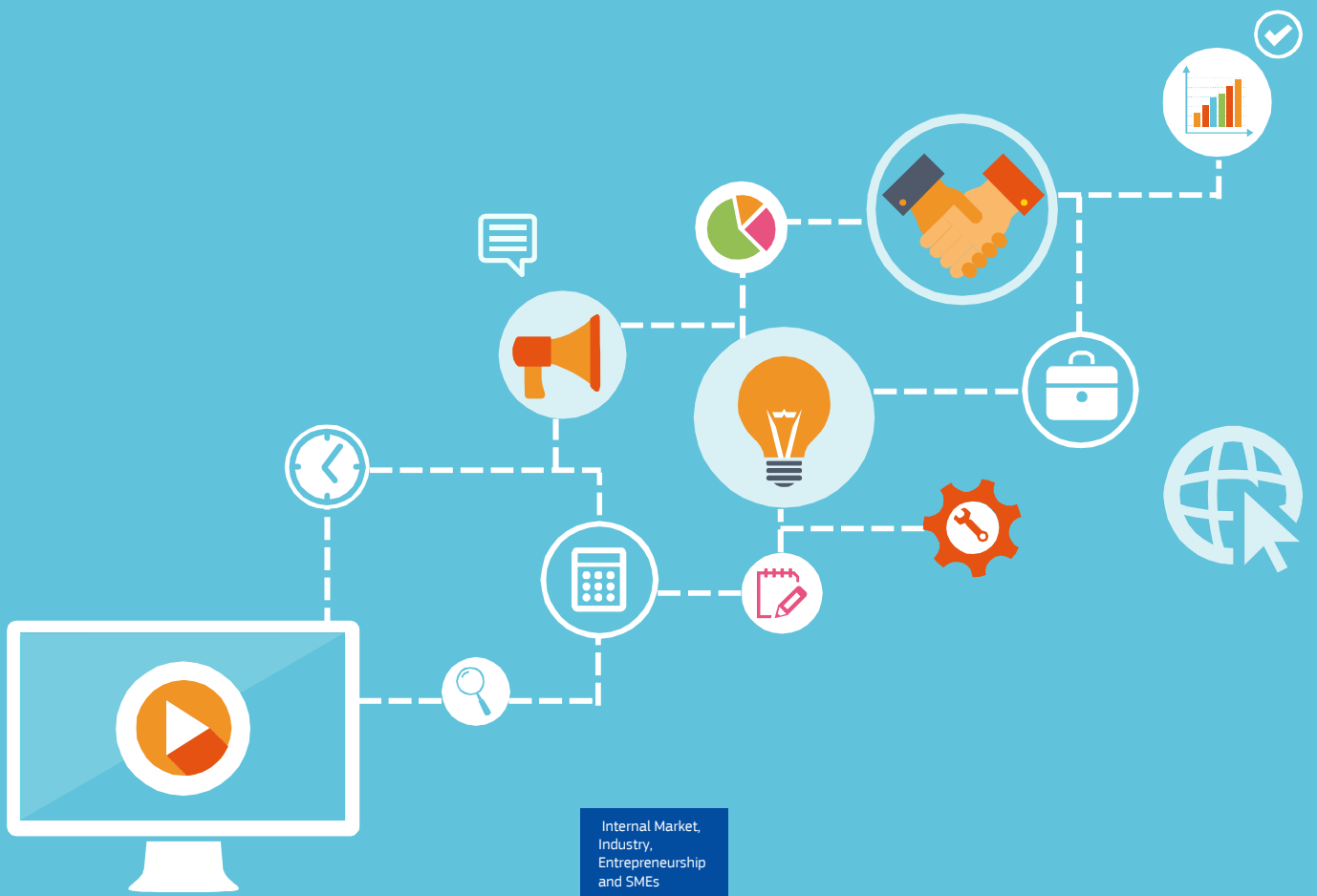


Digital Transformation Monitor

Smart Building: Energy efficiency application

October 2017





Smart Building: Energy efficiency application

If the development of Smart Home is still awaited, the concept of Smart Buildings seems to attract the ecosystem aiming to replace the traditional building management system. Smart Building players work together to fight the lack of standardisation. Regulatory bodies try to encourage the adoption of Smart Building. And real estate developers are increasingly taking a key role in the adoption of the technology, attracted by the potential in terms of energy efficiency in the aim to increase the value of properties.

1

An increased interest for Smart Building

Smart Building, a similar concept to Smart Home

The concept of Smart Building could be defined as a set of communication technologies enabling different objects, sensors and functions within a building to communicate and interact with each other and also to be managed, controlled and automated in a remote way. Indeed, technologies help to connect a variety of subsystems that originally operated independently. Automated processes allow the control of the building's operations including HVAC (Heating, Ventilation, Air Conditioning), lighting, security and other systems.

Large scope of Smart Building with a major focus on energy optimisation

The scope of Smart Building is very wide covering various objects within the household from windows or elevators to vehicle charging. But energy efficiency is expected to mainly come from the two following categories:

- Smart lighting that adjusts the light levels according to times but also according to other smart elements like windows and HVAC system. Occupancy sensors also influence the required lighting when combined with space management;

- Smart HVAC systems that are linked with different types of sensors and that have the ability to adjust quickly and automatically according to weather forecasts, occupancy, ineffective systems....

Contrary to the B2C focus of Smart Home, the Smart Building concept has a B2B approach. Indeed, the buying decision for Smart Building solutions is dependent on building companies, building managers, investors or condominium corporations, comparatively to the owner or occupant that is addresses for Smart Home.

Smart Building, an expected growing market

Moderate growth of 15% between 2015 and 2025

In volume, the installed base of Smart Home and Smart Building devices will grow from 233 to over 980 million units by 2025 ¹ when taking into account the energy management and security-based devices.

European region lagging behind

Geographically, North America is the world leader in the Smart Home/Building market with 40% of installed base. Main innovations are currently coming from the US and services are firstly deployed in the country. The APAC region is also dynamic in the market and expects to reach over 20% CAGR between 2015 and 2025 benefiting mainly from the new real estate installations. APAC will contribute for 33% by 2025. Europe is behind but the market is forecasted to grow reaching 24% of market share by 2025.

Revenue from IoT-enabled Smart Building technology

More than  8 billion USD in 2020

Source: ABI Research²

Figure 1: Scope of Smart Building



Source: IBM

Total costs of building during operation

- 20% building costs
- 80% operating costs
 - 40% energy
 - 30% maintenance
 - 10% other costs

Source: Smart Buildings in smart cities by Siemens

2

Smart Building implementation driven by efficiency

Common stakes between Smart Home and Smart Building

But efficiency is much more important for Smart Building

Smart Home and Smart Building could be mutually supportive with regard to technologies and regulatory trends, across the initial implementation of applications, facilities and services. Indeed, many technologies are similar and can be leveraged both in home and building environments; collaboration should drive many of these technologies across traditional boundaries of each market.

The benefits for Smart Building are about efficiency:

1. **Energy efficiency.** First, the energy management allowed by new technologies helps in reducing the use of electricity consumption within households and building facilities. The idea is to control the energy used by activating/deactivating lights, HVAC systems and any appliances thanks to the communication with other equipment like smart windows or presence detectors in an automatic way or in a real time, and if needed, in a remote way. Secondly, the energy efficiency is linked to the occupancy indicator revealing energy loss for unused space.

According to elektormagazine.com, a 10% reduction of the space needed for workplaces in a 10,000 m² office can save as much as 1,000,000 EUR per year taking into account that 50% of available desks are unused in France due to teleworking³. The major motivation from building occupants/managers to implement smart solutions remains the reduction of electricity bills ahead of any environmental concerns. A study led by the American Council for an Energy Efficient Economy finds a cost saving of 24-32% when using smart HVAC and smart lighting.

2. **Safety and security efficiency.** This was the initial factor driving motivation of implementing smart systems in a building. There is a clear growing trend in the need to secure access control, in order to authenticate authorised persons, detect any irregular intrusion and alert an emergency centre if needed, but also in a monitoring service warning if something abnormal happens such as a fire. More and more, consumers and businesses are ready to pay for more security and peace of mind.
3. **Employee productivity.** Smart solutions help in providing greater convenience, comfort and wellness; they improve occupants' life by providing thermal comfort or by monitoring indicators such as air quality or humidity, highly critical in some cases, that in the end benefit employee productivity.

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Greenfield deployments taking off

Impact on building value

A change in real estate value

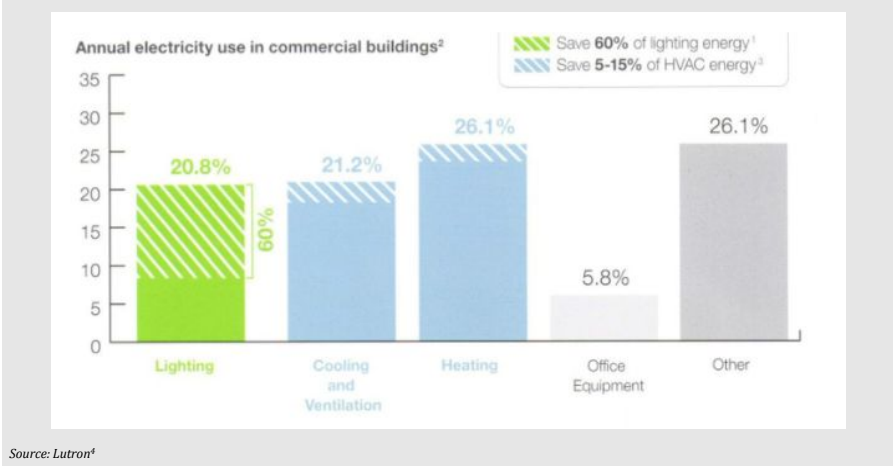
Property investors could be more and more attracted by Smart Buildings. They play a role in the evaluation of commercial properties as property owners notice market prices significantly higher than the average market for Smart Buildings. From commercial real estate, Smart Buildings can bring value for customers, make the difference with competitors and generate new sources of revenue. Also building owners envisage to raise rent to pay for the installation of energy efficiency technology; but tenants/ occupants will expect to be sure that energy bills will be lower in exchange.

Energy-efficient commercial buildings demonstrate

- 2 - 17 % increase in resale value
- 8 - 35% increased rental rates
- 9 - 18% higher occupancy rates
- 30% lower operating expenses
- 9% higher net operating income

Source: Global Real Estate Sustainability Benchmark⁷

Figure 2: Breakdown of energy use in buildings and expected savings



No expected major additional investment for Smart Building

Different voices from the industry indicate that investment on Smart Building will not be heavy for real estate developers and construction bodies.

Bouygues Immobilier, the French construction company said that they are providing Smart Building with hardly any extra costs using wireless connections and existing protocols. According to buildings.com⁸, the average cost of using a building management system (BMS) is around 250,000 USD for 100,000 square feet; while IoT-based networks along with sensors lower Smart Building costs to 5,000-50,000 USD.

Cost comparison between building management system and smart building

BMS cost
250 kUSD

Smart Building
5-50 kUSD

Real estate developer, a key role in Smart Building development

Integrating Smart Building technology in greenfield for new buildings would be the trend in a market where retrofitting an existing building with smart technology could be both cost-prohibitive and complex. As a matter of fact, real estate developers will take a key role. Actually, they are already increasingly equipping the apartments in their new programmes with connected objects. Typically, Bouygues Immobilier's connected apartments called "Flexom" are available in 30% of its 443 real estate programmes. The French construction company claims the construction of 10,000 households per year equipped with this solution.

Implementation of Smart Building for new building already happening

All Flexom apartments include, "free of charge", connected smoke alarms, heating, lighting, shutters and the ability to manage them from the smartphone. Additional paying "packs", ranging from EUR 1,200 to 3,700, are also available for further comfort and security, with additional objects such as alarm with window sensors, flood sensors, "light path" to prevent falls at night.

According to Bouygues Immobilier, these Flexom apartments are their key product, with expected 100% of their buildings compatible as end of 2016.

The Edge building in Amsterdam as major reference in Smart Building

The Edge in Amsterdam is recognised as the top reference for Smart Building and efficiency for space and energy. Initially the building was planned to be 100,000 m². Thanks to smart solutions for space management it ended up being only 60,000 m², saving almost half of the initial space and reducing the costs significantly.

Over 28,000 sensors and actuators have been installed in the building in order to manage energy and data flow. The HVAC system, room control and other critical data can be monitored and controlled by building and facility managers via dashboards. The company Deloitte which is the primary tenant, takes advantage of the building by collecting a huge amount of data. They typically gather data on how the Smart Building and the employees interact, that allows for a situation when a section can be shut down for days with a presence of fewer employees than usual.

Figure 3: Building operations controlled from smartphones



Figure 4: Dashboard view at the Edge building



Source: Deloitte

4

Enthusiasm around Smart Building

Efforts made for the development of Smart Building

Market driven by regulation

Actually, the regulation aspect on Smart Building mainly concerns energy efficiency; it is perceived as the initial stage towards becoming smart. At national level, some countries have put in place legislation to take steps towards a smart built environment, such as encouraging the optimisation of the heating system, using renewable energy, supporting building energy storage or deploying smart metres. Typically in France the "Réglementation Thermique 2012" (RT2012) regulation, introduced in 2013, imposes an energy efficiency three times greater than the previous standard, for any new planning and building works as well as building extensions.

5-6% reduction of EU energy consumption thanks to energy efficiency from buildings

Source: EC⁵

At European level, there is a strong focus set on the energy efficiency of buildings. There were two directives in 2010 and 2012 focusing on the reduction of the energy consumption of buildings, and, in 2016, the Commission updated the Directive on Energy Performance of Buildings. The latter mainly focuses on specific development for new buildings in terms of respect of HVAC control systems and energy efficiency improvements but minimum energy requirements performance is demanded for EU countries for renovation of buildings. According to this directive, "all new buildings must be nearly zero energy buildings by 31 December 2020 and by 31 December 2018 for public buildings".

In the US, The Department of Energy is concentrated on developing energy efficiency standards to improve HVAC products expected to increase the energy efficiency of new commercial units by 15% by 2023.

Main focus on smart metering

The current approach of European legislation does not sufficiently encourage the implementation of Smart Buildings, mainly promoting the implementation of smart metres. BPIE report⁶ demonstrates how Europe has room for improvement for Smart Building.

Front runners include unsurprisingly countries like Sweden, Finland, Denmark and the Netherlands having regulatory frameworks and significant investments in renewable energy

Figure 5: European readiness for Smart Building remains low

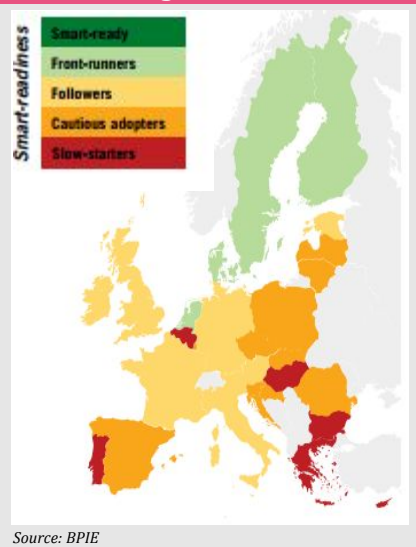


Figure 6: Major players in Smart Buildings Alliance



Standards remain a key issue

Lack of interoperability for currently used protocols

Like the Smart Home market, the Smart Building sector is characterised by a strong fragmentation amplified by the specific communication protocols traditionally used in the Smart Building.

Indeed, beyond popular standards used like Wi-Fi, Bluetooth, Zigbee, EnOcean, Thread or KNX, some protocols are used for a dedicated application of building automation systems such as DALI or Modbus, restricted to the lighting control protocol; Opentherm designed for heating and cooling applications or M-Bus for metering.

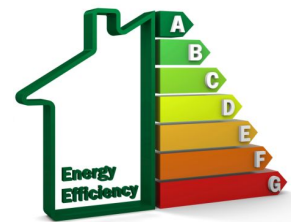
Figure 7: Protocols used in Smart Buildings



But industrials work hand in hand to create standards for Smart Building

With regard to lighting, a consortium of Europe's largest lighting manufacturers has created OpenAIS, a standard for smart lighting with a defined system architecture and open interfaces.

In France, Smart Buildings Alliance (SBA) is an association aiming to promote the Smart Building industry in Smart Cities by combining 170 organisations from different trades related to the construction industry (Industrial companies, service companies, design offices, architects, builders, developers, developers or innovative start-ups). In 2015, the SBA has published a reference framework called Ready2Services defining the technical conditions to deploy Smart Building, defining connectivity and security conditions.



References

¹ IDATE DigiWorld, Smart home and smart building market, April 2017
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³ <http://www.smartbuildingsalliance.org/wp-content/uploads/2017/04/160259-EN-Q-and-A.pdf>
⁴ <https://www.savemoneycutcarbon.com/category/lighting-controls/>
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⁶ bpie.eu/wp.../STATUS-REPORT-Is-Europe-ready_FINAL_LR.pdf
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The Digital Transformation Monitor aims to foster the knowledge base on the state of play and evolution of digital transformation in Europe. The site provides a monitoring mechanism to examine key trends in digital transformation. It offers a unique insight into statistics and initiatives to support digital transformation, as well as reports on key industrial and technological opportunities, challenges and policy initiatives related to digital transformation.

Web page: <https://ec.europa.eu/growth/tools-databases/dem/>

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