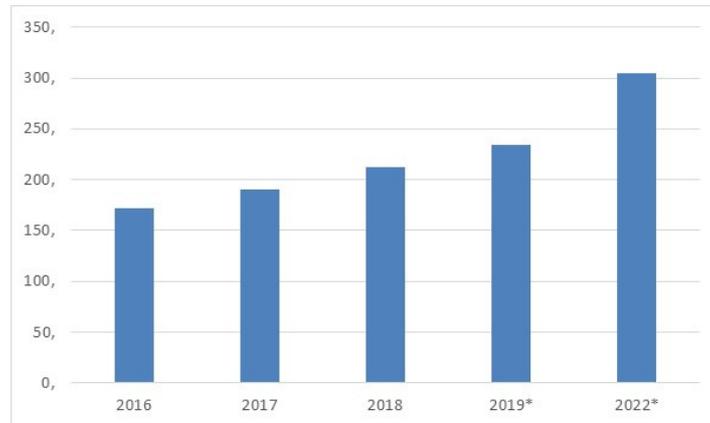
Figure 20 shows the revenue of the global enterprise application software market from 2016 to 2022. Global revenues increased from 171,3 Billion Dollars in 2016 to 190 billion dollars in 2018 and it is projected to reach 305 billion dollars by 2022 at 12% CAGR.

Independent Software vendors are projected to drive more than a half of the enterprise application software market<sup>19</sup>.

<sup>17</sup> **Bring your own device (BYOD)** - also called **bring your own technology (BYOT)**, is an expression used to refer to company policies that allow users to bring their personal devices to their workplace, and use them to have privileged access to company information and their applications. BYOD allows containerization, i.e. to create two different environments on the same device, with company data and personal data (calls, SMS, GPS localization, etc.) strictly separated, up to having a Virtual Machine operating system level controlled by IT or in the firmware of the processor (at the hardware level, below the operating system), or resort to hosted virtual desktop (HVD) or virtual mobile OS solutions, with which the user connects to the company Intranet to applications and data who physically reside on a remote server ([https://it.wikipedia.org/wiki/Bring\\_your\\_own\\_device](https://it.wikipedia.org/wiki/Bring_your_own_device))

<sup>18</sup> <https://radacad.com/what-is-the-common-data-model-and-why-should-i-care-part-3-of-dataflow-series-in-power-bi>

<sup>19</sup> <https://cloudblogs.microsoft.com/dynamics365/bdm/2019/04/17/upcoming-program-for-business-applications-isvs/>



**Figure 20: Global enterprise application software revenue 2016-2022 (billion USD dollars)**

Source: Statista

### 3.3.4 Building Management and Building Maintenance

The Building management system market is expected to reach USD 19,5 billion by 2023 at a CAGR of 16,7% between 2017 and 2023.

The building management market based on software has been further divided into facility management, security management, energy management, emergency management, and infrastructure management software. The market for the energy management software is expected to grow at the highest CAGR during the forecast period. Buildings are the largest consumers of electricity globally. With the increase in the global economy and enhancing the standard of living, the consumption of energy resources is increasing, which, in turn, increases the demand for building energy management systems.

The building management system market has been segmented based on application into commercial, residential, and industrial. The commercial application holds a major share of the overall building automation system market as the demand for energy conservation and reduction of the overall operational cost is the highest in this vertical. Various building regulations and policy frameworks mandate the commercial entities to limit the energy consumption and carbon emission driving the demand for building management systems in the commercial application.



**Figure 21: Building Management Systems Market Drivers**

Source: RINA-C elaborations based on data of “i-scoop”



Therefore, the growing integration of IoT with building automation systems is driving the growth of the building management market based on software. The smart devices that are integrated for building automation and management are expected to be self-governing and intelligent in terms of sharing data with BASs and the cloud<sup>20</sup>.

In this context some of the exploitable results of the INBETWEEN project, can be sold in Building Management sector:

- The **web-based dashboard** is the GUI of a modular web-platform for remote monitoring, follow-up and analysis of any type of parameter in buildings, infrastructures, construction sites, or any other installation/environment where there is a need for remote check of any measurable physical variable. It is also optimized for different devices (e.g. phones, tablets, in-home displays).
- **Method of installation and implementation of wireless sensor equipment in buildings:** this method can be useful for the building management sector and in the building maintenance field specifically, because it can give support regarding choosing the correct and fitting metering equipment in accordance with the building and usage situation.
- **Commissioning Tool** can simplify the commissioning process, facilitating the work of installers thanks to its user interface user-friendly and the tool, which minimizes the level of complexity.
- **Semantic information model** can make the maintenance of the building easier because it provides a common vocabulary for stakeholders and support semantic enrichment of raw data coming from low level devices, and because it makes possible to have a single structured knowledge repository about the site.
- **Demo feedback for continuous product portfolio improvements:** the feedback from end-user of the INBETWEEN platform provides highly valuable insights into the level of user satisfaction and user-friendliness of the deployed devices and the material provided for the commissioning and the installation of devices. These feedbacks enable continuous improvements of devices and material to accommodate the needs of end-user and maintain high level of user satisfaction. So, the resulting knowledge, if shared with the building sector may create best practises which helps the commissioning and installation operations with the consequent benefits for the sector. Feedbacks will also make the customers more autonomous in terms of reduced need to support users, generating savings in maintenance costs and increasing sales as an outcome of a high level of user satisfaction.

### 3.3.5 Healthcare

Some of the exploitable results of the INBETWEEN project may be usefully applied in the healthcare sector.

The push to digitize healthcare has been going on for at least 10 years—that was when the push began for hospitals and physicians to implement electronic health records. Now, providers are looking for ways to achieve measurable results with the systems they have in place. Providers increasingly see the potential to apply artificial intelligence to the patient information that has been collected through various electronic records systems. The long-term goal is to assist clinicians with decision support, reduce financial risk, establish population health initiatives for chronic disease management, and more. Data will transform how providers make decisions—the growing implementation of technology developed for healthcare is creating the opportunity to use clinical data in a more sophisticated ways, enabling clinicians to make better decisions and deliver better care. Through predictive analytics, hospitals will be able to identify the highest-risk patients and refer them to appropriate resources. The lack of interoperability has historically stifled the growth of data management for healthcare.

The cloud plays an important role in this context because it may represent a response to a difficult IT hiring environment, for example for hospitals, which will probably decide to transfer their IT infrastructure to the cloud. In this way, smaller community and rural hospitals in particular will look for cost savings by moving their IT infrastructure to the cloud, which will also have the advantage of being more reliable, secure, and accessible<sup>21</sup>.

<sup>20</sup> <https://www.i-scoop.eu/building-management-building-management-systems-bms/bms-market-2017-2023-research/>

<sup>21</sup> <https://www.healthdatamanagement.com/list/12-trends-that-will-dominate-healthcare-it-in-2019>



In this context, everything that could make easier the development of data and systems integration, is useful for the growth of data management in healthcare sector, and some of the exploitable result of INBETWEEN project can do so.

The installing operation in a big context such as a hospital may be difficult, so the **commissioning tool** can make this phase easier as well as **Squid Smart App**, which can facilitate the application development through API, which makes it possible to configure application on top of an open platform including multiple wireless networks instead of programming them.

Moreover, **Demo feedback for continuous product portfolio improvements**, enable continuous improvements of devices and material to accommodate the needs of end-user and maintain high level of user satisfaction which for a particular sector such as healthcare is the primary objective.

## 4 POTENTIAL CUSTOMERS GROUP AND STAKEHOLDERS’S EXPECTATIONS

The most outstanding stakeholders targeted for the inBETWEEN project are specific groups of people or organizations within the target market at which the inBETWEEN results are aimed at. In particular, these target groups are possible customers of the integrated platform developed by the project.

The inBETWEEN integrated platform could be used by technology providers, government and policy makers, social housing associations and energy service companies.

In the following paragraphs, these target groups will be described, highlighting their needs and how the inBETWEEN project proposes to satisfy them with its application and results.

### 4.1 TECHNOLOGY PROVIDERS

In this Chapter, we will analyze the expectation of Technology providers of smart home devices belonging to the control and connectivity segment that could benefit from the INBETWEEN platform, since it allows the effective integration of their products with other vendors.

The Control and Connectivity segment provides the infrastructure for the connection of smart home IoT (Internet of Things) devices. The products from this segment enable communication between devices as well as between humans and devices. This segment includes smart speakers such as Amazon Echo, Google Home or JDs LingLong DingDong, whose primary purpose within a smart home is to control other devices. Next to voice control, touch devices such as control buttons (e.g. Logitech POP) and dedicated smart home panels are also included.

The Control and Connectivity segment shows global revenues of US\$11.9 billion in 2018. The regional revenue distribution in 2018 is lead by the U.S. with revenues of US\$5.4 billion, corresponding to a global market share of 45%, followed by Europe with US\$2.6 billion (22%) and China with US\$2.1 billion (18%). In China, the market revenue is smaller due to the low prices of devices in this segment.

The following Table 4 shows a list of technology providers of smart home devices.

**Table 4: List of technology providers of Smart Home Devices**

	<p>Google-owned Nest is a name that comes up <b>repeatedly</b> in the smart home domain. Initially known for its app-enabled thermostat and smoke alarm, the company has since branched out into the full comprehensive range of smart home gadgetry.</p> <p>Pioneered by two former Apple employees, the simplicity and slick design elements of Nest clearly denote their lineage.</p> <p>Nest now has a range of smart products including security cameras and doorbells that are all connected together via the Nest app.</p> <p>A lot of them are now integrated with Google’s smart home products, for example, Nest Cam IQ Indoor has a built-in Google Assistant smart speaker.</p>
	<p>The ecommerce behemoth is still forefront of the smart home hub market, with Alexa-powered smart speaker, Amazon Echo.</p> <p>You can summon Alexa to carry out a range of everyday tasks including playing music, making calls, manage to-do lists and shopping lists, and importantly, controlling all other Amazon connected devices in the home.</p> <p>Amazon offers a whole raft of other smart Alexa compatible products including smart plugs, working with a range of third party smart home devices such as Nest devices and Philips smart light bulbs.</p>

	<p>Philips has moved into the smart home market with its wireless, smart Hue Lightbulbs range that let you control the precise intensity and colour gradient of your lighting.</p> <p>Philips have scored a first movers advantage by being the first company to carve a niche within smart lighting and many would say they remain market leaders.</p> <p>The bulbs allow setting schedules and timers, for example setting them to brighten slowly a bedroom in the morning to create a sunrise effect.</p> <p>They are also compatible with a whole range of other smart home systems such as Amazon and Google.</p>
 	<p>Belkin is another serious contender in the smart home appliance market, especially known for its smart outlets and switches as part of its Wemo range. The smart outlet (Belkin Wemo mini) allows controlling how much power a user is using, as well turning off or on anything that is connected to the outlet remotely via the app.</p> <p>Comes with some interesting functionality such as ‘randomised lighting’ that switches lights on and off while a user is out of his home to give the appearance of someone being home.</p> <p>Again, the user can schedule the time appliances turn on, or off, through a smartphone, and it integrates with a number of voice assistants for hands-free control.</p>
	<p>Founded in 2007, Ecobee offers a host of Alexa-enabled devices, developing the first light switches to be compatible with the Amazon voice assistant, Ecobee Switch +. This means the switch can do everything Amazon Echo can, as well as the ability to control other smart devices through it.</p> <p>Ecobee also offers a sleekly designed thermostat and room sensors. The thermostat intelligently adjusts its output based on heating and cooling equipment based on your home’s energy profile, the weather and many other data points. The sensors clock when someone is home and adjusts the temperature in response, claiming to save consequently users 23% on energy bills.</p> <p>Ecobee is pitted against Google-backed competitor, Nest, but the latter still grabs the largest share of the smart thermostat market in the US - 73% compared to Ecobee's 17%. However, Nest’s thermostats do not currently function as Amazon smart speakers, so Ecobee may have the edge.</p>
	<p>The electronics giant has made a concerted push into the smart home market with a range of product launches in the past couple of years. Among other things, they offer a range of SmartThings sensors that track movement and temperature, providing smart home with a wealth of data to work.</p> <p>They also offer a useful smart hub that is compatible with most smart home products on the market, giving user one place to coordinate all of the smart appliances.</p> <p>A smart speaker powered by Samsung’s answer to Alexa, the somehow less catchy ‘Bixby’ is forthcoming, indicating their desire to snatch some of Amazon’s market share.</p>

	<p>Wink Hub 2 is touted as the “first smart home hub designed for the mainstream consumer”. Unlike Alexa or Assistant, Wink does not have any brand loyalty, allowing picking and choosing different smart product brands and merge them seamlessly with one another.</p> <p>Wink Hub 2 supports smart home protocols including Bluetooth LE, Kidde, Lutron ClearConnect, Wi-Fi, Z-Wave, and more. It allows creating a fully integrated smart home with kitchen and walling appliances in-sync.</p>
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Source: RINA-C elaborations based on ComputerWorldUK

**Table 5: Technology providers target group**

Technology providers	
Needs	inBETWEEN benefits
<p>Integration and interoperability of their systems with others to provide a better and complete solution for customers.</p>	<p>INBETWEEN allows the effective integration of technology providers’ products with other vendors. This because the INBETWEEN platform will be able to interact with very large numbers of devices and gateways using different protocols and data formats. Moreover, it will provide a framework for utilization of a common data format to allow for easy integration into the rest of the platform.</p>

## 4.2 GOVERNEMENT/POLICY MAKERS

The results coming from INBETWEEN project can have great impact on energy consumption and emissions reduction. Particularly, EU governments and policy makers will have a great deal of interest in maximizing penetration of the INBETWEEN result to achieve the highly ambitious EU2020 and even 2050 goals for energy consumption and emissions reduction. These institutions are great allies for the promotion of the INBETWEEN.

**Table 6: Government/Policy makers target group**

Government/Policy makers	
Needs	inBETWEEN benefits
<p>Reduction of energy consumptions and emission to achieve the EU2020 and 2050 goals.</p>	<p>INBETWEEN main objective is to provide an ICT solution, which focuses on increasing energy efficiency through changes of the End User behavior and lifestyle. As indicated in the McKinsey 2013 study, Behavioral Energy Efficiency’s potential is far from tapped since it revealed that behavioral interventions could reduce the total US residential energy use by as much as 20%.</p>
<p>Enhance the global conscience relate to the impact of energy generation and use on the environment.</p>	<p>The INBETWEEN user interfaces and user experience aims to engage users with the energy saving and efficiency process. The performance leader board would show the rankings of highest achievers to spur the social race and rewards could be offered to users for good behaviors giving them something for which to strive.</p>



### 4.3 SOCIAL HOUSING ASSOCIATION/MUNICIPALITIES

Social housing associations and municipalities own large amount of social housing and buildings of different size and purpose and, as public entities, they are particularly keen to minimize the normally scarce resources they have to allocate and make economic savings in return. As policy makers, they are entitled to create and use different regulations and standards for use within their jurisdiction that will improve energy efficiency.

#### HOUSING EUROPE

Housing Europe is the European Federation of Public, Cooperative and Social Housing.

It is a network of 45 national and regional federations, which together gather about 43.000 public, social and cooperative housing providers in 24 countries. Altogether, they manage over 26 million homes, about 11% of existing dwellings in the EU.

Social, public and co-operative housing providers have a vision of a Europe, which provides access to decent and affordable housing for all in communities which are socially, economically and environmentally sustainable and where everyone is enabled to reach their full potential.

The European Commission has published on 28<sup>th</sup> November 2018, its strategy to make the continent CO2 neutral by 2050.

The strategy encompasses elements, which have a direct impact on the built environment. Here are the 6 pillars of the strategy:

1. Maximize the benefits from Energy Efficiency including zero emission buildings
2. Maximize the deployment of renewables and the use of electricity to fully decarbonize Europe’s energy supply
3. Embrace clean, safe and connected mobility
4. A competitive EU industry and the circular economy as key enablers to reduce greenhouse gas emissions
5. Develop an adequate smart network infrastructure and inter-connections
6. Reap the full benefits of bio-economy and create essential carbon sinks

Providers of social, cooperative and public housing all over Europe have already embraced the energy transition as shown by statistics on energy consumption and CO<sub>2</sub> emissions in the building sector. On average, in the EU, 20% of CO<sub>2</sub> emissions in the built environment over the time 2005-2015 and an average 2,3% decrease per year of the energy consumption of the building stock (compared to 0,3% in the transport sector).

Housing Europe is committed to help its members through European projects to improve their practices and skills about some of the new frontiers for social housing: zero emission neighborhoods, circular economy, putting users’ acceptance and involvement at the center, combining energy renovation with intelligent energy management system.

Website: <http://www.housingeurope.eu/>

**Table 7: Social housing association target group**

Social housing associations	
Needs	inBETWEEN benefits
Minimize the scarce resources they have to allocate and make economic saves in return.	Thanks to consumption analytics and behavioral pattern recognition algorithms to learn consumer energy consumption habits and steer their behavior towards a more efficient lifestyle, will be delivered an entirely personalized experience where suggested energy saving actions will be tuned to address that particular consumer’s needs. There will be provided awarding points for individual energy saving actions, and badges for completing tasks or goals.



#### 4.4 ENERGY SERVICE COMPANIES

Many ESCOs companies provide energy services to residential sector. They are mainly interested in methodologies and solutions to manage better the energy consumption associated contracts. The proposed INBETWEEN solution contributes to demand reductions (i.e. flattening to load profile), owing to the better energy management of their customers, and lower costs of customer efficiency programs.

In Europe, the market linked to ESCOs' energy efficiency is 2.4 billion euros. The value of ESCOs, in producing energy savings in the market, is recognized by various EU directives and initiatives in the European context, such as the Energy Efficiency Directive, which establishes specific requirements to promote the energy services market<sup>22</sup>.

At European level, an important stakeholder, referring to ESCOs reality, is the European Association of the Energy Service Companies (Eu.ESCO).

##### EUROPEAN ASSOCIATION OF ENERGY SERVICE COMPANIES

Eu.bac is the European Building Automation and Controls Association. It represents the major European manufacturers of product and systems for home and building automation. Eu.bac has founded the European Association of Energy Services Companies (eu.esco) for promoting **Energy Performance Contracting** as the economically sustainable solution for improving energy performance in existing buildings.

According to the Directive 2012/27/EU on energy efficiency, Energy Performance Contracting (EPC) means a contractual arrangement between the beneficiary and the provider of an energy efficiency improvement measure, verified and monitored during the whole term of the contract, where investments (work, supply or service) in that measure are paid for in relation to a contractually agreed level of energy efficiency improvement or other agreed energy performance criterion, such as financial savings.

Eu.esco encourages an energy-efficiency-first mindset for the management team of public and private organizations in their energy related procurements and for policy makers in their decision-making process.

Members accomplish this goal by providing Energy Performance Contracting (EPC), which is a long-term partnership between the client and the supplier that facilitates staged deep energy retrofits with initial funding from a third party, the ESCO or the client. Its activities act as a catalyst for the industry's best business practices and maintain regular interaction between the relevant stakeholders for increasing the transparency, trustworthiness and business impact of EPC.

At the bigger scale, Energy Performance Contracting as a business model is an important facilitator, supporting the European Union in achieving its climate and energy objectives, ensuring competitiveness and improving the employment rate across the European Community.

It is also worth to underline that the eu.ESCO aim is to promote EPC at the EU level and address key barriers such as lack of awareness and/or lack of knowledge, lack of policies and support mechanisms, lack of common definitions and harmonized processes, etc. which can help also INBETWEEN to reach its objectives.

Website: <https://www.euesco.org/home/index.html>

<sup>22</sup> <http://www.habitami.it/efficienza-energetica/il-mercato-dell-efficienza-energetica-e-la-esco-in-italia-e-nell-unione-europea/>

**EUROPEAN ENERGY EFFICIENCY FUND**

The European Union has the aim to promote a sustainable energy market and climate protection through the European Energy Efficiency Fund (eeef).

The final beneficiaries of eeef are municipal, local and regional authorities as well as public and private entities acting on behalf of those authorities such as utilities, public transportation providers, social housing associations, energy service companies etc.

**Table 8: Energy service companies target group**

Energy service companies	
Needs	inBETWEEN benefits
To manage better the energy consumption associated contracts.	INBETWEEN solution contributes to demand reductions (i.e. flattening the load profile), owing to the better energy management of their customers and lower costs of customer efficiency programs.

## 5 SWOT ANALYSIS

The SWOT analysis is a framework, which assesses internal and external factors, as well as current and future potential. With SWOT analysis Strengths, weaknesses, Opportunities and Threats for INBETWEEN project are examined (See Figure 22).

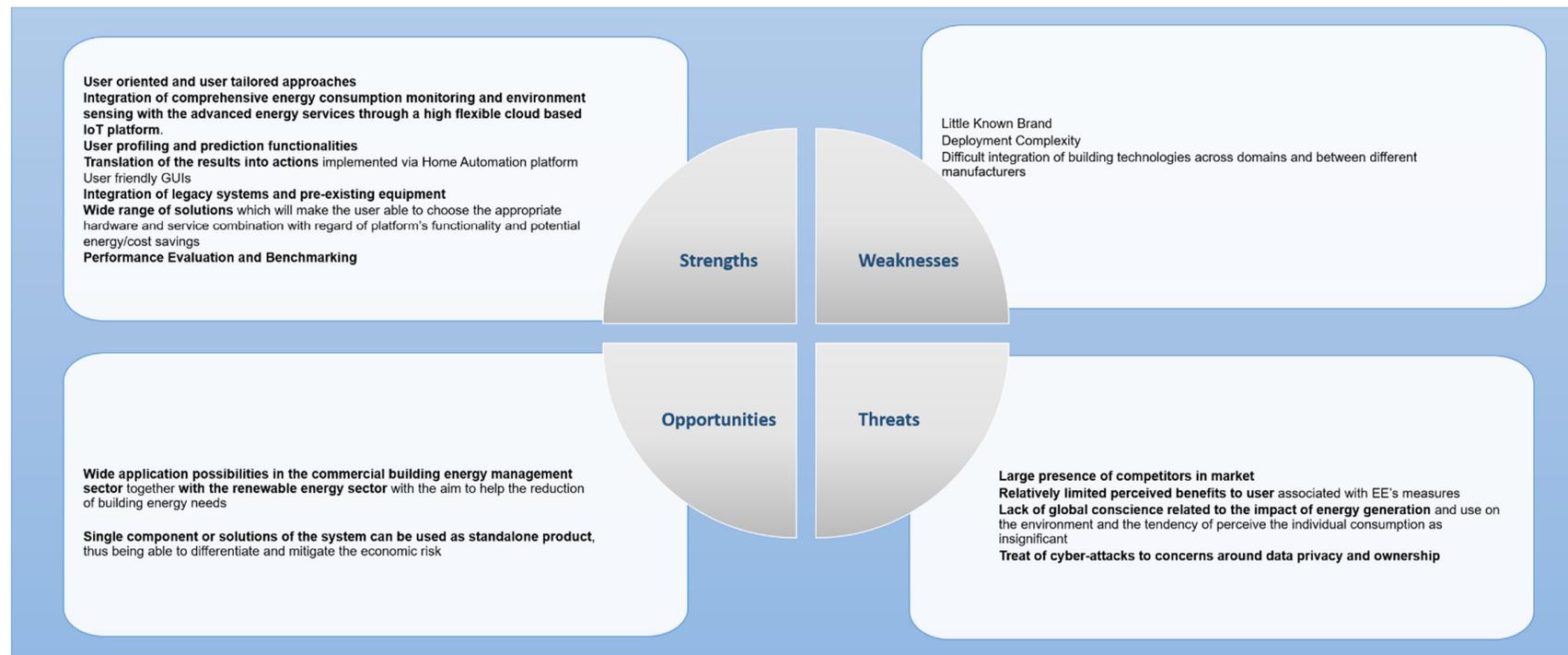


Figure 22: Strengths, Weaknesses, Opportunities and Threats for INBETWEEN project

Source: RINA- C



## 5.1 STRENGTHS

The strength of INBETWEEN project can be summarized in the following:

- The **INBETWEEN project technology** is **user-oriented and user-tailored**. This approach, showing the successful actions, may increase the reliability of the technology towards users and the technology usability.
- **Highly flexible cloud-based IoT platform**. Technology integrates a comprehensive energy consumption monitoring (electricity and gas meters, calorimeters etc.) and environment sensing (occupancy, temperature, illuminance, humidity etc.) which makes able to **upgrade the existing Home Automation Solutions**. The home automation platform, capable of integrate a wide range of home appliances and actuators, allows **translating results of the data analysis into actions** and communicate events of performance deviations, or **give useful recommendations** related to the EE through a user friendly GUIs and mobile/desktop apps. Furthermore, thanks to the application-programming interface, it is possible to **use third-party services** (meteorological data, information about variable pricing etc.). This flexibility will allow the **integration of legacy systems and pre-existing equipment** with a direct impact on the cost-effectiveness of INBETWEEN approach allowing the adoption of a **flexible business approach**. This makes available a wide range of solutions to the end-user, who can be able to choose the hardware and the service combinations, which fits better with his needs and in terms of potential energy/costs savings. The paradigm on which INBETWEEN is leveraged upon is well known: to deliver a significant added value for free to the end user and build the business strategy by providing value added extensions for a reasonable fee and/or subscription. These extensions may refer either to offering advanced services and/or to additional hardware technology, which will be leased to the End User, in order to provide these advanced features.
- **User profiling and prediction functionalities**: with a user-centric energy consumption modelling and consumption predictions connected to the information received by ESCOs, the platform is able to anticipate wasteful practices in terms of costs and energy.
- INBETWEEN permits **energy performance assessment and users benchmarking**. The assessment will consider consumption data together with number of occupant information, building size and construction materials. It sets realistic goals for users, relying on Energy Star Portfolio Manager, developed by the US Environmental Protection Agency, which allows users to benchmark track and manage energy and water consumption against similar users/buildings nationwide. This system is based on the Energy Star Score, a number from 1 to 100, which rates the user's performance on a percentile basis.

## 5.2 WEAKNESSES

Being a little known brand in a sea of many other companies with the same aim, INBETWEEN could have difficulties in emerging. In the smart home industry, in fact, are recently entered many of possible INBETWEEN's direct competitors.

At technical level, the robustness of the sensors and the **communication of data** to the platform could represent another weakness. In particular, the gateway is connected to the internet router of each household via Wi-Fi; this connection can only be processed by an installer, and only few tenants are available to change the internet provider. Therefore, the whole IT architecture has to be efficiently designed and decided, in order to avoid the loss of data (by example having a router in the common parts).

## 5.3 THREATS

The threats of INBETWEEN project may be summarized as following:

- **Relatively limited perceived benefits to user associated with EE's measures**. There is still a lack of consciousness regarding to the importance of a change in energy consumption habits and this is a great challenge to face. This assumption can limit the approach to the technology because the user has a limited perception of his benefits both in terms of economic and energy savings.

- **Lack of global conscience related to the impact of energy generation** and use on the environment and the tendency to perceive the individual consumption as insignificant.
- **Threat of cyber-attacks to concerns around data privacy and ownership:** solutions and processes producing and using vast volumes of data, questions remain around which data will be critical and prioritized, who should own it, and how best to balance the risks and opportunities of data driven solutions. Digitalizing traditional energy infrastructure will require careful management, given the inherent limits to interoperability found in digital business models. Finally, there is the cultural and institutional challenge generated by increased interaction of digital and energy system stakeholders, all with their own particular norms, practices and institutional frameworks<sup>23</sup>.

## 5.4 OPPORTUNITIES

Buildings are responsible for 40% of energy consumption and 36% of EU CO<sub>2</sub> emissions. The improvement of energy performance of building is a key factor to achieving EU Climate & Energy objectives, namely the reduction, by 20%, of Greenhouse gas emissions and a 20% increase by energy savings by 2020. Improving the energy performance of buildings is a cost-effective way of fighting climate change and improving energy security, and the role of energy efficient buildings is coming under increasing scrutiny.

Among the opportunities, for the INBETWEEN solution there is the possibility of wide application possibilities **in the energy management sector for residential and commercial building together with the renewable energy sector** with the aim to help the reduction of building energy needs.

The building and construction industry is the main responsible of high-energy consumption and global greenhouse emissions. Recent attention to the energy consumption reduction, to the environmental impact by government and other authorities, will bring to an increase of the BEMS market demand in the residential, industrial and commercial sector: these sectors are investing, in fact, in technologies for monitoring the energy consumption with the aim of saving energy<sup>24</sup>.

The building energy management system segmented on the basis of application include manufacturing, office & commercial buildings, retail, government & MUSH (Municipal, University, School, and Hospital), telecom and IT systems. Growing consumer awareness for reducing energy costs along with favorable government policies is likely to influence market growth positively. In the commercial sector, maximum solar power installations were in hotels, offices, and healthcare establishments. Water heaters, pool heaters, batteries & chargers, and attic fans are few residential applications, which require large electricity consumption.

If smart building services technology is combined with the use of renewable energies, the energy saving improvement is greater: a photovoltaic system is an excellent way to produce renewable energy, but only if it is integrated into the building's automation system, the user can get the best advantage from the energy produced. INBETWEEN can be the mean through which this upgrade may be obtained efficiently.

**Moreover, single component or solutions of the system can be used as standalone product**, thus being able to differentiate and mitigate the economic risk.

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<sup>23</sup> SETIS Magazine, (May 2018) – Digitalisation of the Energy Sector

<sup>24</sup> Hexa Research (November 2017), "Building Energy Management Systems (BEMS) Market Analysis, Market Size, Application Analysis, Regional Outlook, Competitive Strategies And Forecasts, 2016 To 2024", Executive Summary.

## 6 POTENTIAL BARRIERS

The barriers issue, which hinders the uptake of renovation measures, is well known in Energy Efficiency (EE) literature. Over several decades, literature has identified non-technical market barriers that inhibit large investments in energy-efficiency technologies and practices in the buildings sector. The fact that there is a large untapped cost-effective potential for improving the energy performance of buildings is evidence that consumers and investors, as well as society in general, are not keen on investing in energy saving.

A PESTLE analysis is a framework or tool used to analyze and monitor the macro-environmental factors that may have a great impact on an organization's performance. According to this tool, the potential barriers of INBETWEEN project will be identified and reported below.

### 6.1 POLITICAL ENVIRONMENT

The political environment is very positive and encouraging. The EU Parliament and the EC encourage utilization of energy efficient technologies, user engagement methodologies and ICT for energy efficiency. INBETWEEN complies with the national and international policies and therefore, no political risk is anticipated regarding technologies implementation.

However, some institutional barriers could emerge in terms of regulatory uncertainty, archaic or legacy regulations.

In general, institutional barriers for the EE domain are arguably not addressed with the appropriate political will that its benefits suggest. This is made worse by the number of actors that often need to be convinced in order for energy efficient investment projects. The institutional barriers could be grouped under the following types:

1. **Regulatory and planning issues.** In Europe, there are a variety of regulatory and planning obstacles. These include the lack of comprehensive energy efficiency strategies backed up by strong regulatory frameworks that promote energy efficiency.
2. **Administrative procedures.** In many European countries, administrative procedures can be complex and lacking in transparency, and could be a barrier when trying to obtain financial incentives. Complex and slow administrative procedures to access these incentives prevent investors from implementing energy efficiency measures, especially if the projects are small and the benefits are not large in relation to the effort expended.
3. **Multi-stakeholder issues.** In EE projects involving multiple stakeholders, there may be barriers due to the need to convince and coordinate the high number of actors involved in the process. These barriers are very common in the building sector where it can be difficult to agree on the EE investments in multi stakeholder properties due to difficulties in, or lack of, coordination among stakeholders who have to either approve a decision or make a financial contribution.

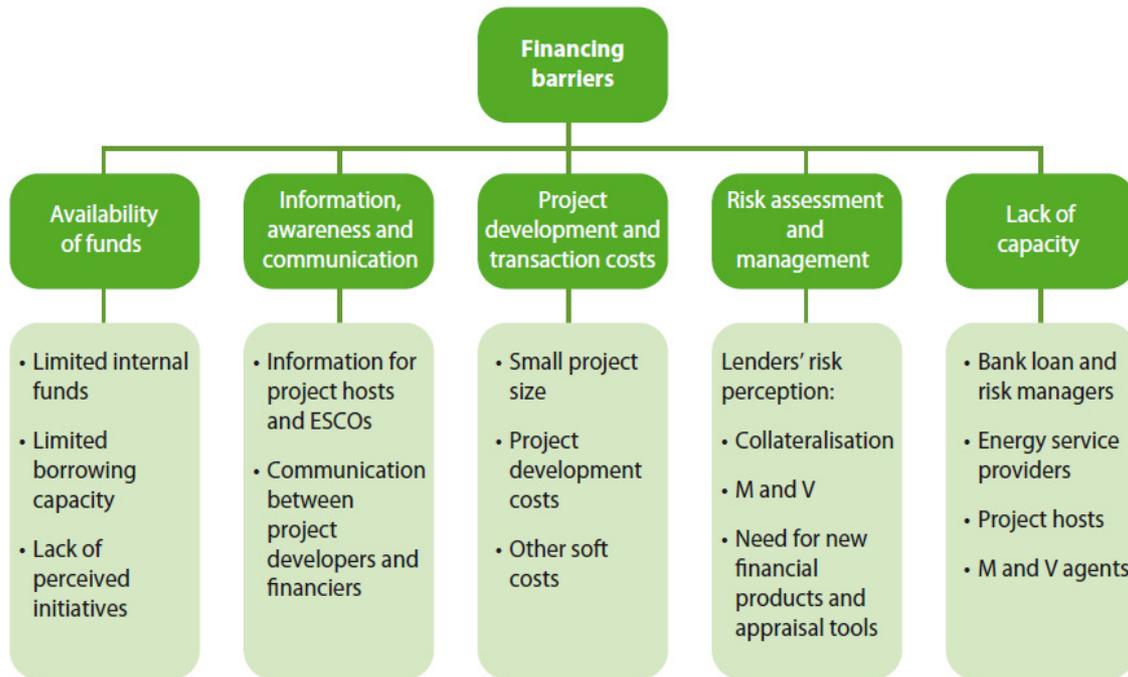
### 6.2 ECONOMIC FACTORS

The main **commercial risks** to be taken into account is the emergence of similar products in the market and the over estimation of the market potential.

Regarding financial factors, the low availability of funds for investing in EE projects could represent a barrier. In particular, the financing barriers could be grouped under five major types and summarized as in (Figure 23):

1. **Availability of funds for investing in EE projects.** EE projects reduce energy costs over time but the members of the financial community have difficulties in clearly perceiving the long-term benefits.
2. **Information, awareness and communication.** Local Financial Institutions (LFIs) generally are not familiar with EE technologies and erroneously perceive EE projects as more complex than their traditional lending. A knowledge gap exists between the organizations developing and implementing EE projects and the beneficiaries (project hosts) and LFIs.
3. **Project development and transaction costs.** The average size of an EE project is small relative to typical LFI loans, thereby making EE projects less attractive to such institutions. EE projects typically have a higher proportion of "soft costs" (project design and development) than traditional LFI loans.

4. **Risk assessment and management.** In the EE projects, the energy savings are often not guaranteed; the measurement and verification (M and V) protocol exist for EE projects but are not widespread, with different guidelines for different countries. This makes it very difficult to appraise EE projects.
5. **Lack of capacity.** Significant capacity limitations exist with respect to project developers and energy services companies (ESCOs), project hosts (energy users), and LFI loan officers and risk managers.



Source: Limaye, 2011.

Figure 23: Classification of EE financing barriers

### 6.3 SOCIAL FACTORS

The main factors, which may influence the implementation of the technology, are social related: as underlined between the threats of the project, in the SWOT analysis, there is a lack of perception of benefits for the user and the tendency to perceive the individual consumption as insignificant.

There is also a generally technophobia which can lead to low rates of technology adoption and use. Technophobia is the fear or dislike of advanced technology or complex devices and includes health concern (i.e. fear of high level of radiation emitted from meters), fear of privacy loss, or fear to loss control on the own environment.

Another factor, which may induce the consumer not to use the technology, is the fact that now there is a lot of tools or platform which usually require intensive user engagement, interfering a lot in the daily habits.

In general, lack of information, awareness and communication, inaccurate ratings and standards represent the main barriers according to social factors. In particular, information and awareness barriers are related to a lack of confidence in new technologies and approaches which often relates to a lack of sufficient, accessible, accurate and trusted information. Many of the groups and actors with the ability to make EE investments and/or behavior choices are not aware of the options available. These barriers could be grouped under three major types (INTERREG IVC, 2013):

1. **Lack of awareness of potential.** The awareness of the EE potential determines the success of the investments and is a pre-requisite for realizing the financial benefits that can be derived. The education and persuasion required

applies to both the public in general and local politicians. Local politicians are particularly important for the public sector as they often have the final say on the implementation of policies and, without their buy-in, many schemes can fail.

2. **Insufficient and inaccurate information.** Insufficient and/or incorrect information can cause agents to make sub-optimal investments in energy efficiency. Another issue is the general lack of awareness among financial intermediaries and commercial banks regarding the available mechanisms for energy efficiency project structuring and financing.
3. **Bounded rationality.** This issue is a consequence of insufficient and inaccurate information. When there is incomplete information, often, decisions are made on a partly rational basis (i.e. household energy refurbishments are carried out when things do not work properly anymore).

#### 6.4 TECHNOLOGICAL FACTORS

There is a lack of common technical standards. A free market for smart meters is also important to ensure that, besides the smart-metering roll-out obligations of Member States, consumers who want a smart meter are able to buy one.

#### 6.5 ENVIRONMENT FACTORS

No environmental factors are anticipated as the development of technologies and applications will cause no harmful pollutants/materials or waste dumping to the environment. On the contrary, the aim of the project is that of protection of the environment by reducing fossil fuel consumption (via increased efficiency) and greenhouse gas emissions through changes of the end user behavior and lifestyle.

#### 6.6 LEGAL FACTORS

Data protection laws – Over the last decade data protection has emerged as critical part of not only privacy issues but also intellectual propriety rights. Therefore, INBETWEEN has to consider this factor to face eventual problems in this field.



## 7 COMPETITIVE ANALYSIS

### 7.1 COMPETING SOLUTIONS

The key ambition of INBETWEEN is to develop an ICT platform capable of capturing users’ attention and generating efficient and sustainable behaviors over time, including also users with low ICT literacy.

There is an increased number of Home Automation platforms present in the market, they are typically focused on energy monitoring and supplying the User with information related to consumption and, in some cases (more advanced solutions) on providing control functionalities. However, these solutions do not provide **information and advice that are relevant to the specific User and that the User can act upon without compromising comfort and convenience**. INBETWEEN will bring such ability to benchmark and compete through evaluation of User **energy social practice and performance rather than (just) consumption**

In this regards, a brief state-of-the art of existing ICT solutions is reported in the following tables.

Despite the fact that they work for the utility industry, their solutions aim at helping customers understand their energy use at the first place and then better manage it. By offering a wide range of solutions ranging from Demand Response and Customer Engagement to Thermostat Management, they are focused on solving the key energy efficiency challenges.

OPOWER – ORACLE CORPORATION	
	<b>Revenue:</b> n.a. <b>Employees:</b> n.a. <b>Headquarters:</b> Arlington County, Virginia, U.S. <b>Founded:</b> 2007 <b>Website:</b> <a href="https://ux.opower.com/">https://ux.opower.com/</a>
Company Description	
Opower is the global leader in cloud-based software for the utility industry providing a software-as-a-service customer engagement platform. It existed as an independent corporation until its acquisition by Oracle Corporation in 2016. The Opower product line are now marketed by Oracle under the Oracle Utilities moniker.	
Products	
<p>Opower is the world’s leading platform for energy efficiency and customer engagement. It combines a cloud-based platform, big data and behavioral science to help utilities around the world reduce energy consumption and improve their relationship with their customers. This helps consumers lower their energy use, costs and significantly reduces carbon emissions.</p> <p>The Opower approach mainly leverages on the use of personalized messaging system that brings important energy saving measures and notifications and warnings related to the user’s energy consumption, which are transferred through the means of their custom designed web and mobile platforms. However, the greatest disadvantage of the proposed solution is that the methodology that drives the personalized messaging system seems to be taking into account only the user’s energy consumption and not the actual performance. The previous solution has the highest market penetration when it comes to the number of active users, probably owing to the fact that does not require any hardware installation at the location of each customer and offer free of charge service to the End User. However, greater energy savings and more focused energy conservation measures may only be possible if both consumption and user behavior is monitored in real-time and benchmarked against similar users.</p>	

**E ON ENERGY SERVICES**



**Revenue:** €29.5 billion (2018)  
**Employees:** 43,302 (2018)  
**Headquarters:** Essen, Germany  
**Founded:** 2000  
**Website:** <https://www.eon.com/en.html>

**Company Description**

E.ON is one of the largest private owned energy companies in the world. It is a German electric utility company that provides solutions for the energy world making sure to satisfy customers' needs. E.ON collaborated with a Swedish company for what they call "Sweden's Largest Energy Experiment<sup>25</sup>".

**Products**

The Sweden's Largest Energy Saving Experiment recruited 10.000 participants that were asked to use and test an online and mobile app connected to their homes able to show their energy consumption in real time. During a year, their consumption could be visualized in five different ways, with the aim to see what would make them save the most.

This approach benefited of a large amount of data but it still lacks the full engagement of social race between the customers.

**NEURIO**



**Revenue:** n.a.  
**Employees:** n.a.  
**Headquarters:** Vancouver, British Columbia  
**Founded:** 2005  
**Website:** <https://www.neur.io/>

**Company Description**

Neurio is a leading energy data company focused on metering technology and sophisticated analytics to optimize energy use within a home or business. Neuroio's hardware and software solutions equip users with the intelligence to manage and control electrical loads, solar systems and batteries to optimize energy consumption and increase savings.

**Products**



Neurio, advanced algorithms were employed to devise user behavior from the consumption monitoring and formulate personalized messages carrying corresponding energy conservation measures. However, a benchmarking platform, which proved to be the key factor for user engagement is missing.

The **Neurio Home Energy Monitor** installs easily within the home's load panel and provides extremely granular energy data that is used to reduce energy usage, monitor solar performance and plan for future storage needs.

<sup>25</sup> <https://forsman.co/work/eon/swedens-largest-energy-experiment>

**SIMPLE ENERGY – WELECTRICITY - LEAFULLY**



**Revenue:** n.a.  
**Employees:** 50 (2015)  
**Headquarters:** Boulder, Colorado, U.S.  
**Founded:** 2010  
**Website:** [www.simpleenergy.com](http://www.simpleenergy.com)

**Company Description**

Simple Energy is a privately held software-as-a-service (SaaS) company with the main aim to motivate people to save energy. The company creates data-driven software that appeals to people interests and desires, informs them about their energy use and makes saving energy social, fun and simple.



**Revenue:** n.a.  
**Employees:** n.a.  
**Headquarters:** n.a.  
**Founded:** n.a.  
**Website:** [www.leaffully.com](http://www.leaffully.com)

**Company Description**

Leaffully aims to help people understand energy usage. It is organized into a few main areas: diving deep into the hourly data with historic trends, understand the effect of the abstract units of energy and taking action with tree values in mind along with friends.

**Products**

Simple Energy and Leaffully offer solutions that do not require any hardware installations but focus their approach on the benchmarking aspects. Hoping that this would lead to the critical commitment of users, they all provide social networks where people can compare, compete and learn from each other's. The pitfall of their approach seems to be a lack of dynamic energy consumption data (they all use energy bills), suggesting very poor resolution (monthly) which consequently lead to very broad energy conservation measures. Furthermore, the aspect of social pressure that should be coming from the employment of social networks has very low impact, due to the fact they are using their own social networks which, unfortunately, has a limited number of active users. Instead, the use of widely accepted social networks (such as Facebook, LinkedIn etc.) would allow for better user engagement, since they already use them, and unlimited dissemination possibilities.

**EFERGY**



**Revenue:** n.a.  
**Employees:** n.a.  
**Headquarters:** Premiá de Mar, Barcelona  
**Founded:** 2006  
**Website:** <https://efergy.us/>

**Company Description**

Efergy was founded in 2006 with the mission to become a global leader in providing energy saving products. It develops consumer products to give homes access to meaningful, tangible and real-time energy information in an engaging format. Having reached to over 1 million homes in over 50 countries, it aims to become a leading global brand for energy saving solutions.

**Products**



Energy monitors are a gateway to the inner energy workings of home. They connect electricity meters to show how much energy a home is using and to provide information about how users can make their home more energy efficient.

There is a range of models and features, including the Elite Classic wireless energy monitor, E2 Classic wireless energy monitor with Elink software for an insight information and analysis, and the Engage online energy monitor, which allows users to track electricity on the web portal, Android and iOS app.

SENSE	
	<p><b>Revenue:</b> n.a.  <b>Employees:</b> n.a.  <b>Headquarters:</b> n.a.  <b>Founded:</b> n.a.  <b>Website:</b> <a href="https://sense.com/">https://sense.com/</a></p>
Company Description	
<p>Sense installs electrical panel and provides insight into user’s energy use and home activity through iOS, Android, and web apps.</p>	
Products	
	<p>Sense is a small but powerful computer installed in home electrical panel by a licensed electrician, usually in less than 30 minutes. Using two clamp-on sensors and a 240v breaker, the Sense monitor samples current and voltage one million times per second to determine where energy is going.</p> <p>The main features are:</p> <ul style="list-style-type: none"> <li>• Track energy use over time</li> <li>• Set device-level notifications</li> <li>• Identify sources of energy waste</li> <li>• Keep tabs on home</li> </ul>

The experience gained in previous deployment of metering and feedback technologies demonstrates that the different engagement platforms, strategies and methodologies lead to varying levels of behavior change and demand reduction (ranging between 3%-20% in kWh) that last for varying periods of time.

The ICT solutions described in the tables above are a number of solutions already available on the market that help customers understand their energy use and better manage it; some of them are characterized by a cloud-based software and some other does not require any hardware installations; some are only web applications, other also desktop applications.

The inBETWEEN integrated platform will be able to enter into this market and gain a competitive advantage because it proposes a new ICT tool used for inducing the end user behavior change towards more energy efficient lifestyle by simultaneously assisting users to identify energy wastes, learn how they can conserve energy and motivate them to act. The inBETWEEN cloud based platform aims to deliver cost-effective solutions that brings benefit offering advanced energy services. Finally, it allows users to integrate their building’s connected devices and systems with advanced energy analytics and optimization services to create a comprehensive recommendation and feedback solution, which will facilitate a cost efficient daily routine.



## 8 CONCLUSION

The present document constitutes Deliverable 6.1 “Market Analysis”. It has been developed within WP6, in the framework of Task 6.1 “Flexible INBETWEEN Supporting Business Model”.

The document presents a technology market analysis with the scope of understanding the evolving opportunities and threats related to the strengths and weaknesses of the INBETWEEN platform, positioning them on the market and assessing their market potential.

Energy efficiency is the catchphrase of the early 21st century. Amid the rising energy demand around the world, concerns about traditional sources and increasing environmental awareness, saving energy, improving transmission and distribution and generating power from renewable sources have become priorities for Europe. Improving energy efficiency will save money, help protect the environment, create new jobs, spur economic growth and improve security of supply by reducing Europe's dependency on imported fossil fuels.

ICT has an important role to play in increasing the energy efficiency in the EU economy and a bulk of innovative firms is rising in order to provide ICT services with the aim of improving energy efficiency through, among the other, the prediction of energy needs, storing power services and monitoring systems.

Analyzing the offering of more than 100 international startups and players in the energy sector, we have identified for the Energy Efficiency aimed ICT tool services, four main target customers segments:

- Renewables
- The Building Energy Management Sector
- The Private Household Consumers
- Cities and Local authorities

INBETWEEN solutions focus in particular on the Smart Home segment, to be linked to the private household consumers segment. This segment has been analyzed from a global point of view, in order to identify possible opportunities for INBETWEEN in the smart applications market.

The worldwide revenue in the Smart Home market amounted to US\$56 billion in 2018. Revenue is expected to show an annual growth rate (CAGR 2018-2023) of 22.3%, resulting in a market volume of US\$153 billion by 2023.

As electricity prices are predicted to rise, consumers are looking at ways to save costs and one of the best way to make these savings is to **invest in an energy management system**. By setting up a system, which is programmed to know the family's schedule and their preferred settings, as well as monitoring the temperature, users have reported **significant bill reductions**.

Among the Opportunities identified for the INBETWEEN solutions, there is the possibility of wide application **in the commercial building energy management sector** together **with the renewable energy sector** with the aim to help the reduction of building energy needs.

**Moreover, single components, or solutions of the system, are standalone products**, thus being able to differentiate and mitigate the economic risk.

In this regard, additional markets have been identified for each of the single exploitable result, considering that they could be commercialized separately from the INBETWEEN integrated platform. In particular, the following additional markets have arisen:

- **Data Analytics Market.** This is a perfect target market where the **energy consumer predictor** of the INBETWEEN project, may be profitably placed due to its structure that can be exploited both in the energy efficiency sector, for which it was designed, but also in all those sectors in which there is the need to make forecast based on past data or behavior.
- **ICT Platform and Cloud Computing Market.** In this context, the **web-based dashboard** and the **Integration Middleware** of the INBETWEEN project can be placed. The first one allows the remote monitoring, follow up and analysis of any type of parameter that, in the specific case of the INBETWEEN project relate to buildings, construction sites etc. However, it can be applied in any other installation or environment where there is a need



for remote check of any measurable physical variable. The Integration Middleware is responsible for orchestration and management of all the INBETWEEN platform components and services by supporting their data exchange and connectivity towards the external data providers and so it can be able to do the same activities for any platform components.

- **Enterprise Application Software Development market.** In this context, the challenge is the integration of applications with different functions. The share data model is the solution for integrate applications isolating them from the changes in other applications.
- **Building Management and Building Maintenance.** In this context some of the exploitable results of the INBETWEEN project, can be sold in Building Management sector. They are: the **web-based dashboard**, **Method of installation and implementation of wireless sensor equipment in buildings**, the **Commissioning Tool**, the **Semantic information model** and the **Demo feedback for continuous product portfolio improvements**.
- **Healthcare.** In this context, everything that could make easier the development of data and systems integration, is useful for the growth of data management in healthcare sector, and some of the exploitable result of INBETWEEN project can do so. They are: the **commissioning tool** and the **Squid Smart App**, which can facilitate the application development, the **Demo feedback for continuous product portfolio improvements** that enable continuous improvements of devices and material to accommodate the needs of end-user and maintain high level of user satisfaction which for a particular sector such as healthcare is the primary objective.

Finally, since many ESCOs companies provide energy services to the residential sector, they are interested in methodologies and solutions to better manage the energy consumption associated contracts. The proposed INBETWEEN solution contributes to demand reductions (i.e. flattening to load profile), owing to the better energy management of their customers, and lower costs of customer efficiency programs.

These and other possible patterns for the INBETWEEN solutions' successful market uptake are described in the document.



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