Building energy management systems

April 2019

wbcsd

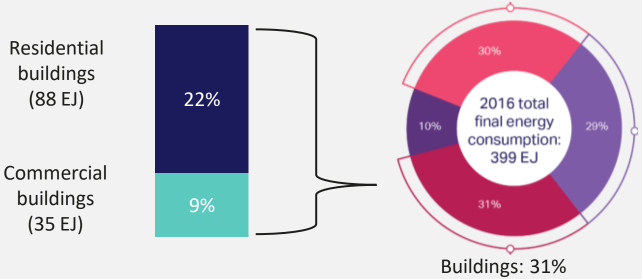
Table of contents

1. Background

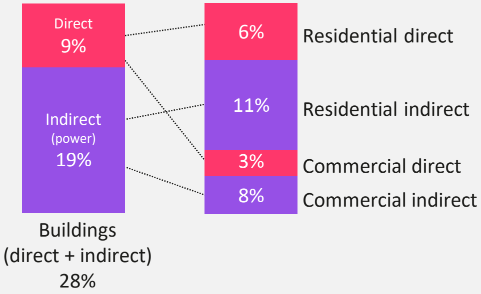
Buildings are responsible for 28% of direct and indirect global CO_2 emissions

Energy consumption of buildings

Share of buildings in global final energy consumption[1]



Share of buildings in global energy-related CO_2 emissions[2]



Focus on commercial buildings

- In both the residential and commercial sectors, there are opportunities to reduce energy use and emissions through improved energy management with active controls to better adapt to occupant habits and energy needs.
- The opportunities for improved energy management are similar in the residential and commercial sectors, but the solutions in the commercial building sector are more mature.
- This business case focuses on the commercial building sector, as the market is more mature than for the residential sector. The residential sector market is emerging with an increasing number of vendors, such as British Gas, Siemens and Google, entering the market.

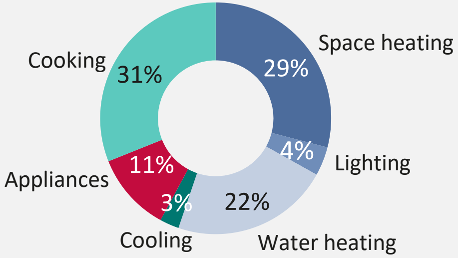
Sources: [1] IEA, 2017: *Energy Technology Perspectives 2017*. [2] UNEP & IEA, 2017: *Towards a zero-emission, efficient, and resilient buildings and construction sector. Global Status Report 2017*.

1. Background

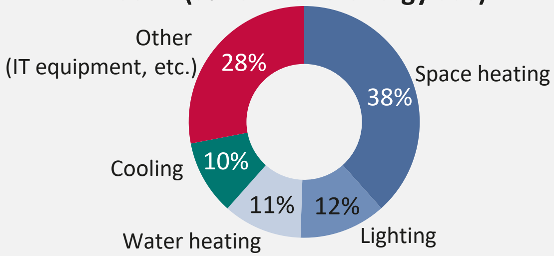
Building energy management systems can reduce energy use for all applications

Energy applications in buildings*

Total final energy use of residential buildings:
88 EJ (22% of world energy consumption)



Total final energy use of commercial buildings:
35 EJ (9% of world energy use)



Solutions to decarbonize buildings

- Energy efficient devices (e.g. cooling and ventilation technologies).
- Renovate existing buildings and build highly efficient new buildings
- Low carbon energy supply to/in buildings:
  - Electric or renewable technologies (heat pumps or solar technologies, small combined heat and power units), coupled with a decarbonizing power system.
  - District heating systems.
- Building energy management systems:
  - Optimizing energy use for technical systems (heating, cooling, ventilation, hot water, lighting) by using sensors, thermostats and controls.

*World building final energy consumption by end-use in 2014. Source: IEA, 2017: Energy Technology Perspectives 2017.

1. Background

Global building energy consumption will increase if no action is taken

Current CO_2 emissions associated with buildings	• CO_2 emissions (direct and indirect) from buildings are currently 28% of global energy-related CO_2 emissions.[1] • Electricity accounts for 31% of global buildings' energy use in 2014.[2] • Natural gas accounts for 21% of global buildings' energy use in 2014.[2]
Forecasted developments in a business-as-usual scenario	• Global buildings' energy consumption could increase to more than 157 EJ in 2050 (compared to 123 EJ in 2014) if action is not taken to improve the energy performance of buildings.[1] • Under the IEA's Reference Technology Scenario (a scenario that would result in a 2.7°C temperature increase by 2100), CO_2 emissions from buildings would increase by 10% by 2050.[2]
Obstacles to decarbonizing buildings	• Performance requirements for buildings tend to focus only on new builds and major refurbishments. • Split incentives between landlords and tenants hinder the uptake of energy efficiency measures. • The commercial buildings sector is driven by the needs of the core business of the occupant; energy efficiency is often not taken into account in business decisions. • Many vendors have struggled with a go-to-market strategy that achieves economies of scale with smaller buildings.

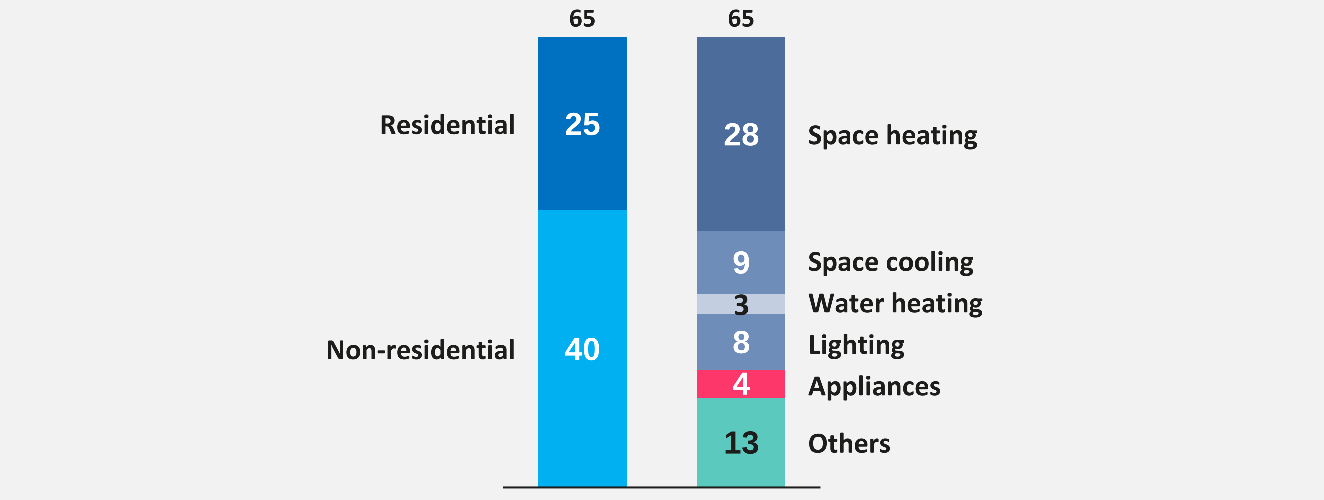
Source: [1] IEA, 2017: *Energy Technology Perspectives 2017*; [2] UNEP & IEA, 2017: *Towards a zero-emission, efficient, and resilient buildings and construction sector. Global Status Report 2017*.

1. Background

There is significant potential for digitalization to improve energy services in buildings

- Digitalization of energy services in buildings, such as the introduction of a building energy management system, could cut the total energy use in residential and commercial buildings between 2017 and 2040 by as much as 10% compared with a business-as-usual scenario.
- Cumulative energy savings over the period from 2017 to 2040 would amount to 65 PWh – equal to the total final energy consumed in non-OECD countries in 2015.

Cumulative energy savings (in PWh) to 2040 in buildings from widespread digitalization



Source: IEA, 2017: Digitalization & Energy.

2. Description of building energy management systems

Overview

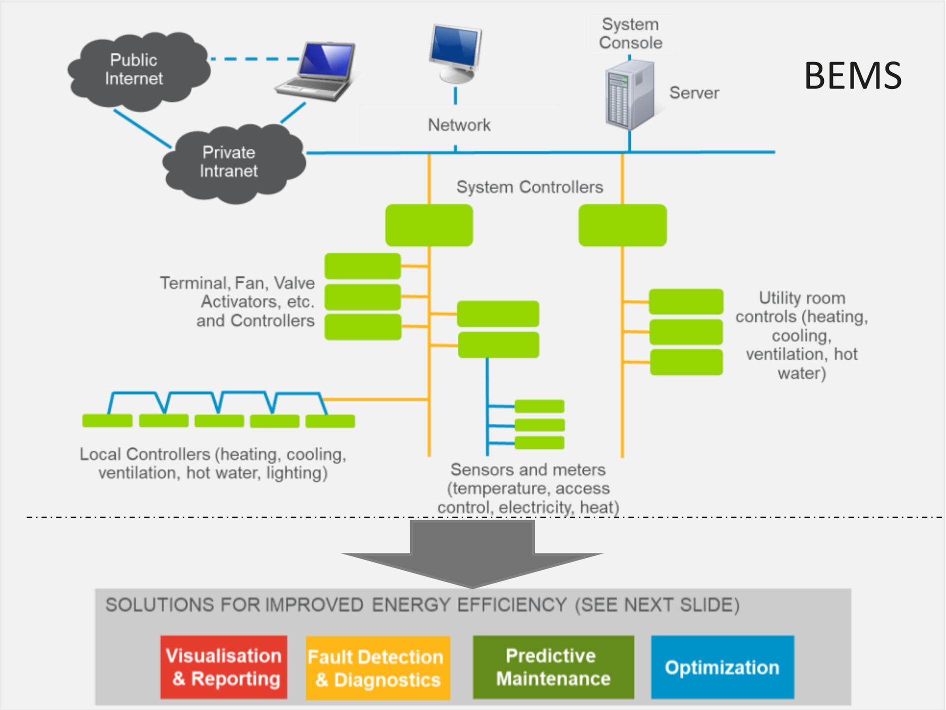
Description of the new solution concept	• We define building energy management systems (BEMS) as an **IT-based solution** that extends the capabilities of sensing, control, and automation hardware to direct **automated and manual improvements to system operations** and energy efficiency in buildings. • The terminology used in this business case focuses on BEMS for the **commercial buildings sector**. • BEMS is part of the Technical Building System (TBS)*. BEMS delivers four solution offerings: **visualization and reporting, fault detection and diagnostics, predictive maintenance & continuous improvement, and optimization**.
Rationale for developing this solution	• A BEMS helps to meet **energy efficiency** and **sustainability targets**. • Makes individual building performance visible. • Energy and resource cost optimization. • A BEMS helps with improved operational efficiency and maintenance needs. • A BEMS helps to increase occupant engagement and employee satisfaction.
Assessment of technology readiness status	• The **basic BEMS** functionality (visualization and reporting) is **very mature**. • There is a broad variety of vendors for Building Energy Management Systems from software start-ups to utilities to Energy Service Companies (ESCOs). • The adoption rate of more complex functionalities (see slide 9) is higher in large facilities than in smaller facilities.

*Technical Building Systems (TBS) means technical equipment for the heating, cooling, ventilation, hot water, lighting or for a combination thereof, of a building or building unit.[1]

Source: [1] *EPBD recast 2010, Article 2 (3.)*.

2. Description of building energy management systems

A broad set of data-collection devices, together with an IT-based solution



BEMS definition

The term BEMS covers a broad set of solutions that deliver improvements in facility energy efficiency. BEMS utilizes data from traditional control and automation systems, smart meter interval electricity consumption data, supplemental submeters and advanced sensors, and/or other business intelligence offerings. The following definition of BEMS clarifies the boundary around technologies and services that shape this market in energy management solutions: "IT-based solutions that extend the capabilities of sensing, control, and automation hardware to direct automated and manual improvements to system operations."

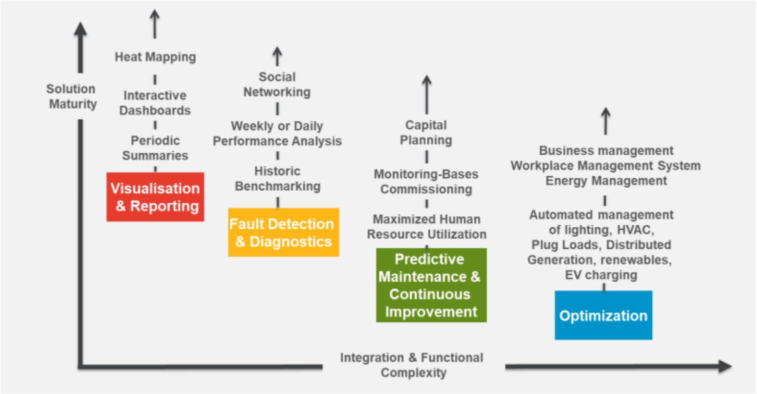
Source: Navigant Research, 2016: *Building Energy Management Systems*.

2. Description of building energy management systems

The solutions offered by a BEMS can be categorized into four groups

- BEMSs deliver solutions through four categories: visualization & reporting, fault detection & diagnostics, predictive maintenance & continuous improvement, and optimization.
- Some BEMSs only focus on one of these solutions, while others cover more solutions.

BEMS solutions



Sample visualization & reporting interface

- The emergence of the Internet of Things (IoT) has made more BEMS solutions available to a growing number of customers.
- The significant reduction in cost of new IoT technologies as compared to traditional controls and automation make the benefits of BEMSs attainable for smaller facilities.

Source: Navigant Research, 2015: *Next-Generation Building Energy Management Systems*.

3. GHG reduction potential of building energy management systems

GHG emissions assessment of current and new solution

- Building energy management systems reduce the use of all energy sources in the building (natural gas, electricity, district heating, oil, etc). Factors influencing the performance of a BEMS include the software system, the quality of the heating, ventilation, and air conditioning (HVAC) system and operator training. In addition, regular servicing is also important to maintain performance.
- The IEA estimates that the total energy use savings from improved controls in residential and commercial buildings between 2017 and 2040 |could be as much as 10% compared with a business-as-usual scenario.[1]
- Assuming up to 10% savings and building-related emissions growing from 9.4 $GtCO_2$ in 2014 to 10 $GtCO_2$ in 2050,[2] the abatement potential from BEMS is around 1 $GtCO_2$ per year.
- The avoided direct CO_2 emissions from e.g. heating depend on the fossil energy source. The following table[3] provides estimates of the CO_2 saving potential per kWh avoided:

Fossil fuel	CO_2 emissions (gCO_2/kWh)
Natural gas	205-216
Fuel oil	250

- Additionally, BEMS lowers indirect emissions by reducing electricity consumption. The avoided indirect emissions depend on the country specific electricity grid emission factor (e.g. EU emissions grid factor is 390gCO_2/kWh).

Sources: [1] IEA, 2017: *Digitalization & Energy*; [2] UNEP & IEA, 2017: *Towards a zero-emission, efficient, and resilient buildings and construction sector. Global Status Report 2017*; [3] EPA, 2018: *Emission Factors for Greenhouse Gas Inventories*.

4. Cost assessment and sensitivity analysis

Investment costs	• The investment cost for a BEMS is highly dependent on the purpose and functionality of the system. • The cost assessment should take into account costs for hardware, software, and for analysis and action (by internal and/or external staff). • As a rule of thumb (see ROI) the **investment costs in hardware and software is about 20% to 40% of the annual energy bill** of the site. • Examples are provided in the following slides.
Return on investment (ROI)	• The **ROI** of a BEMS **is highly case specific**. • Typically, the proposed solution and budget available for implementation are tailored towards a configuration with a **payback time below 3-5 years**. • As such, the required payback time often determines the configuration. • The business case usually accounts only for the energy saving benefits. • Though more difficult to quantify, **non-energy benefits** (e.g. improved productivity through better comfort) should ideally be included in the business case.
Sensitivity analysis	• The business case is sensitive to the following factors: - **The purpose of the BEMS:** the size and functionality of the technical building system determine what energy and other savings can be achieved. - **Economies of scale:** applying a similar solution at multiple buildings can increase the attractiveness of the business case.

Source: Navigant.

4. Cost assessment and sensitivity analysis

Good documentation is required for a detailed cost assessment

- Cost data on BEMS hardware and software is highly case specific. Hence, it is recommended to make a draft project costing at an early stage (e.g. using the template on the right).
- It is important to take all costs into account, including:
  - Hardware
  - Software
  - System integration
  - Operational costs
  - Training
- Maintenance costs can represent the largest share of costs over the lifetime of the BEMS. It is therefore important to choose a BEMS vendor for which there is a large number of companies available to provide maintenance services.

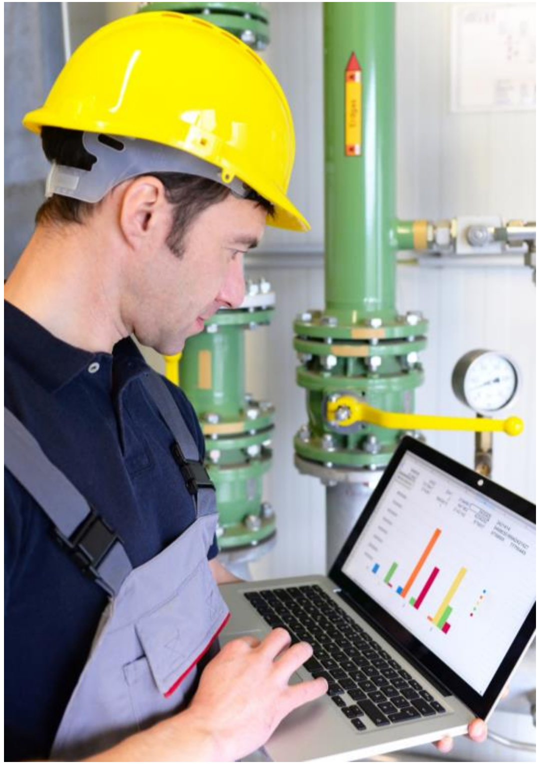
Sample template for project costing

Costs	Year 1			Description	Cost basis			
	Internal Costs	External Costs	Total Estimate		Quoted (Y/N)	Supplier Name	Estimated (Y/N)	Estimator
Hardware								
Utility Meters								
Driver Measurement								
Communications								
Installation								
Hardware Subtotal								
Software								
Software License								
Annual Maintenance								
Installation, Configuration, Training								
Software Subtotal								
Systems Integration								
Hardware								
Installation, Configuration, Training								
Software Support								
Systems Integration Subtotal								
Training								
Energy Management Champion								
Sponsor/Steering Group								
Improvement Teams								
Training Subtotal								
Project Support	-							
Project Management								
Management Support								
Project Support Subtotal								
Contingency								
Subtotal Cost								
Incentive or Grant Funding								
Net Cost								

Source: National Resources Canada, 2010: *Energy Management Information Systems. Planning and Manual*.

4. Cost assessment and sensitivity analysis

The following ballpark figures can be used for a first cost assessment



- The average cost to deploy a basic BEMS is EUR €20 to EUR €30 per m^2, equivalent to EUR €250,000 for a 10,000 m^2 building.
- Using the newest Internet-of-Things control and monitoring technologies can substantially decrease the traditional BEMS costs.
- The installation of a BEMS typically requires a systems integrator or in-house electrician and IT network professional.
- An energy engineering specialist is recommended to analyze the data - even in case of a fully automatic system - to maximize savings.
- For a typical 10,000 m^2 building, annual energy savings of EUR €50,000 to EUR €80,000 per year can be achieved.

Focusing on heating, ventilation, air-conditioning, lighting, and some types of electrical loads, it is reasonable to expect cost savings in the range of at least 5% to 10% when implementing a state-of-the-art BEMS.

Source: Boss: *What's the Cost of a Building Energy Management Solution?*.

4. Cost assessment and sensitivity analysis

Value proposition for the energy user

+

- **Cost effectiveness**
  Energy efficiency savings of about 5%-10% of utility bill, with payback time designed to be less than 5 years.
- **Reduced carbon emissions**
  Through efficiency measures that can be applied in all building types of all sizes.
- **Space utilization**
  BEMS can track space utilization to help employers make the right leasing decisions.
- **Productivity, engagement, and satisfaction**
  BEMS can be an effective tool to help increase employee satisfaction by creating comfortable workspaces.
- **Visibility of portfolio-wide operations**
  BEMSs offer simple dashboards to represent energy consumption across the building portfolio.
- **Supports ISO 50001 certification**
  ISO 50001 Energy Management System certification, provides a framework for best practice energy management.

−

- **Energy bill and energy savings are small compared to rent and payroll costs in commercial buildings**
  The energy bill is typically only 1:10 of the rent and 1:100 of the payroll costs per m^2 for a building. As a result, it is important to also try to include positive impact from a BEMS on the rent and payroll in the business case.
  These benefits could be more efficient space utilization to reduce the rent per employee or reduced payroll costs by lower staff turnover due to better comfort in the buildings.
- **Economies of scale**
  For smaller buildings, the energy savings could be relatively small. As a result, BEMS might need to be installed in multiple buildings to develop economies of scale to achieve a payback time of less than 5 years.

Source: Navigant.

4. Cost assessment and sensitivity analysis

Reference case: office building

Reference case

- Floor area: 1,676 m^2
- Annual energy bill: EUR €39,850
- Annual energy consumption: 497,772 kWh
- Energy prices:*
  - Gas: EUR €ct5.9/kWh
  - Electricity: EUR €ct21.9/kWh
- Opening hours: 5 days x 12 hours
- Geographical region: Europe
- CO_2 emissions: 149 tCO_2

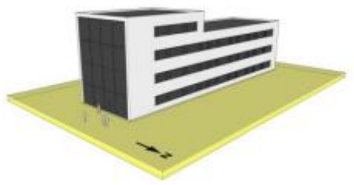
Investment costs & energy savings

- BEMS solution implemented:
  - Heating & cooling (e.g. individual room control);
  - Ventilation (e.g. room air control);
  - Lighting (e.g. occupancy and daylight control).
- Total investment: EUR €78,350
- Operational costs and maintenance: EUR €7,835
- Energy savings: 121 kWh/m^2
- Energy cost savings: EUR €18,560

Payback time and CO_2 savings

- Payback period: 7.3 years
- CO_2 savings: 67 tCO_2 (45%)

Reference Office building
Floor area: 1,676 m^2



View Northeast

Final energy consumption: 297 kWh/m^2a

Heating	Gas condensing boiler
Hot water	Instantaneous water heaters
Ventilation	Mechanical ventilation system without heat recovery
Cooling	Compression chiller
Lighting	Direct/indirect fluorescent tubes

Energy application	Energy savings
Heating	39%
Hot water	0%
Ventilation	61%
Cooling	78%
Lighting	48%
Total [%]	**41%**
Total [kWh/m^2a]	121

*EU28 energy cost average from 2017 to 2030 from EPBD impact assessment

Source: Ecofys, 2017: Optimising the energy use of technical building systems – unleash the power of the EPBD's Article 8; Ecofys: Office building – Case study.

4. Cost assessment and sensitivity analysis

Reference case: Supermarket building (without heat recovery)

Reference case

- Floor area: 1,025 m^2
- Annual energy bill: EUR €75,785
- Annual energy consumption: 916,350 kWh
- Energy prices:*
  - Gas: EUR €ct5.9/kWh
  - Electricity: EUR €ct21.9/kWh
- Opening hours: 7 days x 14 hours
- Geographical region: Europe
- CO_2 emissions: 275 tCO_2

Investment costs & energy savings

- BEMS solution implemented:
  - Heating & cooling (e.g. individual room control);
  - Ventilation (e.g. room air control);
  - Lighting (e.g. occupancy and daylight control).
- Total investment: EUR €35,360
- Operational costs and maintenance: EUR €3,536
- Energy savings: 437 kWh/m^2
- Energy cost savings: EUR €30,700

Payback time and CO_2 savings

- Payback period: 1.3 year
- CO_2 savings: 129 tCO_2 (47%)

Reference Supermarket building
Floor area: 1,025 m²

View Northeast

Final energy consumption: 181 kWh/m²a

Heating	Gas condensing boiler (heat recovery from refrigeration system)
Hot water	-
Ventilation	Mechanical ventilation system without heat recovery
Cooling	Central staged compression chiller for refrigeration and air conditioning
Lighting	Direct/indirect fluorescent tubes

Energy application	Energy savings
Heating	50%
Hot water	-
Ventilation	59%
Cooling	62%
Lighting	17%
Total [%]	**49%**
Total [kWh/m²a]	437

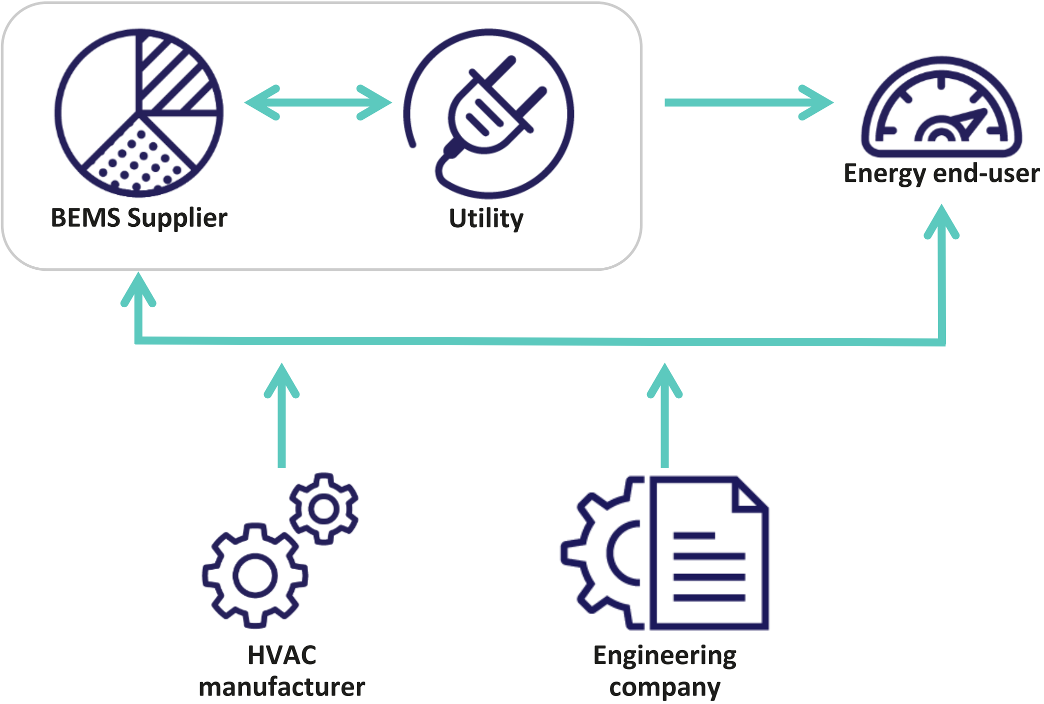
*EU28 energy cost average from 2017 to 2030 from EPBD impact assessment

Source: Ecofys, 2017: *Optimising the energy use of technical building systems – unleash the power of the EPBD's Article 8*; Ecofys: *Supermarket building (with heat recovery) – Case study*.

5. New partnership opportunities

Utilities and BEMS suppliers can partner so that utilities can provide energy savings with help of BEMS. This opens up opportunities for utilities to consolidate their position in the market for energy supply and energy services to energy end-users.

HVAC manufacturers and engineering companies can offer services to energy users, utilities and BEMS suppliers. This ensures that the energy users can be connected smoothly to the BEMS and that the system is designed appropriately.



6. Building energy management systems SWOT analysis

Strengths

- **Economically feasible option**, even for smaller sites when taking advantage of economies of scale.
- **Mature technology** and ongoing developments to collect data with lower costs via IoT.
- **Co-benefits**, such as better space utilization and employee satisfaction.
- **GHG emission reduction.**

Opportunities

- (Part of) the **hardware costs** for building energy management systems are often **subsidized** by the government.
- There is an opportunity for **partnerships between different suppliers** - each with their unique capabilities - to offer more BEMSs at a lower cost and with more functionality.
- **Further reduction in energy costs** could be achieved by using BEMS for demand response.

Weaknesses

- Building owners **lack awareness** on potential energy savings from a BEMS.
- Requires input from building users and attention from technical staff throughout its operational life to **maintain optimal settings** and maximum effectiveness.
- Staff are not aware of **what steps to take** for a successful introduction of a BEMS.

Threats

- Potential **landlord – tenant conflict**: the landlord may need to invest in a BEMS, but cost savings realized by the tenant.
- **Payback times might be perceived as too long** to justify upfront investment when design and costing is not carried out properly. Cost data for BEMS can be quickly outdated. Applying the newest BEMS technology substantially decreases the BEMS costs.

7. Success factors

Further roll out of new business models

New business models (e.g. energy service companies, software as a service)—which have been introduced to overcome financial barriers—need to be further rolled out. In some regions, there is limited familiarity with these business models.

Policies and regulation

Policies promoting energy management (e.g. ISO50001, including BEMS) and subsidies for installing a BEMS are important drivers to uptake. These already exist in many regions around the world. Also, a carbon price on energy could provide a price signal to incentivize building managers to reduce energy consumption.

Minimum building size for cost effective BEMS

For smaller buildings, the energy savings could be relatively small. As a result, BEMS needs to be applied to multiple smaller buildings to achieve sufficient economies of scale.

Cooperation between suppliers

Various types of suppliers can bring unique solutions to improve the business case for the BEMS. Partnerships between suppliers are key in the BEMS market for achieving higher uptake.

8. BEMS: Case studies (1/3)

Data center and office building

CLP (Hong Kong, China)	
Context	• CLP operates a data center and office with over 1000 people (Sham Shio Po Site). • Traditionally, facilities management had to rely on engineers being onsite to manage the HVAC system and other major facilities and BMS alone does not provide enough data to take preventive action.
Project description & objectives	• CLP Building Scope was deployed to prevent device and facilities faults through analytics from the current BMS. • Investment costs were USD $15,000 in the first year (2018). • Partners and partnership model: SaaS platform charge per data point. • Started in January 2018.
Main technical data	• CLP Building Scope scope is an AI building energy management system • Capacity: scalable cloud platform • Operational characteristics: hardware agnostic system that uses AI to tag all traditional BMS data and identify device faults. • The technology is launched and use is growing.
Benefits	• USD $21,000 in energy bill was saved in one year. • 45 days per year for manpower were saved as all issues are repaired before breakdowns occur and fault investigation value at USD $8,000. • 161,574KWh or 85.84 tCO_2 are saved annually.

Predictive faults

Provides early warning of faults through automated alerts and visibility of reoccurring faults.

BMS agnostic

Analytics platform that sits on top of any existing BMS.

Source: CLP SEC, 2019: About Building Scope.

8. BEMS: Case studies (2/3)

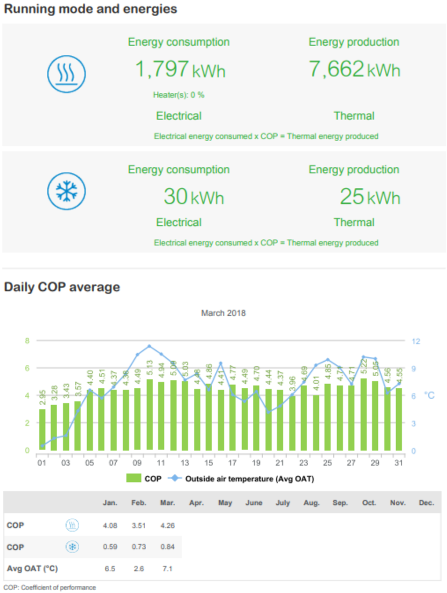
Childcare center

Child care center (France)	

Context	• Child Care Center in France that offers educational services.
	• Issues/challenges/targets that led to the project:
	  - Occupant complaints due to discomfort.
	  - Risk of non-compliance with childcare building regulations.
	  - Concern with undersized heat pump used for heating and cooling.
	  - No data to identify issues and confirm assumptions.

Project description & objectives	• Schneider EcoStruxure Facility Facility Advisor Energy was deployed with the following objective:
	  • Monitor and accurately assess the building's energy performance.
	  • Monitor heat pump performance and status.

Benefits	• EUR €40,000 was saved over a two-year period. • Right level of comfort achieved, eliminating occupant complaints. • 33 percent potential energy savings identified. • Heat pump energy consumption reduced 40 percent; life expectancy extended. • Better management of air handling unit.



Source: Schneider Electric, 2018: [From smart services to building excellence](#).

8. BEMS: Case studies (3/3)

Automobile distribution center

Volkswagen (Wolfsburg, Germany)	
Context	• Autostadt GmbH – a fully-owned subsidiary of the Volkswagen Group – is a visitor and automobile distribution center. • It operates a site with 20 buildings.

Project description & objectives	• Honeywell Enterprise Buildings Integrator (EBI) was deployed with the following objectives:
	  ◦ Increase energy efficiency and reduce carbon footprint.
	  ◦ Reduce the system's running time and minimizing energy costs.
	  ◦ Integrate thermal and electrical energy.
	  ◦ Minimize risks to guarantee availability during the entire system lifecycle and optimal building functions at all times.
	• EBI connects 37,000 data points out of which approximately 23,000 are hardware points at field level.
	• Partnership between Volkswagen and Honeywell goes back to 1998.

Benefits	• Energy savings of 41% per year and CO_2 emission reductions of 460 tCO_2 annually. • Lower system running time and reduced energy costs. • Successful integration of thermal and electrical energy. • Optimized building functions and enhanced availability during the entire system lifecycle.

Source: Honeywell: *The Autostadt driving energy efficiency at Volkswagen Group's HQs*; Henn: *Autostadt*.

9. Summary

Emissions and energy	• Direct and indirect CO_2 emissions from buildings account for 28% of energy-related CO_2 emissions. • CO_2 emissions from buildings are expected to increase by 10% by 2050 according to the IEA.
Solution	• Building energy management systems (BEMS) are an information technology-based solution that uses sensing, control and automation hardware to deliver automated and manual improvements to system operations and energy efficiency in buildings. • There are four types of BEMS functionalities: visualization and reporting, fault detection and diagnostics, predictive maintenance and continuous improvement, and optimization. • The total energy savings from improved controls in residential and commercial buildings could be as much as 10% between 2017 and 2040 compared with a business-as-usual scenario.
Avoided GHG emissions and co-benefits	• BEMS can help avoid direct GHG emissions e.g. from natural gas heating, and it can also lower indirect emissions by reducing electricity consumption. The direct GHG emissions avoided depends on the fossil energy source substituted and the indirect emissions avoided depends on the country's specific electricity grid emission factor. • Better space use or increased employee productivity, engagement and satisfaction are additional benefits.
Readiness status	• The basic BEMS functionality (visualization and reporting) is very mature and the emergence of the Internet of Things (IoT) has made more BEMS functionalities available to a growing number of customers.
Barriers	• Potential landlord-tenant conflict where the landlord might need to make the investment, but the tenant realizes the BEMS cost savings. • Lack of awareness of the potential energy savings from a BEMS.
Success factors	• Policies that promote energy management and subsidize BEMS installations. • New business models (such as energy service companies, software as a service). • Cost-effectiveness via a minimum building size or a combination of multiple smaller buildings.

10. Key sources and references on BEMS

- ABB: Manufacturing Operations Management - Energy Monitor App - a web-based energy management solution
- Boss: What’s the Cost of a Building Energy Management Solution?
- CLP SEC, 2019: About Building Scope
- Ecofys, 2017: Optimising the energy use of technical building systems – unleashing the power of the EPBD’s Article 8
- Ecofys: Office building – Case study
- Ecofys: Supermarket building (with heat recovery) – Case study
- Energy Performance of Buildings directive (EPBD), 2010 (recast)
- Henn: Autostadt
- Honeywell: The Autostadt driving energy efficiency at Volkswagen Group’s Hqs
- IEA, 2017: Energy Technology Perspectives 2017
- IEA, 2017: Digitalization & Energy
- EPA, 2018: Emission Factors for Greenhouse Gas Inventories
- National Resources Canada, 2010: Energy Management Information Systems. Planning and Manual
- Navigant Research, 2015: Next-Generation Building Energy Management Systems
- Navigant Research, 2016: Building Energy Management Systems
- Schneider Electric, 2018: From smart services to building excellence
- UNEP & IEA, 2017: Towards a zero-emission, efficient, and resilient buildings and construction sector. Global status Report 2017
- WBCSD, 2018: New energy solutions for 1.5 C°. Pathways and technologies to achieve the Paris Agreement

WBCSD (Delhi)
WBCSD India, 4th Floor,
Worldmark 2,
Aerocity New Delhi 110 037
India

WBCSD (Geneva)
Maison de la Paix l Chemin
Eugène-Rigot 2B
CP 2075 1211 Geneva 1
Switzerland

WBCSD (London)
WeWork Mansion House
33 Queen Street
London EC4R 1BR
UK

WBCSD (New York)
747 Third Avenue
Suite M205, New York
NY 10017, United States
USA

WBCSD (Singapore)
WBCSD Asia Pacific
2 Science Park Drive
#01-03 Ascent
Singapore 118222
Singapore