

ENERGY EFFICIENCY AND ECONOMIC EFFICIENCY - PILLARS OF COMPANY'S ECO - EFFICIENCY

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JEL Classificaton:
E00, L16, N70.

Review

Primljeno / Received: February 19, 2014

Prihvaćeno /

Accepted: March

31, 2014

Abstract

For many companies, global warming, rising energy prices, new environmental regulations and customers' increasing ecological awareness have pushed energy efficiency to the top of the agenda. Manufacturing firms have been affected particularly strongly because through their production activities they are supposedly primary polluters. Therefore, companies are striving to identify the most effective measures to increase energy efficiency in manufacturing processes and to integrate energy efficiency performance in production management in order to improve overall economic efficiency. As economic efficiency is realized through the principle of maximal results with minimal inputs, energy efficiency in the context of economic efficiency would mean the realization of maximal results (volume of production and services provided) with minimal energy inputs. Improvements in energy efficiency have been suggested as both a measure of progress towards sustainable development and as a means of achieving sustainability. Companies have to ensure that they source their inputs from other companies which have employed environmentally desirable methods, have produced their products to the highest environmental standards and have ensured that waste products can be disposed of in the most environmentally efficient way. Better environmental management, and energy management within it, can lead to economic gains and eco-efficiency.

Key words: *energy efficiency, economic efficiency, energy management, environmental management, economic performance*

1. INTRODUCTION

Concept of eco-efficiency emphasizes the potential economic gains for companies from reducing pollution and better managing natural resources – better environmental management [7]. The business world and the natural world are inextricably

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cably linked. Our economy and society depend on natural resources. The environment provides critical support to our economic system – not financial, but natural capital. The leading companies learned to manage environmental risks and costs as closely as they do other risks and costs, to lower operational costs and even lower lending rates from banks that see reduced risk in companies with carefully constructed environmental management systems and corporate environmental awareness. The companies' response to the environmental threat could indicate the 'health of a company'.

The economic challenges facing industry today highlight the critical need for innovative technology solutions that will increase productivity, competitiveness and sustainability. One of the main goals of every company is to achieve profit, but beside this, more and more companies recognize that its activities have a wider impact on society (economic, social, and environmental) and decide voluntarily to contribute to a better society and cleaner environment [9]. This concept is known as corporate social responsibility.

Sustainability in relation to business concerns, among the other things, the actual production process, particularly energy use and waste generation, plus the product life cycle. Companies waste about 30% of their energy (mainly in buildings) and it has been calculated that a 20% reduction in energy costs is equivalent to a 5% increase in sales. Sustainability at an organizational level can be about energy management (energy efficiency and energy conservation), waste management, sustainable material usage, sustainable construction, etc.

Throughout the manufacturing process, energy is lost due to equipment inefficiency and mechanical and thermal limitations. Optimizing the efficiency of these systems can result in significant energy and cost savings and reduced carbon dioxide emissions. Understanding how energy is used and wasted - or energy use and loss footprint - can help plants pinpoint areas of energy intensity and ways to improve efficiency. Reducing total energy use is only one aspect. The source of energy can also be examined to encourage recycling of energy and the use of renewable energy or waste to energy solutions.

Looking at energy use and waste generation leads to the whole product in terms of life cycle assessment (LCA). An LCA examines all environmental impacts associated with the life of a product from raw material extraction, to pre-production processes, to actual production, and through to distribution and final disposal of used product. For many products each of these stages involves quite significant environmental impacts, apart from the production process itself. Companies have to ensure that they source their inputs from other companies which have employed environmentally desirable methods, have produced their products to the highest environmental standards and have ensured that waste products can be disposed of in the most environmentally efficient way. In that context, extended producer responsibility requires companies to take ownership of their products' environmental challenges through the product life cycle [2].

Product design, packaging and eco-labelling also present opportunities for environmental gains. Material can be saved in production and packaging. Packaging can be used not only to provide useful environmental guidance on the product, but also information on safe disposal of the used product and packaging (eco-labelling). Clearly, some of these features have an obvious benefit to company, in terms of saving raw materials and the use of energy. But others will have benefits further down the line reducing transport costs, and landfill or incineration costs [26].

2. RESOURCE AND ENERGY EFFICIENCY

Resource efficiency means using the Earth's limited resources in a sustainable manner. We depend on natural resources - metals, minerals, fuels, water, land, timber, fertile soil, clean air and biodiversity - for our survival. They all constitute vital inputs that keep economy functioning, as well. Being efficient with resources - including water, energy, raw materials and waste - benefits all businesses. It also benefits the environment through better use of finite assets and a reduction in carbon emissions [23].

Increasing resource efficiency is the key to securing growth and jobs. It brings major economic opportunities, improves productivity, drives down costs and boosts competitiveness. Therefore, it is of vital importance to develop new products and services and find new ways to reduce inputs, minimize waste, improve management of resource stocks, change consumption patterns, optimize production processes, management and business methods, and improve logistics. Resource efficiency can help stimulate technological innovation and development of more sustainable products, as well.

Resource productivity means raising the ratio of 'output' to natural resource 'inputs'. The less natural resources used per unit of output, the less potential waste there will be. The First Law of Thermodynamics dictates that every tonne of materials or energy taken from the environment must eventually return to it: matter and energy cannot be created or destroyed. Hence raising resource productivity both saves resources and helps improve the environment [17].

The motivations for raising resource productivity are numerous: to conserve 'scarce' energy and materials resources, to conserve the natural environments which act as the receiving 'sinks' for resources when they are converted to wastes, to increase profitability in firms - provided the costs of improving resource productivity are not greater than the cost savings, profits will rise [17].

The means of making natural resource use more efficient are: reducing the wasteful use of resources, adopting technological change which raises the efficiency of a given unit of resource, substituting other inputs, such as labour, for natural resources, so that output stays the same but resource use is reduced, recycling materials so that the 'same' unit of resource is used several times, substituting

one resource for another (if the focus is on environmental pollution, one tonne of one material may be less polluting than one tonne of another).

On the other hand, energy efficiency includes the efforts to reduce the amount of energy required to provide products and services. Improvements in energy efficiency are most often achieved by adopting a more efficient technology or production process. Energy efficiency and renewable energy resources are twin pillars of sustainable energy policy. At the same time, energy efficiency improvements and usage of renewable energy resources pave the cleaner energy path.

Energy efficiency can be used to reduce the level of energy consumption and may slow down the rate at which energy resources are depleted. The idea of meeting energy needs by increasing efficiency instead of increasing energy production is realized through negawatt power - a theoretical unit of power representing an amount of energy (measured in watts) saved [36]. The energy saved is a direct result of energy conservation or increased efficiency.

Energy efficiency used to be known as 'the fifth fuel'. It can help to satisfy growing demand for energy just as surely as coal, gas, oil or uranium can and could get the world halfway towards the goal of keeping the concentration of greenhouse gases in the atmosphere below 550 parts per million. Unlike most other schemes to reduce emissions, a global energy-efficiency drive would be profitable.

3. ECONOMIC VS. ENVIRONMENTAL PERFORMANCE

In recent years, companies have faced strong pressure from their stakeholders to implement environmental management. Manufacturing firms have been affected particularly strongly because through their production activities they are supposedly primary polluters. In these circumstances, however, there is a trade-off between a company's environmental and economic performance, because private environmental costs lead to higher prices and reduced competitiveness [17].

Significant efforts have been made to test the relationship between environmental management practices and business performance empirically. For example, the subject of different researches were whether the relationship between the implementation of the technologies for the reduction of energy and resource consumption in production and the performance of manufacturing firms was positive or negative. But, no consensus has been reached. The main difficulty in drawing clear conclusions lies not only in the mixed results from different research but also the fact that scholars use different definitions/measures of business and environmental performance. Business performance may be measured by different performance variables, mostly in terms of both financial/accounting ratios and market-based measures. The most commonly used measures of business performance are return-on-equity (ROE), return-on-assets (ROA), return-on-investment (ROI), return-on-sales (ROS), stock price, market share, sales growth and profitability [17]. Environmental variables, either in terms of production activities or energy

efficient technologies, includes: energy consumption per unit, waste water generated per unit, green gasses emissions, etc.

A number of studies that tested the relationship between environmental practices and business performance fell into two groups: studies that link environmental variables to improved economic performance and studies that link environmental variables to negative economic performance or provide no evidence of improvement [13].

Many scholars argue that there is no single, direct relationship between proactive environmental management and economic performance of the company. Rather, this relationship seems to depend on environmental management and environmental performance, the firm resources most directly associated with proactive environmental management and the effect that proactive environmental management and environmental performance have on competitive advantage and business performance.

Among studies which have documented a positive relationship between being proactive in environmental issues and company performance argue that with the tightening of environmental regulations and the increase in people's environmental awareness in recent years, companies are being compelled to spend large amounts on environmental costs through measures such as obtaining ISO 14001 certification, investing in environmental equipment and clean technologies, developing environmentally friendly products, etc. In that context, better environmental management performance is associated with improved business performance i.e. good environmental performance is significantly associated with good economic performance.

Firms that reduce pollution emissions can increase their economic performance through an increase in demand and an improvement in productivity. For example, the adoption of environmental standards such as ISO 14001 improves manufacturers' profitability in the fashion and textiles related industries over a three-year period as measured by return-on-assets (ROA) [13]. It also improves cost efficiency, as measured by return-on-sales (ROS), exerts a positive and significant impact on a firm's market value. One study examined three specific areas of impacts of the implementation of ISO 14001 on the facilities' environmental performance: natural resource use, solid waste generation, and wastewater effluent. The results showed that ISO 14001 helps to reduce all three impacts.

There is, also, a positive and significant impact of environmental management system (EMS) on corporate performance measures such as reduced costs, improved quality, and reduction of lead times. An EMS influences an organization's structure, responsibilities, practices, procedures, processes, and resources for environmental management, so that a firm can improve management control while reducing its negative environmental impact.

Different types of attempts to make production cleaner may have different implications for business performance. One of the most recent studies found an overall positive impact of cleaner production on a firm's business performance, but

not in all circumstances. Low-cost cleaner production activities, such as improving employee environmental consciousness, improving working conditions to reduce waste, strict enforcement of rules on cleaner production, or increasing the recyclability of products and components, make a bigger contribution to economic performance than the high-cost activities, such as using energy efficient and clean technologies or using renewable resources as raw materials. The latter require significant financial investment but may not result in immediate economic benefit. The low-cost clean production activities do not require significant financial input but may bring immediate financial benefits [13]. On the other hand, the use of energy and material saving technologies does not have a clear and significant relationship with economic performance. But, a significant positive relationship is found between energy and material saving technologies and environmental performance.

Pollution emissions and their reduction are one of several significant environmental concerns alongside greenhouse gas emissions and waste disposal. Reduction of pollution emissions could be achieved through the selection of the control (end-of-pipe) or prevention (cleaner production) approaches. According to the findings based on panel data for Japanese manufacturing firms over the period 2002-2008 [16], firms that have reduced their pollution emissions can increase their economic performance through the increase in demand for their products (e.g. through the increase in sales to environmentally conscious customers) and through the cost reductions associated with the improvement in productivity. However, the latter is conditional, because the selection of the approach concerning the reduction of pollution emissions differently influences a firm's productivity, and the prevention approach is more preferable than the control approach. Therefore, the positive effect through an increase in demand is currently important for most firms, at least in the short term, and they will further acquire a competitive advantage through an improvement in productivity by developing their pollution reduction strategy in the future.

If we regard all firms as homogeneous, the reduction of pollution emissions increases a firm's economic performance only through the increase in demand. However, if firms are heterogeneous in terms of the strategy chosen to reduce pollutions, we also observe the positive effect through an improvement in productivity for those firms reducing pollution emissions through the prevention approach. Accordingly, firms that reduce pollution emissions through the prevention approach can acquire a competitive advantage, through not only the increase in demand for their products, but also through the improvement in productivity [16].

4. ENERGY EFFICIENCY IN PRODUCTION AND ENERGY MANAGEMENT

For manufacturing companies, global warming, rising energy prices, and customers' increasing ecological awareness have pushed energy efficient manufacturing to the top of the agenda. Industrial companies are striving to identify the most

effective measures to increase energy efficiency in manufacturing processes and to integrate energy efficiency performance in production management.

The manufacturing industry, with its 31% of primary energy use and 36% of carbon dioxide (CO₂) emissions, is one of the main consumers of energy as well as one of the largest emitters of CO₂. The European Commission for example, estimates that an energy saving potential for the manufacturing sector of 25% could be realized by measures such as implementing energy efficient motors, fans and lightings. From the manufacturing companies' point of view, there are three important drivers to introduce energy efficiency improvements [4]:

- rising energy prices (in the energy-intensive manufacturing industries (e.g., steel, cement, pulp and paper, chemicals), energy can account for up to 60% of operating costs (e.g., chemical industry), thus representing a strong factor for competitiveness,
- new environmental regulations with their associated costs for CO₂ emissions,
- customers changing their purchasing behaviour with regard to 'green' and energy efficient products and services.

The above mentioned drivers make energy efficiency an important pillar contributing to sustainable manufacturing framework.

The term energy management has been used differently in academic literature, there is no cohesive definition. What many descriptions of energy management have in common is that they mainly focus on implementation of energy efficient technologies and replacing inefficient equipment [1]. However, energy management also includes care and maintenance of technology to preserve an efficient operation. It requires continuous work and improvements. What successful energy management means depends on the organization. For companies, it depends on the size and type of industry. However, many descriptions of energy management contain similarities. In that context, successful strategic energy management consists of: energy auditing to gain knowledge about energy flows, courses and training to increase and maintain awareness and house-keeping that includes keeping up the operations, set efficiency goals, and communicate on-going energy performance to stakeholders in an organization.

Examples in the literature and in the world of practice show that although the manufacturing sector has made continuous improvement in energy efficiency, economically beneficial energy efficiency potential is not yet exploited. Implementing an energy management can be a way to reduce energy consumption and the related CO₂ emissions. Within the framework of energy management, the integration of energy efficiency into production management is one important lever to enhance production systems towards energy efficiency as it may be the basis for successfully implementing energy efficiency improvement measures. Energy efficiency performance has to be considered simultaneously with other important performance areas of industrial companies, such as cost, productivity, flexibility, delivery time, and quality.

Energy used in industry can be classified in indirect and direct energy as energy is used in production processes (direct) and in supporting processes (indirect), such as ventilation, lighting, heating and cooling, etc. Energy efficiency, in terms of production, is understood as “the ratio of energy services out to energy input [meaning] getting the most out of every energy unit”. Increased energy efficiency may be accomplished by, for example, more efficient technology and machines, energy recovery in the same process or further use of energy waste in different processes, increased energy conversion efficiency or optimized operational practices production processes.

Increased energy efficiency is reflected in reduced energy intensity (EI) or specific energy consumption (SEC). EI is defined as the ratio of energy consumption to a monetary value, such as the gross domestic product (GDP). SEC is defined as the ratio of energy consumption to units, such as tonnes of product. For both indicators, energy consumption can be measured in different ways, such as demand for primary energy carriers, net available energy, and purchased energy or CO₂ emissions.

5. ENERGY EFFICIENCY TECHNOLOGIES IN PRODUCTION

Since the early 90s the EU has taken a number of initiatives, trying to cope with the climate change problem and the exhaustibility of energy resources. In this context, a range of policy measures has been introduced which aims at increasing energy saving and reducing energy usage and carbon dioxide emissions. Among the policy measures introduced are the incentives to adopt Energy Efficient Technologies (EETs), which primarily target manufacturing firms.

Pan-European survey of businesses, including SMEs and large enterprises revealed that close to two thirds of Small and Medium Enterprises (SMEs) operating in the EU do not even have simple rules or devices for saving energy while only 4% of EU SMEs have a comprehensive system in place for energy efficiency. Even more worrying is the fact that the manufacturing industry is not included among the top three energy-conscious sectors while the transport sector is only third, with the hospitality and healthcare sectors taking the first two places. Such results really question the efficiency of energy efficiency policies.

As the relative field research has shown, in the huge majority of cases the embodiment of EETs in the existing production technology is not for reasons related to productive performance improvements. On the contrary, the firms' decision to adopt EETs resides in environmental regulations, or in business strategies which depart from cost leadership behaviour and focus on differentiation strategies developed from factors such as the firms' social responsibility, customers' loyalty and rapid innovation. This does not mean that the adoption decision is irrational but rather that the contribution of EETs to the firms' overall performance comes from directions other than the improvement of their productive efficiency.

EETs affect positively the firms' technical efficiency and in terms of Productive Efficiency (Productive Performance), EETs have differential effects with respect to various industries and firm size. The authority responsible for the design and implementation of policies that aim at the reduction of energy consumption by manufacturing firms should have taken into account two factors which lead to differential policy initiatives. More specifically, efficient policy initiatives should have been twofold, giving emphasis on the firms' motives to adopt EETs on one hand, and producing EETs which fit (suit) to technological and size characteristics of the targeted manufacturing firms on the other [19].

6. STANDARDIZATION ENABLING ENERGY EFFICIENCY IN COMPANIES

Environmental management system standards aiming at increasing the environmental performance and the energy efficiency of a company by improving the organization processes exist. Standardization increases the transparency of companies' processes and stakeholders can more easily assess the commitment of a company for improving its environmental performance. Already mentioned, the ISO 14000 addresses various aspects of environmental management. It provides practical tools for companies and organizations looking to identify and control their environmental impact and constantly improve their environmental performance. The other standards in the family focus on specific environmental aspects such as life cycle analysis, communication and auditing. ISO 50001 supports organizations in all sectors to use energy more efficiently, through the development of an energy management system (EnMS). ISO 50001 is based on the management system model of continual improvement also used for other well-known standards such as ISO 9001 or ISO 14001. This makes it easier for organizations to integrate energy management into their overall efforts to improve quality and environmental management. Using energy efficiently helps organizations save money as well as helping to conserve resources and tackle climate change. ISO 50001:2011 provides a framework of requirements for organizations to: develop a policy for more efficient use of energy, fix targets and objectives to meet the policy, use data to better understand and make decisions about energy use, measure the results, review how well the policy works, and continually improve energy management [37].

7. EXAMPLES OF ENVIRONMENTAL AND ENERGY MANAGEMENT

Making businesses more efficient, through energy and resource efficiency is seen as a largely untapped solution to addressing the problems of pollution, global warming, energy security, and fossil fuel depletion. Companies recognize the effects that a changing climate could potentially have on the sustainability of business operations and supply chain. Threats to water availability, increased energy prices and regulation could cause additional costs and reduce ability to manufacture and distribute products. Therefore, companies strive to minimize climate im-

compact by reducing emissions, increasing efficiency and changing the way they use energy as well as sources of energy. In this context, definition of company's goals and principles, as well as indicators of business performances have changed. Both include and reflect consideration for the environment protection.

The following selected examples presents how companies and public authorities can reduce costs and improve economic efficiency through energy efficiency and usage of renewable resources.

Starbucks Coffee Company has different strategies to reduce environmental impact. According to company's report more than 80% of direct and indirect greenhouse gas emissions come from the energy used to power stores, offices and roasting plants. Company is intently focused on improving the environmental performance of facilities and more than 18,000 stores with green store design and energy and water conservation strategies. Build all new, company-owned stores to achieve LEED certification (Leadership in Energy and Environmental Design). In 2012, 69 percent of new global company-owned stores were built in accordance with LEED, and one of the the aims to reduce energy and water consumption by 25% in company- owned stores by 2015. In 2011, activities were focused on testing and validating new, effective energy conservation solutions for stores. For example: installing energy management systems and hybrid water heaters to heat water and cool stores. Also, providing recycling in Starbucks stores and ensuring the recyclability of cups is a foremost priority for Starbucks and their customers. Company offered a cup with 10% post-consumer recycled paper fiber since 2006 and keep working to decrease the materials used in packaging, find new ways to encourage reusables and implement recycling solutions for cups. Company's approach is to not only provide customers with cup choices for their beverages, but to also collaborate with others to create locally relevant improvements in the recycling infrastructures of communities where they operate by taking a close look at the materials been used and opportunities for material reuse in the future [27].

Henkel's Energy and Climate Strategies includes an aim of a 15 percent reduction in energy consumption and the associated CO₂ emissions per production unit by 2015 (base year 2010) and regular checks of production sites to determine whether the use of renewable energy sources is ecologically and economically worthwhile. Resource efficiency through goal-oriented optimizations includes consistent application of the "Total Productive Management Plus" optimization program which has, for example, helped company to reduce energy consumption by 22 percent over the period of five years. These savings were achieved by a series of measures, including smart lighting and ventilation technologies, improved water consumption and energy management [28].

Coca-Cola Enterprise Inc is committed to reduce overall carbon footprint of business operations (manufacturing, distribution and product cooling) by an absolute 15% by 2020 as compared to 2007 baseline. In 2010, Coca-Cola Enterprise Inc invested \$10.4 million of capital expenditures on carbon project reduction. Manufacturing operations make up 22% of company's core business emissions and

around 80% of this comes from energy used at manufacturing and distribution sites. In 2010, company used nearly 2% less energy in manufacturing operations than in 2009 – a total of 494,000 megawatt hours (MWH), down from 504,000 MWH – while increasing production volume. This reduction is achieved through monitoring energy use, planning and training, energy efficient technologies, and investing in renewable energy. Company placed energy meters on production lines and energy intensive equipment such as bottle blowers, compressors and chillers in order to discover where energy is being used and how efficiently the equipment is working. Coca-Cola also invests in new, energy efficient technologies – new lighting, compressed air and heat recovery. In facility in Sidcup, Great Britain, company have invested \$125,000 to replace standard fluorescent light tubes with new Light Emitting Diode (LED) technology. Each new LED uses a quarter of the energy of a fluorescent tube, so the company will save 416 MWH of energy per year, (one percent of Sidcup's total usage) and around 197 tonnes of CO₂e. As LEDs last longer, it will also make annual maintenance savings of around \$6,000. Company is exploring the most suitable renewable and low-carbon energy solution at each site, depending on geography and location (water turbine, wind turbines, solar panels, combined heat and power).

Transporting products currently accounts for 16% of core business emissions. In the Netherlands, company has introduced five new 'Eco-Combi' trucks. This improves the carbon efficiency of company's deliveries by transporting 38 rather than 26 pallets at once, reducing CO₂ emissions by 20 percent per pallet. In Great Britain, company is trialing biogas-powered vehicles and in Belgium, piloting hybrid vehicles.

Cold drinks equipment makes up the greatest proportion (62%) of core business emissions. At the end of 2010 Coca-Cola Enterprise Inc had approximately 490,000 coolers, vendors and fountain machines in the marketplace and approximately 21,000 open-fronted coolers across Europe. By fitting doors, energy use can be reduced by up to 50 percent and by replacing standard fluorescent lighting with long-life LEDs which can be up to 80 percent more efficient additional savings can be achieved. Company has installed energy management devices which recognize patterns of use and responds by shutting off lights and adjusting temperatures when the cooler is not being opened regularly. In this way it can reduce energy consumption by up to 35 percent per cooler [29].

Besides manufacturing, service industries have an excellent potential to increase energy efficiency and reduce CO₂ emissions. Nowadays, service sector has become an engine of economic growth and is one of the factors used to measure an economy's progress, its development, its quality and its perspectives. In the world, service industries represent 63.2% of the gross domestic product, occupy 41.9% of the labour force, consume 12% of energy and account for 9% of CO₂ emissions. In the European Union, the service sector requires approximately one-eighth of the energy required by the manufacturing industries to generate one unit of gross production [14].

Company Air France & KLM has voluntarily committed to improve its energy efficiency by on average 2% per year between 2012 and 2020. Since 2009, the reduction achieved has reached 4.8% - by installing curtains that keep cold air inside saved 365,000 kWh/year, changing washing methods for trolleys saved 156,000 m³ of gas per year and 136,000 kWh per year was saved on cooling computer rooms. In September 2010, Air France also committed to improving energy efficiency by signing the World Business Council for Sustainable Development (WBCSD) Manifesto for energy efficiency in offices. At the end of 2010, 45% of Air France's ground equipment fleet was electrically powered, in line with targets for 2020. For the purchase of new material, electrically powered equipment has priority.

At KLM's Engineering & Maintenance division, a pilot has been launched together with Philips, the Dutch lighting company, with LED lights in the hangars. This reduces energy usage and energy costs, improves the workplace comfort of employees and increases the total amount of light covering the planes that are undergoing maintenance. At the end of 2010, KLM started to replace all cabin lights - tubular lighting - in its F70s by LED lights that use around 20% less energy, have a longer life span, create less heat and are also 8 kilos lighter, thus saving fuel and CO₂ emissions. By 2011 all 26 F70s should have their lighting replaced with LED cabin lights [30].

In Austria, a Boutiquehotel Stadthalle in Vienna is world's first city hotel with a zero energy-balance. It means that in the course of a year hotel creates the same amount of energy that is used to run it. For this, renewable energy sources like solar and photovoltaic panels, ground water heat pumps and even three wind turbines are used. Rain water is used to tend plants and flowers and hotel rooms are provided with hot water heated by the solar power. Construction costs for this type of hotels are about 10% higher than for conventional ones. It has been estimated that additional investments would pay off within 8 years, even less if the energy price is about to grow. In order to promote environmental consciousness, each guest that arrive at the hotel by train or by bike, get 10% discount [33].

In addition to manufacturing and service companies, government-owned companies could contribute to less energy consumption through procurement of energy efficient products. Green Public Procurement (GPP) is defined as a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured. Public authorities are major consumers in Europe: they spend approximately 2 trillion euros annually, equivalent to some 19% of the EU's gross domestic product. By using their purchasing power to choose goods and services with lower impacts on the environment, they can make an important contribution to sustainable consumption and production. Local and state governments may obtain significant reduction in energy bills by changing purchasing policies to, for example, specify Energy star qualified products. The table below presents a basket of Energy

Star products – computers, vending machines, compact fluorescent lamps, and water coolers – applicable to state and local governments.

According to this example, these products combination can save about \$214.000 in electricity costs (based on an electricity rate \$ 0.095 kWh) and prevent 2.000 tons of carbon dioxide emissions over their lifetime compared to conventional products [31].

Table 1: Savings achieved with Energy Star products

| Action | Annual Eergy & Maintenance Savings (\$) | Net Life-Cycle Savings (\$) |
|--|---|-----------------------------|
| Use Energy Star power management to enable low-power mode on 5.000 computers | 13.900 | 50.300 |
| Replace 50 conventional vending machines with energy star versions | 10.600 | 112.200 |
| Replace 300 incandescent lamps with CFLs | 7.800 | 23.500 |
| Replace 100 water coolers with Energy star versions | 3.400 | 27.900 |
| Totals | 35.700 | 213.900 |

8. CONCLUSION

The paper presented potential economic gains for companies from reducing pollution and better managing natural resources – better environmental management, with the special attention paid at energy usage and energy efficiency. One of the main goals of every company is to achieve profit, but beside this, more and more companies recognize that its activities have a wider impact on society (economic, social, and environmental) and decide to contribute to a cleaner environment. Being efficient with resources - including water, energy, raw materials and waste - benefits all businesses. It also benefits the environment through better use of finite assets and a reduction in carbon emissions. The motivations for raising resource (and energy) efficiency is to conserve energy and environment, but also to increase profitability.

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