Energy Consumption in Office Buildings:

a Comparative Study

SKANSKA

CUSHMAN & WAKEFIELD

GO4ENERGY

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> We shape our buildings and afterwards our buildings shape us.

Winston Churchill

Arkadiusz Rudzki
Managing Director, Skanska Property Poland

Our office buildings are the product of the input of experts in many fields. This multidimensional approach to office development ensures the comfort and well-being of the people working in them, and creates business space that enhances the character and needs of the surrounding community. Most of all, we aim to improve the environment of which our buildings are part by making energy-efficiency a core part of the design and construction process. A green building, constructed in accordance with these principles, is also a quality investment, because it will maintain its value over the long term.

Zuzanna Paciorkiewicz, MRICS
Partner, Business Space Asset Services Poland, EMEA Asset Services, Cushman & Wakefield

Office buildings are becoming more complex in their structure and technological framework. Their development and operation requires an integrated, holistic approach based on accurate data collection. Managing these buildings efficiently means focusing on operational energy performance. But energy efficiency is not an end in itself. The key role of the property manager is to reduce the building's energy consumption without sacrificing the comfort enjoyed by its users.

Tomasz Augustyniak, MRICS, CCIM
Partner, CEO, GO4ENERGY

The core of the building performance quality assessment is a detailed analysis of the energy consumption and operation of every system within a building. Using this, a comprehensive energy management plan tailored to a building's specification and users' requirements is then prepared. GreenFM activities are valuable complements to these processes by ensuring that systems' operations are monitored, verifying the proper functioning of the installed systems, and identifying opportunities to reduce service charges by lowering costs.

1. Introduction

Massive investment over the past several years has transformed Polish cities into modern European metropolises. Innovative architecture, modernised road infrastructure and improved retail, food, cultural and leisure offer have helped to make the cities attractive places to live, work and play.

Strategies for planning and shaping urban environments are changing as lifestyles, consumer habits and work patterns evolve alongside advances in digital technology and the changing needs of local communities and users.

Building design now incorporates sustainable features to create friendly public spaces and green areas with easy access to local amenities and workplaces.

With their growing functional and structural complexity, office buildings now play an increasingly important role in shaping the fabric of the urban environment. Modern construction methods and materials, as well as technological advances, have enabled developers to vary the internal structure of buildings and adapt them to serve various functions. Contemporary office schemes offer space that can be used as halls, receptions, atria, server rooms, machinery spaces, garages, offices, conference rooms, restaurants, shops and services units. Each structural component may require a separate technical system to guarantee an optimum level of comfort and safety. Therefore, to ensure that all these elements form an integral, functioning whole, managers and developers should install advanced automation and control systems – BMS (Building Management Systems). In some cases a framework for managing energy consumption, the Building Energy Management System (BEMS), can supplement the BMS. Together, these two systems work in harmony to achieve the most comfortable internal environment for users, and to optimise energy consumption.

Today, office building design and development employs the Performance-Based Building concept, which assesses the level of comfort enjoyed by a building's users in order to verify the quality of its architectural and structural features. Developers need to offer attractive design, advanced spatial solutions and a variety of construction materials to provide the user with an optimal working environment. This process also involves the installation of top-quality heating, ventilation and air-conditioning systems (HVAC), lighting systems, hot water production systems, and integrated automatic control systems.

The key strategy is thus not only investing in cost-savings activities but controlling the equilibrium between economic factor and people's well-being by optimizing operations such as lighting, ventilation and air conditioning. Engineers responsible for the design and installation of building systems must balance capital costs, energy costs and operational costs with users' constantly rising comfort expectations. All this requires harmonizing the complex interactions of investors, architects, installation engineers, property managers and tenants.

Because commercial property – its development and operation – accounts for 40% of Europe's energy consumption, the rational use of energy is becoming increasingly important.

“The construction industry generates about 9% of European GDP and accounts for 18 million direct jobs. Construction activities that include renovation work and energy retrofits add almost twice as much value as the construction of new buildings, and SMEs contribute more than 70% of the value added in the EU building sector”.

Proposal for a Directive of the European Parliament and of the Council amending Directive 2010/31/EU on the energy performance of buildings, Brussels, 30.11.2016

Around 75% of Europe’s buildings are not energy efficient. Therefore, increasing the quality and energy efficiency of refurbishments offers a huge energy-saving and cost-saving opportunity.

Energy Performance of Building Directive 2010/31/UE requires the determination of a building’s energy performance at the design stage, and the display of its energy performance indicators and its energy performance certificate at the operational stage.

In Poland a great deal of effort, from legal point of view, is placed on the rationalization of a building’s energy consumption, especially at the design stage. A negative consequence of such a one-dimensional analysis, one that looks only at energy use, may be that one goal (energy reduction) is attainted at the cost of the other (user comfort). Therefore, it becomes necessary to transform building assessment into a multi-criteria analysis. Of these criteria, the most important is the assessment of a building for compliance with sustainability principles.

Such certification assumes that buildings will have both optimal indoor air quality and lower environmental impact. In order to compare them in terms of fulfilling these criteria, a number of certification schemes have been created. In Poland the most widely used schemes are the LEED™ and BREEAM® systems, which are also the most popular with investors because they can confirm the quality of a building at each stage of the design, construction and operation stages (eg LEED BD+C, BREEAM International NC). The assessment schemes dedicated to tenants (eg LEED ID+C, BREEAM RFO) are a gainful complement to them. In case of existing buildings, which are managed to a higher standard, the certificates confirming high quality management (eg LEED O+M, BREEAM In-Use) seem to be the most valuable.

2. Guiding Principles

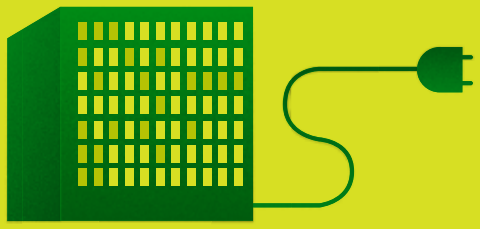
- Solutions aimed at increasing energy efficiency in office buildings should ensure the highest possible indoor air quality while maintaining the most cost-effective energy consumption levels.
- Sustainable development principles should balance energy costs with the comfort and health of the user.
- Only close collaboration among all stakeholders involved in a building's life cycle from the design stage – investor, tenant, architect, engineer, monitoring firm and property manager – will guarantee an energy-efficient building.
- LEED and BREEAM certificates are effective tools for assessing the sustainability of a building during its design, construction and operational stages.

3. Aims and Objectives of the Study

The study was conducted from 1 June to 17 October 2016, based on energy consumption data from 2015, by the project partners comprising, Skanska Property Poland, Cushman & Wakefield and Go4Energy. The objective of the study was to assess electricity and heat usage in office buildings in Poland.

Assessment criteria

- energy consumption by a given user depending on technological processes;
- comparison of the energy consumption of different tenants in different buildings;
- estimation of energy savings achieved by buildings holding a green certificate;
- comparison of the energy usage of buildings in operation to their predicted energy usage and energy performance;
- estimation of energy savings in recently completed buildings;
- evaluation of the efficacy of activities undertaken by the investor (project) and the property manager (operation) aimed at optimising energy usage; and
- assessment of the building's durability in terms of its energy performance.



Summary of the buildings

The study covered 20 office buildings. The surveyed facilities were selected based on data provided by the project partners and technical capabilities of the developed methodology.

All buildings are located within large cities:

- Gdańsk – 1 building,
- Kraków – 1 building,
- Łódź – 2 buildings,
- Poznań – 1 building,
- Warsaw – 12 buildings,
- Wrocław – 3 buildings.

Some of the analysed facilities hold sustainable development building certicates:

- 8 buildings – LEED CS certificate; including 2 with at the Gold level, 6 at the Platinum level,
- 8 buildings – BREEAM certificate; including 5 certificates for buildings in operation (BREAM In Use), 3 BREAM NC, of which 2 at the Very Good level and 1 at the Excellent level.

The buildings are located in Poland's different climate zones – they were thus designed according to different calculation parameters both for summer and winter period.

4. Methodology and Methods of Data Compilation

This study uses an innovative approach to the analysis of the energy consumption of office buildings. It is the first study in Europe to utilise elements of traditional data compilation, such as surveys and interviews, and statistical analysis, such as data comparison with performance indicators, and has yielded detailed, accurate conclusions. Its innovative elements comprise:

The pilot application of the Delphi method

This involves presenting the results of the analysis to an external group of experts with specific knowledge and experience in the selected data set.

A comparative analysis of the energy model of the building

The operating reference model and the measurements recorded in the Building Management System (BMS).

Preparation of the GreenFM reports on the individual buildings

These ensure that the energy data for each building is reliable by ranking the energy consumption of the building alongside its expected consumption. They also consider how the building is used, how much energy it uses based on monthly analyses, and suggest actions for the technical department to take, such as refurbishments, or system upgrade or replacement.

The methodology is a practical implementation of the objectives presented on 30.11.2016 in the proposal of changes to Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings. The approach specified in this directive allows member states to introduce systems that monitor and analyse energy consumption continually, and to perform ongoing comparative analyses of the energy performance of a building.

It is the first study which uses the method of analysis of the building energy performance that separates the energy profile of the tenants/users from the profile of the building.

5. Survey-Based Comparative Analysis

The first stage of the research included the acquisition of data, by means of a survey, on the buildings and their construction, embedded systems, technical equipment, heating, cooling and electricity sources.

The buildings' electricity and heat performance was compared in terms of a building's age, area (floorspace and ceiling height), proportion of space leased to total space, number of persons using the leased areas, thermal insulation of windows, thermal insulation of external walls, parameters of the glass used in external windows and embedded systems.

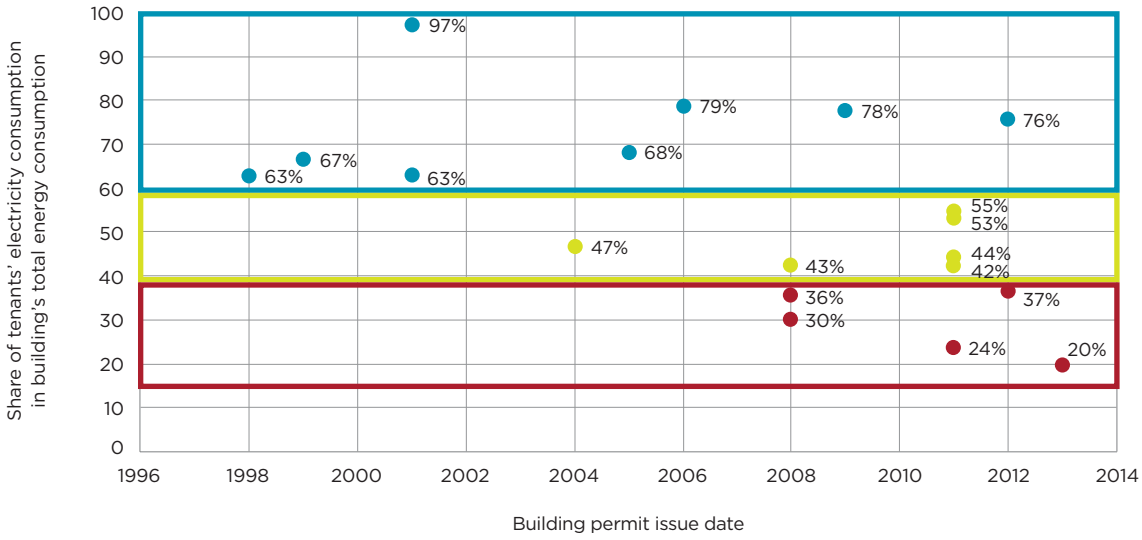
The analysis revealed:

- the correlation between the age of the buildings and the parameters of the building envelopes – the heat transfer coefficients for the external walls and windows and the g-coefficient for the windows;
- in all cases except one, the amount of heat recovery in the ventilation systems;
- a reduction of the electricity consumption of newer buildings, and differences in energy consumption of buildings based on the energy habits of each building's tenants.

Tenants' Share of Electricity Consumption in a Building's Total Energy Balance

The analysis compared the electricity consumption of the tenants of a building to the total electricity consumption of the building. The average was 55%, and the extremes were 20% and 97%.

Tenants' share of a building's total electricity consumption

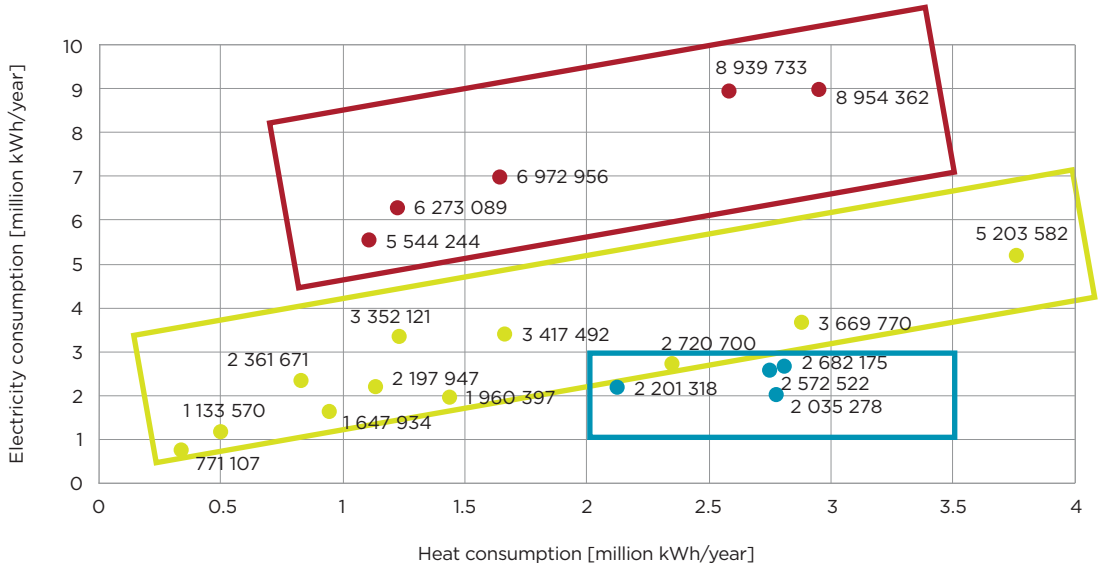


The analysis revealed the amount of electricity consumed by the tenants, and how this amount affected the energy balance of the building and the operation of HVAC systems.

Energy Performance of the Building – Electricity v. Heating

The next step was to rank the buildings in terms of their energy performance by comparing two basic energy parameters – heat consumption and electricity consumption.

Electricity Consumption v. Heat Consumption



buildings with high electricity consumption relative to their heating consumption

buildings in which the amount of electricity and heating consumption is roughly equal

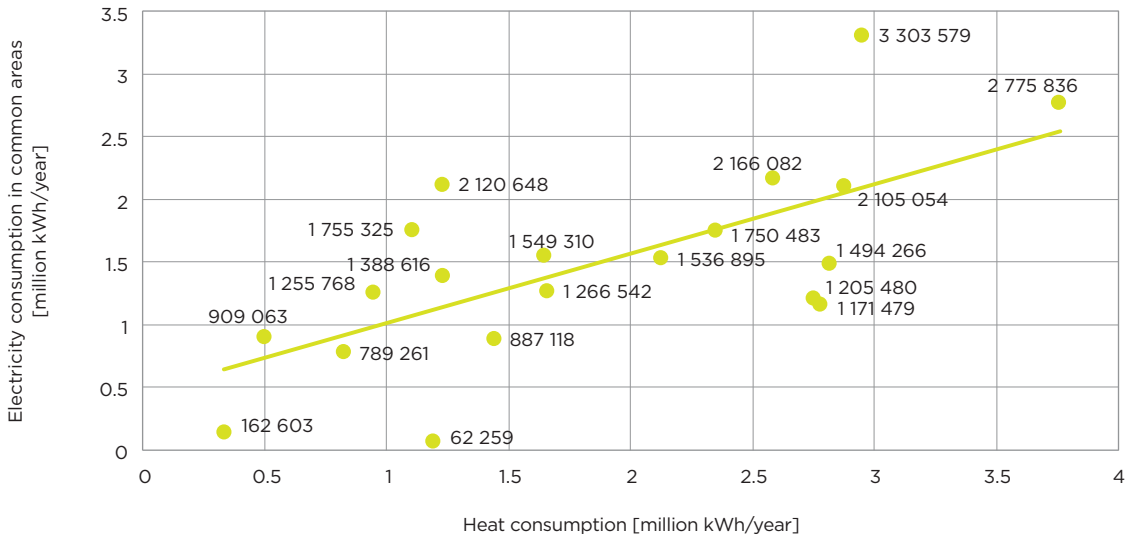
buildings with low electricity consumption relative to their heating consumption

Taking into consideration the energy performance of the building and the amount of energy used by its tenants, the study excluded the electricity consumption by the tenants in its analysis.

Excluding the energy used by a building's tenants allowed for a more detailed determination of a building's energy performance, and yielded a correlation between heat and (non-process) electricity consumption, highlighting the impact of tenants' energy consumption habits on the building's total energy performance.

Because compliance with the principles of sustainable development define much of the construction industry's activity, the analysis looked at a building's key energy indicators in the context of its sustainable development certificate (or green certificate).

Electricity consumption in common areas v. heat consumption



Comparison of Certified and Non-certified Buildings

The average total electricity consumption of certified buildings was 142 kWh/m^2. This is only marginally below the consumption of uncertified buildings, 144 kWh/m^2.

The average electricity consumption, around 160 kWh/m^2, was comparable to the results of analyses presented in a 2014 report entitled "Operational Costs of Office Buildings", covering 48 properties, prepared by the Construction Marketing Group together with partners.

Comparing electricity consumption to a building's total area, the study found little correlation between a building's certificate type and degree, and its electricity consumption.

The study did, however, find that heating consumption in certified buildings was 26% lower than the consumption in uncertified buildings.

The User's/Tenant's Role

This part of the study describes the effect of tenants' energy use habits on the total energy balance of buildings.

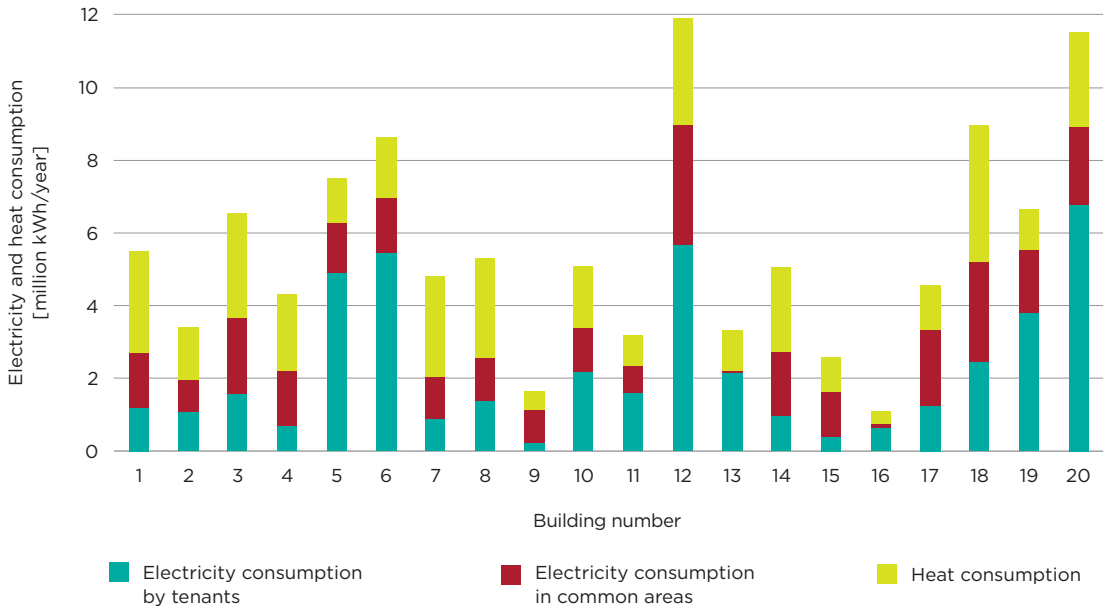
In the first step, the study analysed tenants' electricity consumption in relation to their leased area, in the context of the building's energy certificate.

The analysis found that in certified buildings, tenants' average electricity consumption per square meter of leased area was 150 kWh/m^2, a figure only marginally less than the energy consumption of non-certified buildings of 159 kWh/m^2.

It is thus difficult to see a correlation between the certificate, its degree and the amount of energy consumption. Moreover, some buildings with the highest certification degrees (BREEAM Excellent and LEED Platinum) had the highest indicators in the group. Therefore, the study concluded that:

- electricity consumption in certified and non-certified buildings was similar;
- because of the small sample size, it was not possible to find a correlation between a building's electricity consumption and its type and level of certificate.

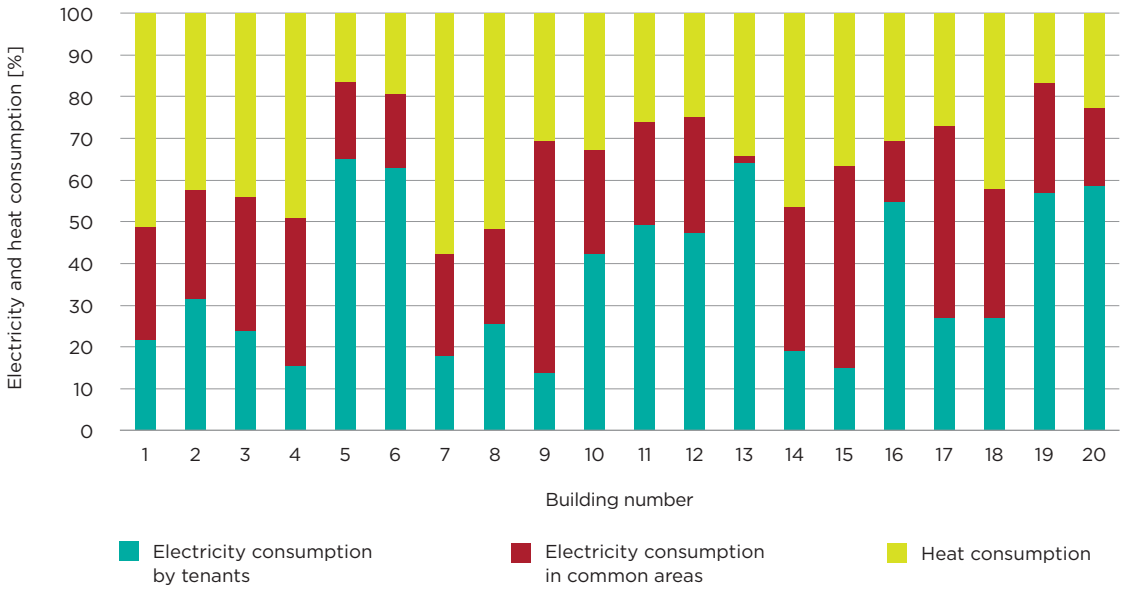
Distribution of electricity and heat consumption



The detailed analysis of electricity consumption by the tenants (blue), the electricity consumption by the other components of the building (red) and the heat consumption (green-yellow) showed that these three factors varied considerably among all the buildings analysed in the study. The following section looks at each of these factors and its effect on a building's total energy consumption.

The share of energy consumed by tenants showed a wide variation, 14% to 65%. A wide variation was also seen in the percentage of a building's total energy consumption that is consumed by the building's users. It was therefore necessary to develop a more complex method of analysis that separates the energy profile of the tenants from the profile of the building; that is, one that separates the consumption issues connected to tenants' energy consumption from consumption issues connected to the building's investor/owner and for which the investor/owner is responsible. An energy model of the building was used.

Distribution of electricity and heating consumption – percentages

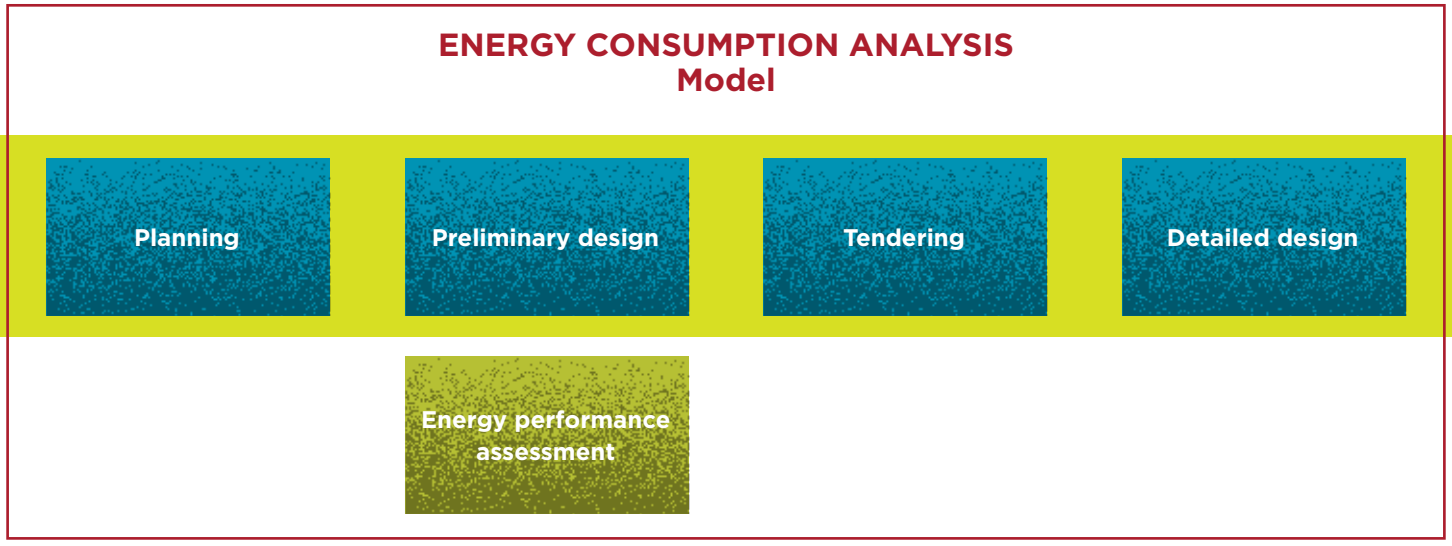


6. Comparative Analysis Based on the Energy Model of the Building

The energy model for each building was calculated from energy data supplied by the respondents – property managers and technical departments – of that building. A reference model based on current minimum legal requirements and taking into account basic design and functionality was also developed for every building. Then the energy consumption relative to the reference model for the building was calculated.

This methodology served to minimise differences connected to the buildings' different energy operations, which depend mostly on the users, and allowed the determination of energy savings.

Energy modelling at a design stage is a standard procedure. It can be performed using a simplified method (eg calculations for energy performance assessment) or a more complex one (eg calculations for energy models for LEED and BREEAM).



Modelling Methodology for Energy Consumption Based on Comparative Analysis

Reference building

Existing building

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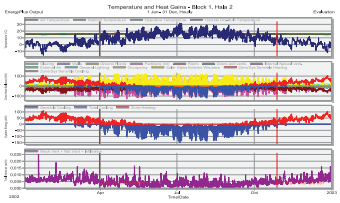
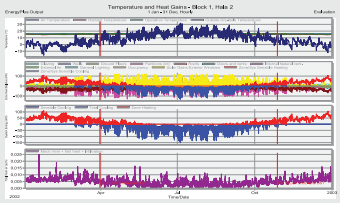
Examples of savings





23% Energy consumption (invoices, BMS)

14% Primary energy

The proces of commissioning allows for adjusting energy models parameters to the actual level of energy consumption at building's early operational stage.

The study uses an innovative concept of the analysis of the distribution of energy consumption at an operational stage based on energy modelling.

ENERGY CONSUMPTION ANALYSIS
Model v. Building's Actual Energy Consumption

ENERGY CONSUMPTION ANALYSIS
Model

Construction

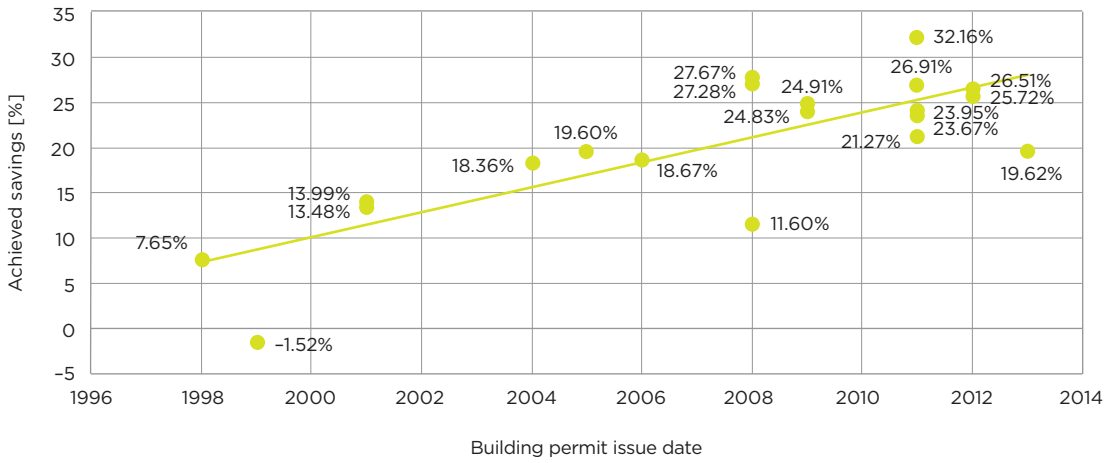
Handover

Operation

Energy performance certificate

The analysis enabled a more thorough assessment of actual energy performance of office buildings.

Energy savings of buildings



The first part of the analysis included the age of the building as a factor of the observed energy savings.

A comparison of the results of the building's energy model and its reference model showed the correlation between the savings resulting from the installation of various materials and the age of the building.

The greatest amount of energy savings, 32%, was seen for buildings constructed within the past six years. The results illustrate the importance of energy-efficient design and materials, and top-quality construction methods.

These savings also showed the cost savings potential of newer buildings, which have energy and heating costs that are more than 30% less than buildings built to the minimum legal requirements. These costs can translate to annual cost savings of as much as PLN 500,000 for a large-scale green building in relation to a low-efficiency building.

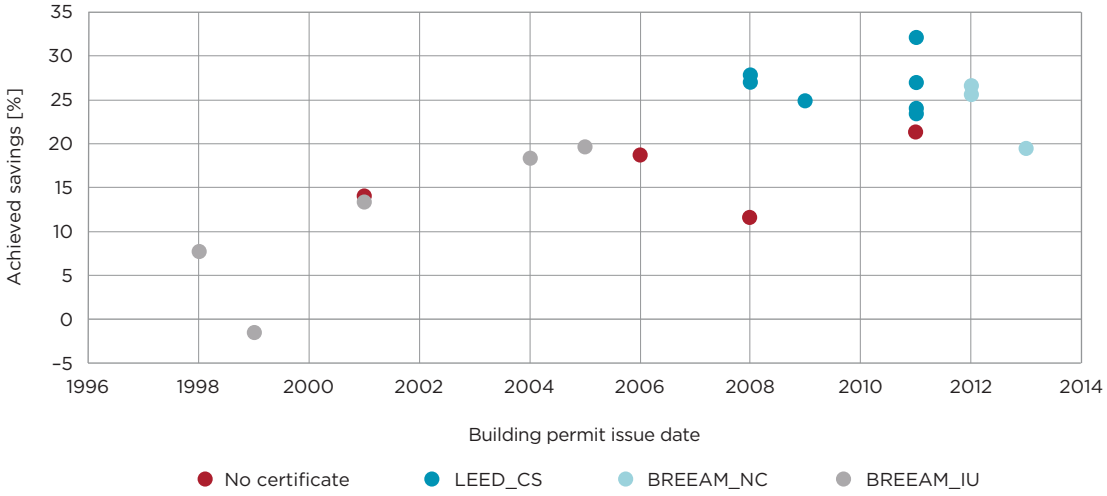
In case of older buildings included in the study – one was 18 years old – this savings potential was smaller but the results still showed the cost savings that are possible when a building's real energy performance exceeds the minimum energy requirements.

The next step was to analyse the obtained savings with regard to the age of the building and the green certificate of the building.

An analysis of the building's energy cost savings in the context of the age of the building and its certificate demonstrated that:

- differences between the energy savings of the buildings were so small that it was difficult to determine how the certificate type and/or certificate degree affected the energy savings of the building;
- buildings with "full" certificates, which denote the top level of energy-efficient design, materials and construction, produced a higher average cost savings, 26%, than the average of 20% for the other certificate types included in the survey (BREEAM NC, LEED CS);
- buildings with "In Use" certificates (BREEAM In Use) offered superior cost savings through energy efficiency, with one exception, compared with buildings of the same age. This may be the effect of the requirements for the certificate, which are intended to ensure the energy-efficient management of the building. However, the differences were so small that it was difficult to show this relationship clearly;
- buildings without a certificate offered lower cost savings relative to certified buildings, but they still showed a modest amount of cost savings, demonstrating to their owners that these buildings were aging to a manageable extent in terms of energy consumption;

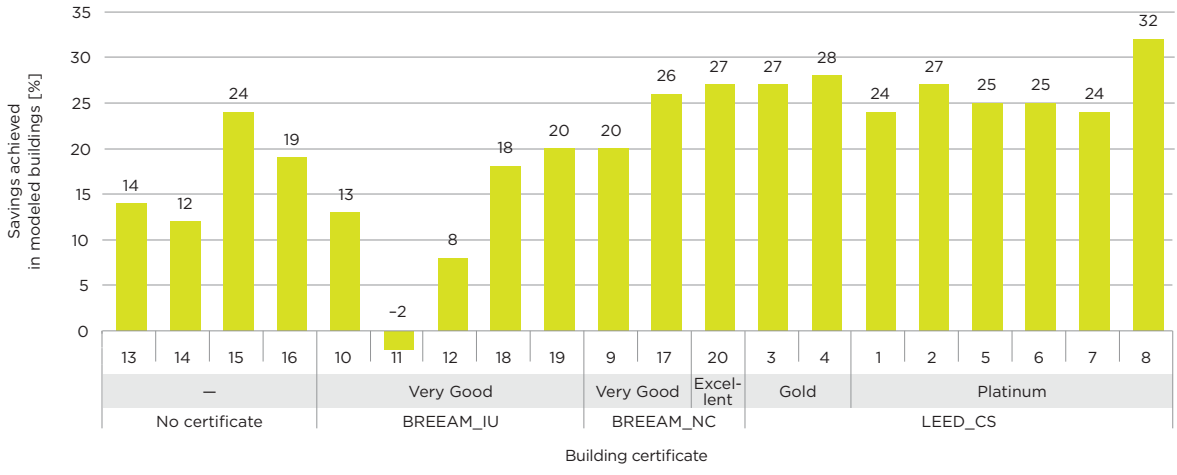
Energy cost savings for buildings as a function of their certificate and age



An analysis of the building's energy cost savings in the context of its certificate demonstrated that:

- the level of certification does not impact significantly the achieved savings. In the case of buildings with a BREEAM NC, the building certified at the Excellent level showed a greater degree of energy cost savings than buildings certified at the Very Good level. However, the differences were so small that it was not possible to determine certificate level as their cause. In the case of buildings certified with the LEED CS system, the superiority of the buildings with a Platinum certification degree over the buildings with a Gold certificate was not observed.
- differences between the buildings in terms of sustainability were influenced by the construction materials and components of each building, which may mean that buildings that perform better in the multi-criteria assessment do not always achieve better results in an energy context.

Energy cost savings relative to a building's certificate

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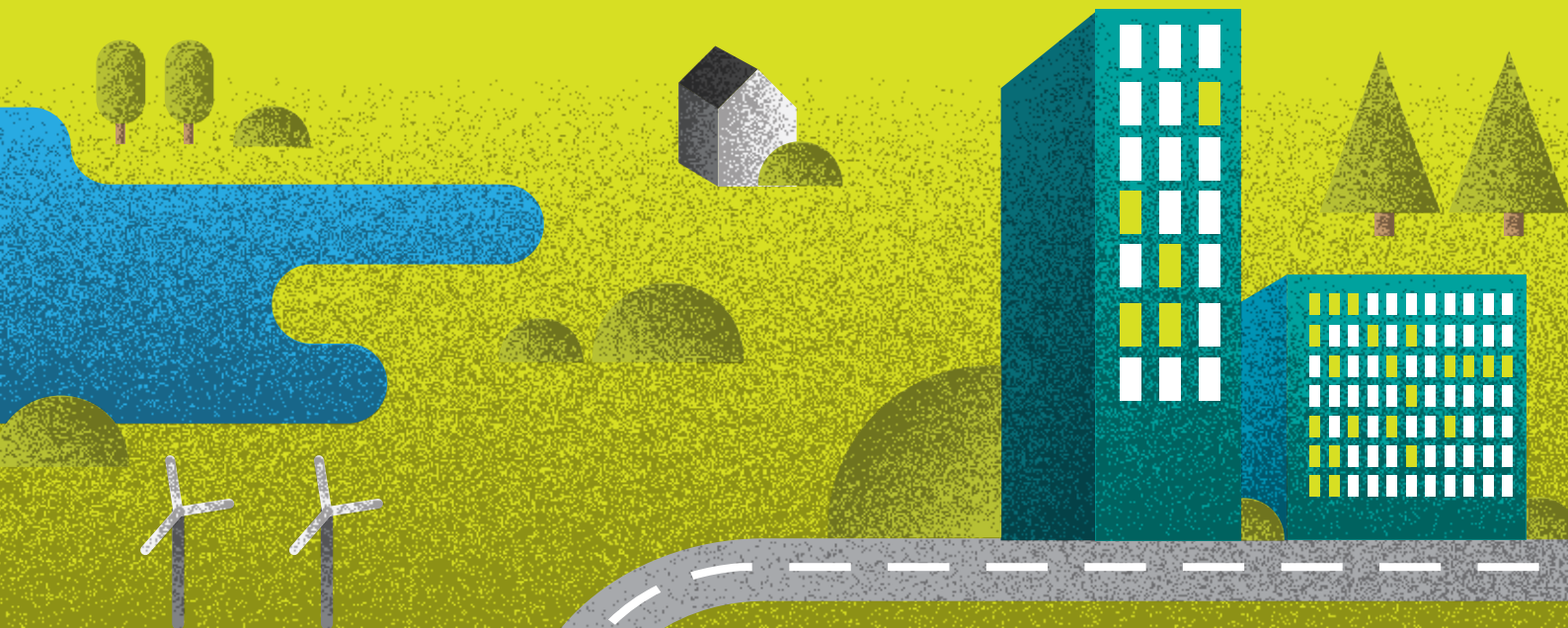
7. Key Findings

- The investor has a significant effect on the energy performance of a building. Developing a building according to the specifications of certification systems may yield operational energy savings of 30% or more. This could equate to operational cost savings of PLN 500 000 annually.

- Buildings certified at an operation stage have limited energy savings potential owing to the existing building structure. However, they can improve their energy efficiency performance and reduce their energy costs through careful management of their technical infrastructure.

- Buildings constructed to full certification standards have greater potential for energy savings because energy-efficient processes are applied from the beginning of the development.



- Complementing property management activities with the ongoing GreenFM processes means that up-to-date, sustainability-oriented property management techniques are in operation, construction and systems are verified as energy efficient and cost savings are obtainable. GreenFM service also provides a useful database for comparison and analysis.

- Tenants' energy use habits have a critical impact on a building's energy consumption. Tenants were found to be responsible for 14% to 65% of a building's total electricity consumption.

- This analysis is the first of many. Its conclusions will form the basis of more analyses conducted using its methodology, to create a dynamic, up-to-date comprehensive picture of the energy efficiency of Polish office buildings. These analyses will be co-ordinated under the auspices of the National Association for Supporting the Sustainable Building Industry (OSWBZ).

8. Commentary

SKANSKA

At Skanska, we learn from our experience gained in Poland and the experience of our teams based in countries across the world. We are an organization that is always learning as we design offices that help to create a better society and are timeless and innovative. In our everyday work we focus on the added value that our office buildings generate on behalf of our business partners. We keep in touch with our counterparties and listen to their needs. We analyze all errors to make sure they are never repeated. This feedback allows us to create buildings that are constantly improving from both a comfort and an efficiency standpoint. In addition, Skanska's unique collaborative approach involving investors and construction specialists allows us to utilize knowledge gained from previous projects.

During our more than 20 years developing high-specification office buildings, Skanska has been gathering data on how our buildings perform. Our balanced approach to design, construction and user comfort guides us in our quest to enhance the value of our products.

Over the years, we have noted the key role of real estate managers and technical service specialists in the process of designing high-value, reliable office investments. Our analysis of their daily work and observations allows us to select ever-better technical solutions in our designs.

In order to test the efficacy of our designs and their functionality, it is necessary to compare the operation of our buildings with other office buildings in Poland. But we found that no comparative analyses of this type existed.

In response, Skanska and our partners, Go4Energy and Cushman & Wakefield, have put together a comparative analysis covering a number of buildings in the Polish office market, looking at them in terms of their features, age and environmental specification. As a leader in sustainable, LEED-certified developments, we use this tool to study the parameters applied to the certification process. But we never compromise on comfort for users of our certified buildings.

This report compares buildings' energy consumption level to the level assumed at the building's design stage and to the levels associated with the certification process. These levels can be determined through cooperation between the owner and manager but, as our report shows, tenant activity also has a key role in setting energy consumption levels. Until now, this activity has not been taken into account in the design of energy consumption models. Data presented in our report will demonstrate the potential of cooperation between management, owners and tenants, and will enhance the work of our design teams.

Our report will enable Skanska to create a new generation of modern office buildings that fit into the smart city concept. Our designs harness the vast experience and knowledge of Skanska's teams and our business partners. We want to share this knowledge with you.

Arkadiusz Rudzki
Managing Director, Skanska Property Poland


ABB

As one of the world's leading commercial property managers, Cushman & Wakefield is committed to introducing and implementing sustainable development initiatives for office buildings. We took part in this study to gain in-depth insight into the mechanisms that affect energy performance in different buildings and the steps property managers can take to make buildings more energy efficient and reduce their running costs. The analysis covered 20 buildings in Poland, including office buildings managed by our company.

Using a novel energy-use model and a unique approach to assessing energy issues in office buildings, we have proved that the end user, the tenant – not the attributes of the building itself – is the most important factor determining a building's energy performance. The model is also an effective tool for monitoring energy consumption in different buildings, regardless of their user type. Until now, building energy-use benchmarks did not yield accurate results, because they did not separate the energy used by a building's tenants from the building's total energy use. The report provided us with data that will help develop methods to optimise energy consumption. What is more, the EU is likely soon to require the collection and processing of buildings' energy-use data.

By using facility management techniques, we are now able to identify areas where energy consumption is excessive or energy is used inefficiently, and adjust the relevant parameters appropriately. A standard procedure implemented by Cushman & Wakefield involves monitoring all electricity and heat energy consumption and comparing the results to historical data. We also educate our tenants on energy efficiency and encourage them to alter their energy consumption habits.

As a manager of more than 30 office buildings in Poland, Cushman & Wakefield keeps an eye on the energy-consuming systems – electricity and heating – in each building and recommends upgrades and improvements to the owners. As we monitor systems for signs of wear and tear, and keep abreast of new products and technological advances in energy use, we have found that many office buildings in Poland are in urgent need of system replacement or upgrades – modernisation. This applies in particular to HVAC systems, which consume significant amounts of electricity. A replacement or upgrade boosts the energy efficiency of the system and improves the energy balance of the building. Even the best system management and maintenance merely postpones the need for modernisation; it is no substitute for it. We want to demonstrate that modernisation makes it possible to achieve real savings while maintaining the same level of comfort.

Our analysis is a pioneering study and will facilitate the development of better energy management systems for buildings, as well as refine the use and management of existing systems. We intend to expand these analyses to a larger sample of Polish office buildings, using the same methodology, to create an even more accurate picture of the energy profile of this market. This will be a useful tool for owners, developers and managers who, through implementation of proper property and facility management activities, are aiming for energy efficient buildings and reduced costs.

Zuzanna Paciorkiewicz MRICS
Partner, Business Space Asset Services Poland
EMEA Asset Services, Cushman & Wakefield

Energy performance certificates and energy efficiency for buildings are becoming mainstream property issues. The process of making buildings more energy efficient must, however, have as their ultimate goal the health and comfort of their occupants. It is therefore important to provide the developer, as early as the design stage, with energy modelling and advice on sustainable construction materials and efficiency-enhancing systems.

Our experience shows that complementing these activities with the Commissioning Plan, a process that ensures building systems perform as intended and to the owner's operational requirements, will allow the developer to optimise energy efficiency at the design and construction stages. This is particularly useful for certifying the building according to its energy efficiency. LEED and BREEAM implementation processes we are running at the design stage allow us to introduce technical and energy rationalisation measures to improve efficiency.

Energy performance during the first two years of operation is crucial for determining long-term energy performance. The Commissioning Plan is invaluable at this stage because it enables not only the detection of any operational irregularities, but also suggests adjustments to the design to ensure optimum energy-efficiency performance.

Achieving good results depends on close co-operation between the owner, the manager and the user. The platform for such cooperation is provided by GreenFM certification processes, which require accurate monitoring of the key factors affecting the energy consumption of the building and verification of the collected data. These enable owner, manager and user to optimise energy performance and lower costs by reducing consumption.

Our approach to property management has been reflected in upcoming EU directives to be adopted also in Poland. Implementing the energy performance assessment systems at the operational stage (LEED O+M and BREEAM In-Use) enables managers to assess and adjust the operation of a building to reduce its operating cost and avoid technical failures, and to minimise any negative environmental impact. Improving energy efficiency, along with providing a healthy, friendly and comfortable indoor environment – the main objective of our company's activities – has now become the subject of building evaluation systems represented by the WELL systems and the Polish Green Building Standard.

Because we consider these processes, which are shaping the global built environment, to be of urgent importance, we, together with the leaders of Poland's real estate industry, are playing a key role in an analysis the country's office buildings. The analyses carried out so far indicate that tenants' activities are key to achieving an energy-efficient workplace with lower energy costs. Based on the findings of the study we have developed a new energy performance evaluation method that separates the energy consumption of tenants from a building's total energy consumption. This method has shown that, through proper operation and maintenance, even older buildings can attain energy efficiency levels that surpass the existing standards. And, by employing principles of sustainable construction during the design and construction stages, it is possible to create both a healthy, comfortable environment for users and an energy-efficient, lower-cost profile.

This report, which sums up the results of the analysis, is an important tool for implementing energy-efficient and sustainable building development.

Tomasz Augustyniak MRICS, CCIM
Partner, CEO, Go4Energy


Green2Day

9. Project Partners

SKANSKA

Skanska Property Poland is an innovative developer of green office buildings that create a perfect environment for business development and provide their users with healthy and friendly space as well as blending in perfectly with the surrounding urban tissue. The company has been operating in Poland since 1997. Skanska Property Poland's schemes comprise high quality, LEED-certified office space in superb locations. It is active in seven major Polish markets: Warsaw, Wroclaw, Poznan, Lodz, Krakow, Katowice and Tri-City. The company was awarded "Developer of the Year" in the prestigious CEE Investment & Green Building Awards 2015 and "ESSA Green Developer of the Year" in the CIJ Awards 2015 competition.

Visit the unit's profile on LinkedIn at
https://www.linkedin.com/company/skanska-property-poland

Waldek Olbryk

Waldek Olbryk currently is Head of all Support Departments for Skanska business in Poland. He is an expert in the field of B2B as well as in the area of business relations development. For the last 20 years he has been working in real estate and investment sector. Over the years, he has gained the extensive experience working on different levels in the organizational structure representing such investors as BP, Apsys, Philips and Skanska as well as being responsible for the maintenance area. He specializes in the implementation of innovative solutions for business and in the support activities for change processes in business area. He joined Skanska in 2008. After three years he was appointed the Managing Director of Skanska Property Poland, as the first Pole on this position. He graduated from the University of Łódź with a degree in economics and has a MBA degree at the University of Łódź and College of Maryland. He holds the title of Professional Project Manager awarded by the Project Management Institute (PMI).

Artur Wysocki

Artur Wysocki is Facility and Property Coordinator at Skanska Property Poland. He is responsible for conducting the verification and coordination of project design solutions in the area of building installation. Artur has 10 years' experience in the real estate and construction industry. As an external consultant, he has been involved with Skanska since 2006. In 2009, he joined the company's Facility Management team. Currently, his responsibilities include providing technical support for the company's investments, control over the quality and content of project documentation and construction works, cooperation with facility management companies as well as conducting analyses of the exploitation costs of selected buildings and providing support for environmental certification processes. Artur graduated from the Faculty of Building Services, Hydro and Environmental Engineering at the Warsaw University of Technology.

Cushman & Wakefield is a leading global real estate services firm that helps clients transform the way people work, shop, and live. Our 43,000 employees in more than 60 countries help investors and occupiers optimize the value of their real estate by combining our global perspective and deep local knowledge with an impressive platform of real estate solutions. Cushman & Wakefield is among the largest commercial real estate services firms with revenue of $5 billion across core services of agency leasing, asset services, capital markets, facility services (C&W Services), global occupier services, investment & asset management (DTZ Investors), project & development services, tenant representation, and valuation & advisory.

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Zuzanna Paciorkiewicz

Zuzanna is Partner at Cushman & Wakefield. She is a RICS member and a licensed property manager. She has many years experience in commercial real estate, with a focus on offices. She heads a 34-strong team managing 900,000 sq m of commercial space on behalf of international funds, private investors and developers. She is responsible for buildings' opening management set-up, sales preparation and implementation of sustainable and innovative solutions.

Grzegorz Dąbrowski

Grzegorz is a licenced property manager and a licenced BREEAM IN-USE assessor. He graduated from Bialystok University, Faculty of Construction and Environmental Engineering. He also completed postgraduate studies in Property Management and Valuation at Warsaw University of Technology. He is responsible for property management of three office buildings in Warsaw. From the beginning of his professional career, he is involved in implementation of sustainable development principles in commercial buildings as well as coordination of green building certification.

Wojciech Lipniowiecki

Wojciech is Senior Technical Manager in Asset Services of Cushman & Wakefield. He has over 18 years' experience in the maintenance and technical management of commercial properties, including office buildings and shopping centres. His responsibilities include procuring third-party services for the managed properties and coordinating bidding procedures. Wojciech is also responsible for supervising the technical aspects of commissioning buildings, as well as conducting internal quality audits in the properties under management.

Go4Energy provides professional consulting and training services on rational energy use in buildings. Based on cutting-edge calculations, simulations and modelling tools it offers analyses of building energy consumption, thermal comfort of users, daylighting, indoor air quality. It cooperates with many investors, building owners, designers, contractors and property management companies. It is licensed by the British organization BRE (Building Research Establishment) to conduct the BREEAM certification process, and is a member of USGBC (U.S. Green Building Council). The company promotes the idea of sustainable growth and works on improvement of the LEED (Leadership in Energy and Environmental Design) certification system for energy-saving buildings.

More information at www.g4e.pl

Tomasz Augustyniak

Partner, CEO at Go4Energy. He is the originator and president of the National Association for Supporting the Sustainable Building Industry (OSWBZ), supporting educational activities in environmental engineering and energy-efficient buildings in Poland. He is also the originator and co-founder of Green Building Standard certificate, a novel building certification system, which promotes the users' comfort and ensures the highest possible indoor air quality while maintaining the most cost-effective energy consumption levels. He is a member of CCIM (2007) and RICS (2008) and a BREEAM Accredited Professional. He holds a professional property management license (2005). He graduated from Warsaw University of Technology, Faculty of Environmental Engineering.

Piotr Bartkiewicz

Partner at Go4Energy. The author, consultant and leader of many projects on building energy management and sustainable development. He holds the post of adiunkt (associate professor) at the Faculty of Building Services, Hydro and Environmental Engineering at the Warsaw University of Technology. Piotr specializes in computer aided design aimed at backing-up the designing processes, BIM systems, CFD simulations, energy use, energy modelling, HVAC systems, daylight processes, user's comfort, office environment quality, project management, LCA analyses as well as LEED, BREEAM and GB certification processes. Piotr is a member of ASHRAE and IBPSA. Member of the Polish Sanitary Engineers and Technicians Association (PZITS) and co-founder of OSWBZ. He is also EU projects' coordinator (Intelligent Energy Europe – IDES EDU, Performance Based Building – PeBBu, STEP and KODnZEB).

Robert Iliński

Energy Modeling Manager at Go4Energy. He is responsible for coordination and managing GreenFM services. He creates building energy simulation models, performs analysis of energy consumption, thermal comfort, natural ventilation and daylight access for commercial buildings, for the purposes of BREEAM and LEED certification. In addition, he is involved in BMS systems assessment for commissioning process. Robert graduated from Warsaw University of Technology, Faculty of Environmental Engineering.

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