

Sustainability – energy efficiency and business sustainability

Energy efficiency as a driver of sustainable business: global challenges and opportunities

In modern society, energy efficiency and business sustainability have become key concepts in defining organizational success. Global trends increasingly focus on reducing negative environmental impacts and improving energy efficiency. These concepts are no longer just an option but an imperative for businesses aiming for long-term competitiveness and responsible relationships with society and the environment. In this paper, we will explore the connection between energy efficiency and business sustainability, and how these concepts are closely linked to the global sustainability movement, including the increasingly important topic of Environmental, Social, and Governance (ESG) frameworks.

Sustainable development and business

Sustainable development is defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. In the business context, this means integrating environmental, social, and economic goals to ensure the long-term prosperity of organizations and societies as a whole. Global challenges such as climate change, depletion of natural resources, environmental pollution, and social injustice have placed sustainability at the center of the global agenda. Organizations are under increasing pressure from stakeholders—including governments, investors, consumers, and non-governmental organizations—to take responsibility for their impact on the environment and society. This is especially true for organizations that consume enormous amounts of energy for their operations, and in the current ranking of leading global companies, particularly in the IT sector at the global and EU levels. For example, data centers, a crucial link in today's digital age, require enormous amounts of energy, including electricity and water. The global energy consumption of data centers is significant, with estimates ranging from approximately 1% to 2% of the world's annual electricity consumption.



These digital processes result in a large carbon (CO₂) footprint, contributing to the planet's warming. The question arises: how can we keep the wheels of innovation turning without succumbing to a technology-driven apocalypse? Technological advancement, driven by human creativity and the desire to push boundaries, opens new "keyholes" to human destiny.

Also, the trend is a growing demand for energy due to the increasing reliance on data centers for various services and applications, and the development of artificial intelligence (AI) is contributing exponentially to this. AI data centers, i.e., high-performance computing (HPC) centers, significantly contribute to this energy consumption. Although concrete and separate figures for HPC data centers are not yet available, they are typically more energy-intensive due to the high-performance demands of their computing equipment. For example, one HPC data center may require 100 MW or more of energy, equivalent to the energy consumption of a small European city.

Why being environmentally conscious is good for business?

In today's world, companies are not only judged by their end product or service but also by their environmental, social, and governance practices, as measured by their ESG index. This approach has become an important tool for assessing and improving business sustainability.

It includes three key areas:

- 1. **Environmental Aspects:** This involves measures an organization takes to reduce its environmental footprint, such as reducing greenhouse gas emissions, waste management, conserving natural resources, and improving energy efficiency.
- 2. **Social Aspects:** This relates to how organizations treat their workers, communities, and society at large. It includes issues like working conditions, health and safety, workers' rights, and community contributions.
- 3. **Governance Aspects:** This refers to the framework of rules, practices, and processes by which a company is directed, monitored, and controlled. It encompasses aspects like board structure, transparency, accountability, ethical behavior, and risk management, ensuring the company operates in the best interest of its stakeholders.



Companies that take ESG seriously often enjoy better reputations, attract capital more easily, and reduce operational risks related to environmental and social issues. In today’s business environment, ESG is increasingly seen as an indicator of a company’s long-term sustainability and resilience to market changes, enabling them to remain relevant and successful in an increasingly complex global economy.

Energy efficiency as a key element of sustainable business

Energy efficiency refers to optimizing energy use to achieve maximum results with minimal energy investment. It is crucial for reducing operating costs, lowering greenhouse gas emissions, and increasing market competitiveness. Thus, while focusing on the planet is vital, the business contribution is equally important, leading organizations to increasingly adopt “green” business practices.

Energy management involves the comprehensive planning, monitoring, and optimization of energy consumption within an organization. Beyond the immediate goal of cost reduction, proper energy management is a key component of long-term business success. By adopting energy-efficient technologies and practices, businesses can minimize operating costs, gain a competitive edge, and reduce their carbon footprint. Organizations should collect, analyze, and interpret energy consumption data to identify weak points in the system that reduce efficiency, and accordingly set performance benchmarks and improvement strategies. Smart meters, building management systems, and energy management software have become critical tools in this endeavor.



Considering all of the above, key energy efficiency parameters can be defined. We start with **energy consumption per unit of product** (Energy Intensity), which is a measure of energy efficiency indicating the amount of energy required to produce one unit of product. This value is fundamental to industrial producers' business models and is the starting point for calculating the final cost of the product that enters the market. The logical conclusion is that lower energy consumption per unit of product means greater energy efficiency. In addition to optimal energy consumption from an ESG perspective, the **efficiency of**

renewable energy sources is crucial. Using renewable energy sources like solar and wind reduces reliance on fossil fuels and contributes to lower greenhouse gas emissions, i.e., a significantly smaller CO₂ footprint.

The **energy loss** parameter in production processes tracks the amount of energy lost during production, remembering that standard generator sources of stable power, such as thermal power plants, have significant losses — a good portion of the energy is consumed by the plant itself to keep the process running. Reducing energy losses can significantly increase overall efficiency. In construction and housing, it is worth highlighting the parameter of **efficiency of heating, ventilation, and air conditioning (HVAC)** systems. HVAC systems often represent a significant portion of energy consumption in buildings, with some analyses showing that they account for about 35% of total electricity consumption. Moreover, HVAC systems require refrigerants (such as freon compounds). Many of these refrigerants have a significant impact on the CO₂ footprint due to their high global warming potential (GWP). Although some freons have been gradually replaced with less harmful substances, many still contribute to greenhouse gas emissions when leaks or improper disposal occur. Replacing these substances with more environmentally friendly alternatives is crucial for reducing the overall impact of HVAC systems on climate change. Considering their share of total consumption, it is concluded that HVAC system efficiency directly impacts the overall energy efficiency of buildings and ecosystem sustainability.

The benefits of energy efficiency for business and society

Sustainability, which includes environmental, social, and economic concerns, has evolved from a catchphrase to a fundamental business principle. Modern consumers are aware of the consequences of their decisions, and stakeholders expect companies to align their activities with sustainability goals. Sustainability emphasizes business responsibility, enhances brand reputation, and attracts environmentally conscious consumers and investors. Resource conservation is an important aspect of sustainability. Energy, as a critical resource, plays a key role. By using renewable energy sources such as solar and wind, organizations can reduce their dependence on fossil fuels, lower greenhouse gas emissions, and contribute to a better future.



Furthermore, energy-efficient building projects, renewable energy systems, and waste reduction measures contribute to long-term ecological work environments. Accordingly, here are the main benefits of implementing energy efficiency in business and social processes:

1. **Reduction of operating costs:** Reducing energy consumption leads to lower energy costs, which can significantly improve an organization's profitability. This is especially evident in manufacturing activities where energy input costs are a key factor in defining end goals.
2. **Reduction of greenhouse gas emissions:** Energy-efficient practices reduce CO₂ and other greenhouse gas emissions, contributing to the fight against climate change. We are all witnessing significant changes to which we are gradually adapting and living in uncertainty about what the future holds. These measures not only contribute to mitigating climate change but also increase business resilience to future regulations and market changes related to carbon emissions. Here, ESG evaluation acts as a control and motivation tool.
3. **Increased competitiveness:** Organizations that implement energy-efficient practices often enjoy benefits such as improved image, attracting investors, and customer loyalty. The previously mentioned ESG evaluation contributes to this, and large companies subject to such reporting strive to be at the top of the ESG success pyramid.
4. **Contribution to sustainable development of society:** Energy efficiency helps preserve natural resources, reduce pollution, and improve quality of life. By implementing energy-efficient technologies and practices, pressure on ecosystems is reduced, enabling the long-term preservation of biodiversity. Moreover, energy efficiency can stimulate economic growth by reducing energy costs and creating new jobs in the green economy, further contributing to social stability and community well-being.

Challenges and strategies for effective implementation of energy efficiency and sustainability

While the benefits of energy efficiency and sustainability are obvious, several challenges can hinder their implementation. The first and foremost is the parameter of **high initial costs**, which is often the main stumbling block for implementing measures in systems that have set sustainability as their goal. Implementing energy-efficient technologies often requires significant upfront investments. This can be a barrier, especially for small and medium-sized enterprises. **Lack of awareness and knowledge** is the result of companies and organizations investing in the education of their resources. Many organizations are still not sufficiently educated about the benefits of energy efficiency and sustainability, which can lead to a lack of initiative for change. The issue of **regulation strategies and measures** can also present a challenge. Although many governments promote energy-efficient practices, the lack of globally harmonized standards can make implementing these strategies and processes difficult. **Technological challenges** can often be an obstacle, especially in older systems requiring modernization in all fields. Developing and implementing new technologies that improve energy efficiency can be complex and require significant resources and time in the implementation phase. For example, consider automating some outdated industrial plants. Where the human factor dominated all process steps yesterday, that same process is now being automated with AI-based robotic technologies. We can confidently say that integration will not be easy and must be carried out gradually.



Here are a few key strategies necessary for integrating energy management and sustainability in high-profit companies and organizations:

- Conduct comprehensive energy audits to identify consumption trends and efficiency reductions. This data forms the foundation for targeted changes.
- Invest in technology such as IoT devices¹, automation, and data analytics for real-time energy consumption monitoring and optimization. This should be done not only at standard measurement points but at all locations where energy optimization is possible.
- Engage employees in sustainability strategies. Very often, the best ideas and practices for improving efficiency and related processes come from the employees themselves.
- Think strategically, and during procurement, select energy-efficient equipment and materials. Partnering with suppliers who share the same or similar commitment to sustainability can be a good "click," especially in terms of exchanging experiences and good practices.
- The concept of a culture of continuous improvement by setting reasonable goals, monitoring progress, and modifying techniques as needed is something that large companies worldwide and in the EU are introducing as a standard.

¹ Internet of things (IoT) describes devices with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the Internet or other communication networks. The Internet of things encompasses electronics, communication, and computer science engineering.

- Along with all of the above, it is very important to provide ongoing education and training for employees on energy management, sustainability practices, and the importance of their contributions. After all, people and quality personnel are the main foundation of any successful company, including those who have set a sustainable path.

Examples of good practice in energy efficiency and business sustainability

Many global companies have recognized the importance of energy efficiency and sustainability and have implemented advanced strategies to achieve these goals. But it is not enough that only big technology companies that dictate trends do it so. For global sustainable success, small and medium-sized enterprises, the lifeblood of the economy, must also apply concepts that lead to energy-efficient business. Involving small and medium-sized enterprises in this transition creates a chain of positive changes that can accelerate the shift to a more sustainable economy. These companies often have greater flexibility in implementing innovative solutions, enabling them to respond more quickly to environmental challenges and adapt to changes in legislation and consumer demands.



There are many examples of good practice, and it is worth highlighting some achievements in sustainability from companies we are all familiar with and often serve as examples and benchmarks for others. In the digital world, where innovations constantly occur, Google is a good example of a company fully committed to sustainability. In 2007, they became the first major company to achieve carbon neutrality, and today they are one of the world's largest users of renewable energy. Their data centers use 50% less energy than average data centers, thanks to advanced technologies, applied innovations in infrastructure, and

operations optimization. On the same continent, Tesla has become synonymous with sustainability in the automotive industry. Their mission is to accelerate the world's transition to sustainable energy, and they also strive to push the boundaries of human potential with contributions to space technology. According to all analyses, they have become leaders in producing electric cars and battery systems, with their Model 3 becoming the world's best-selling electric car. Tesla is also on the list of manufacturers developing battery energy storage systems (BESS), which is crucial for integrating renewable energy sources into the power grid. As a final example of good sustainable business practice that is not outside the old continent, we must mention IKEA. The global company specializing in furniture and household products is known for its affordable and practical home solutions and has set ambitious sustainability goals. It strongly focuses on business sustainability, aiming to become fully circular by 2030, meaning all products will be made from renewable or recycled materials. As part of its sustainability strategy, IKEA invests in renewable energy sources such as solar panels and wind farms, having already invested over 25 billion euros. The company continuously works to reduce its environmental footprint through the optimization of production processes and logistics. Thus, IKEA not only responds to global environmental challenges but also sets new standards for the sustainable furniture industry.



Conclusion

Energy efficiency and business sustainability are key elements for the long-term success of organizations and environmental preservation. By integrating ESG principles into business strategies, organizations can significantly contribute to the global goal of sustainable development. Although there are challenges in achieving energy efficiency, the benefits are numerous—from cost reduction and greenhouse gas emission reduction to increased competitiveness and contribution to social development. Examples of global companies like Google, Tesla, and IKEA show that it is possible to achieve a high level of energy efficiency and sustainability through innovative technologies and strategies. Through continuous education, investment in technology, and adapting regulatory frameworks, the business community can take a leading role in combating climate change and creating a sustainable future for all.