CSR in Supply Chains of Brewing Industry

Arkadiusz Kawa and Iwona Łuczyk

Abstract The European brewing sector engages in Corporate Social Responsibility (CSR) activity on various aspects. More and more importance is being attached at breweries to responsible use of resources in the production process. All large beer-producing concerns currently employ experts in environment protection. Their job is to analyse the impact of production on the natural environment. At present, special attention is paid to: responsible sourcing, sustainable packaging, reverse logistics, minimising water and wastewater use as well as energy and gas emission. They inform about their progress in this field in CSR reports. It not only helps to emphasise the ethical aspect of the company's operation and authenticate its mission in the clients' eyes, but also facilitates cost optimisation—reduction of water consumption or recycling are economically profitable. The aim of this chapter is to show the way in which the CSR conception is put into practice by Polish brewing enterprises and how it influences their functioning on the example of the two largest beer producers in Poland.

Keywords Brewing industry · CSR · Supply chain sustainability

1 Introduction

In the era of progressive globalisation, growing production and consumption scale as well as environment degradation, a number of social, environmental and economic problems appear. This requires a change in the management's attitude towards their enterprise's operation and acceptance of responsibility not only for

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shareholders and employees, but also for the society, environment or suppliers. Companies must start neutralising the negative effects of their operation and supporting the principle of sustainable development. This paradigm is realised in economic practice by the concept of corporate social responsibility (CSR). ISO 26000 defines CSR as "an organisation's social responsibility and commitment to including social and environmental aspects in the decision-making process and acceptance of responsibility for the effect of the decisions and activity on the society and environment" (Gadomska-Dzięcioł et al. 2012).

It may seem that the conception of corporate social responsibility is another short-lived fashion for a specific manner of management, similar to the conception of total quality management (TQM) or knowledge management. Many managers still approach this subject with distrust, treating CSR activity only as an additional cost and a waste of time. Their scepticism may also be justified by saying that they fear changes which implementation of environmental management systems carries. It should, though, be noticed that economic, social and ecological responsibility stops being "good practice" and becomes a necessity. The authors of "Green growth, green development" (Henzelman et al. 2011), however, claim that "similarly to the previous changes, the green revolution will sweep away from the market those companies, or even whole industry branches, which will miss or ignore signs thereof (…). The present revolution does not have to influence the competitiveness of enterprises negatively. They can use it as a springboard to get to the first league, providing they take active part in transforming the industry and establishing new rules of the game".

The conception of socially responsible business is effectively supported by the United Nations Global Compact initiative inaugurated in 2000 by the UN Secretary-General Kofi Annan. The UN Global Compact is a "leadership platform for the development, implementation and disclosure of responsible and sustainable corporate policies and practices" (UN Global Compact 2010).

By means of a wide spectrum of activities, co-operation with the private sector, non-governmental organisations, scientific institutions and other stakeholders, the UN Global Compact propagates and supports implementation of ten UNGC principles, which have been divided into four areas: human rights, labour, environment and anti-corruption. With nearly 12,000 corporate participants in 145 countries, the UN Global Compact is currently the world's largest corporate sustainability initiative. The UN Global Compact is not a regulatory instrument, but rather a voluntary initiative that relies on public accountability, transparency and disclosure to complement regulation and to provide a space for innovation and collective action (UN Global Compact 2010). The Global Compact initiative is a response to the rapid globalisation processes, whose negative effects include, among others, deepening disproportions and unsustainable development.

Entrepreneurs aware of the current conditioning actively participate in the development of business policies based on environmental aspects. A particularly high level of ecological awareness and a desire to reduce the negative impact on the environment are demonstrated by the European brewing sector. The largest European beer producers, also operating on the Polish market, the SABMiller

group (which includes Kompania Piwowarska) and the Heineken Group (the main shareholder of Grupa Żywiec), have committed themselves to applying the United Nations Global Compact (UNGC) principles. Taking part in the UN Global Compact project, the breweries seek solutions to strategic economic problems, create sustainable growth processes on an international scale and neutralise the negative effects of beer production processes. They contribute to the development of the conception of socially responsible business in this way.

The aim of the study is to show the way in which the CSR conception is put into practice by Polish brewing enterprises and how it influences their functioning. The beer market in Europe and Poland has been described. Next, the operation and results of the two largest beer producers in Poland, i.e. Kompania Piwowarska and Grupa Żywiec, have been analysed in terms of the most important sources of increasing sustainable development: responsible sourcing, sustainable packaging, reverse logistics, water and wastewater, energy and gas emission. These data were received from CSR reports published annually by both Kompania Piwowarska and Grupa Żywiec. They are prepared in accordance with the new GRI G4 guidelines in the 'Core' version. In the case of Kompania Piwowarska, the Sustainability Assessment Matrix (SAM) programme was used to draw up the report, which means that within individual areas it is partly identical to the GRI guidelines and, additionally, adjusted to the nature of the operation. The report is also verified by the consultancy PwC, in accordance with the International Standard on Assurance Engagements 3000 (ISAE 3000). The report of Grupa Żywiec, in turn, is prepared by PwC and is the only social responsibility report referring to the Global Reporting Initiative (GRI) guidelines as well as to measuring the social and economic influence of the organisation in the whole brewing industry in Poland. Writing CSR reports by beer producers facilitates development and a comparison with others, as well as an exchange of the so-called good practices and effective methods of solving different production, social or environmental problems not only in Poland, but also on the international arena. Companies making such analyses not only respond to their stakeholders' expectations more adequately, but also, seeing the whole picture of the social and economic impact, plan and operate more effectively (2012).

2 Brewing Industry in Europe and Poland

2.1 European Brewing Sector

The European Union is one of the most important beer-producing regions in the world. This beverage, known to Europeans for a few 100 years, plays a significant role in every country and constitutes an inseparable element of culture and consumption. The European Economic and Social Committee emphasises the continuous development of the brewing sector and its ability to adjust as well as resistance to fluctuations of economic conditions. The operation of this sector is compatible

with the aims of the "Europe 2020" strategy in its priority areas: employment, eco-development, innovation, education and social inclusion. The European Union meets a quarter of the world demand for this product (Jirovec and Calleja 2013). It has just recently been overtaken by China in terms of production volume, but still ranks higher than the United States, Russia, Brazil and Mexico. In 2011, in Europe more than 380 million hectolitres of beer were brewed and sold all over the world (Berkhout et al. 2013).

The European brewing sector is extremely varied. It is not only home to the world's largest brewing companies, such as ABInbev, Carlsberg, Heineken and SABMiller but also to numerous small and mid-sized, independent breweries. The number of breweries in the European Union increases every year. In 2013 there were 4,460 of them. Germany has the most breweries within the EU, with a number of 1,339. Other EU Member States with over 100 breweries are: the United Kingdom (1,113), France (503), Italy (425), the Czech Republic (213), Austria (171), Belgium (165), the Netherlands (165), Denmark (150), Poland (132) and Spain (132). The total beer sales in 2010 reached EUR 106 billion, which corresponded to 0.42 % of GNP of the European Union. It is estimated that over 63 % of the European beer production is purchased through the off-trade channel, that is, in supermarkets and other retail outlets. The remaining 37 % falls on the on-trade channel in the hotel and gastronomy sector, that is, in bars, pubs and restaurants (see Fig. 1) (Berkhout et al. 2013).

Since 2007 a fall in beer consumption has been noticed in Europe, which has a direct influence on brewery operation. After many years of expansion on the EU market, beer production has significantly decreased—from 420 million hectolitres in 2007 to 377 million hectolitres in 2011. The change of economic and legal conditions expected in the next few years and an increase in beer export outside the

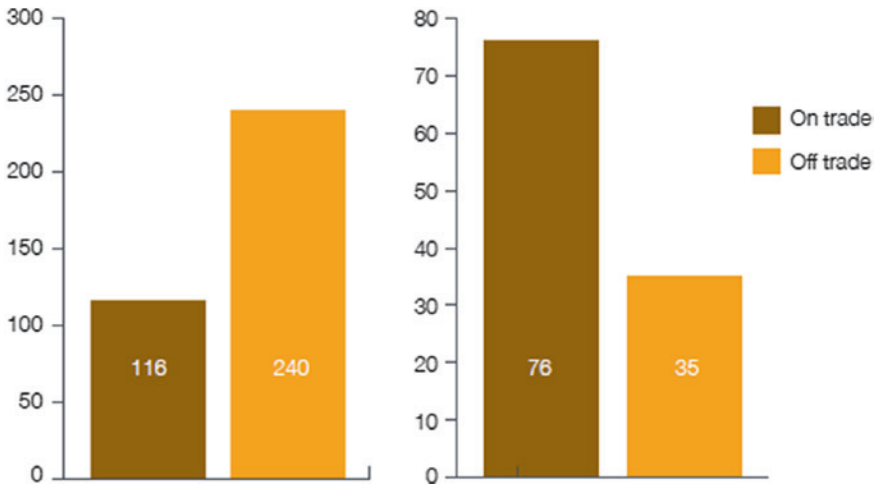

Fig. 1 Beer consumption in the European Union in millions of hectolitres (*left*) and billions of Euro (*right*) in 2012 (adopted from Berkhout et al. 2013)

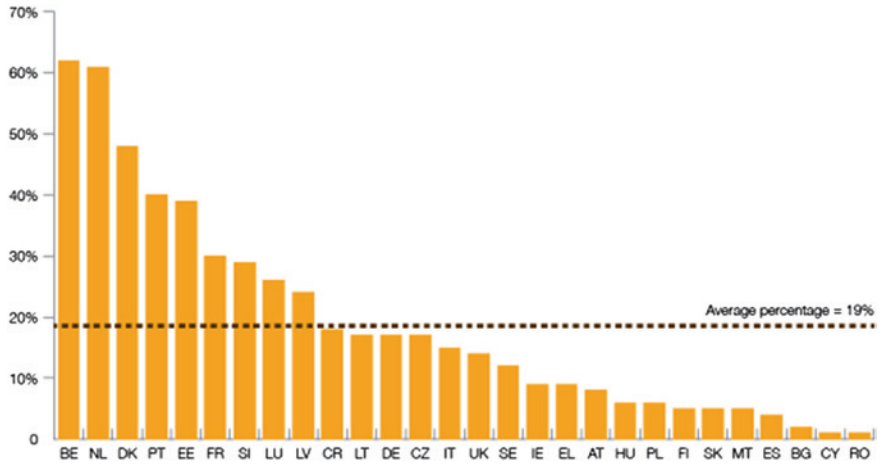

Fig. 2 Exports (intra-EU/extra-EU) in 2012 as a percentage of total production per EU Member State (adopted from Berkhout et al. 2013)

European Union could contribute to a revival in the brewing sector (Jirovec and Calleja 2013).

Most European beer production is sold on the internal market of the European Union, but export to other regions of the world has continuously been rising since 2000 (so far, this growth has amounted to 30 %). The greatest export receivers include: the United States, Canada, Angola, China, Switzerland, Taiwan, Russia and Australia. Moreover, European breweries are also large investors on all continents and participate in various initiatives of co-operation with local breweries and distributors. In 2012, beer export from Belgium, the Netherlands, and Denmark was particularly important (see Fig. 2). The percentage of the total national beer production exported from these Member States was relatively high, ranging from 48 to 62 %, and can also be accounted for by the presence of large multinational brewing companies. In absolute terms, Germany (15.7 million hectolitres), the Netherlands (14.7 million hectolitres) and Belgium (11.7 million hectolitres) were the largest European Union beer exporters (Berkhout et al. 2013).

In 2012 47 million hectolitres of beer produced in the European Union were imported. The largest importers were: Luxembourg, Estonia, France, Italy, and Malta, with 32–60 % of total beer consumption comprising imported beer (see Fig. 3). In absolute terms, the United Kingdom (8.8 million hectolitres), France (7.4 million hectolitres), Germany (7.3 million hectolitres) and Italy (6.2 million hectolitres) were the most important importers (Berkhout et al. 2013).

In the last 15 years the European beer market has undergone diverse changes resulting from technological progress, investments in development, mergers and establishment of new enterprises, as well as changing consumer attitudes. An increase in the number of smaller breweries has been noticed in all countries of the European Union. This contributes to a wider range of products being offered to consumers. It is also a favourable phenomenon from the viewpoint of sustainable

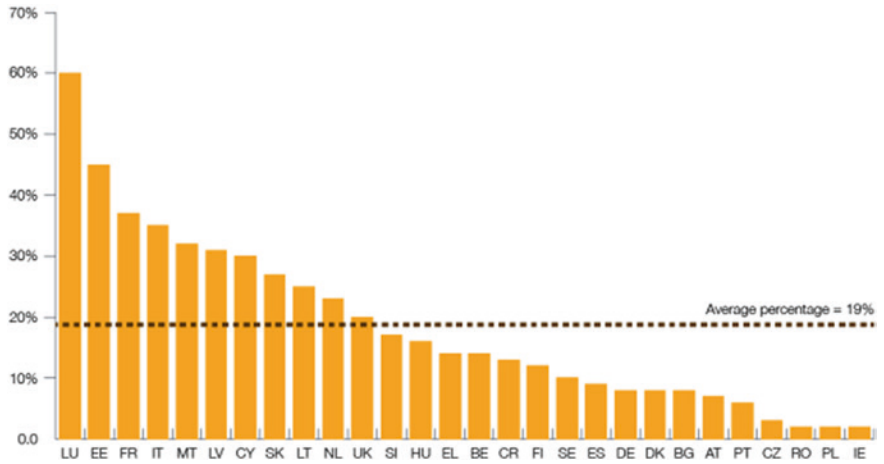

Fig. 3 Imports (intra-EU/extra-EU) in 2012 as a percentage of total consumption per EU Member State (adopted from Berkhout et al. 2013)

development because, as a rule, it indirectly contributes to development of regional tourism and a shorter production and consumption cycle, which has a positive influence on the environment (Jirovec and Calleja 2013).

The growing number of breweries and product innovations has also led to emergence of new products bringing benefits to consumers, the society and environment. Opportunities for breweries of all sizes have appeared thanks to diversification towards low alcohol and non-alcoholic beer, which has led to a rise in sales. Availability of ecological beer is increasing all the time, too (Jirovec and Calleja 2013).

2.2 Polish Brewing Industry

Thanks to fast privatisation of the leading breweries with the participation of foreign investors, the brewing sector in Poland quickly achieved world class in terms of technology. Between 1993 and 2002 beer production in Poland doubled (Lichota 2012), whereas between 2000 and 2011 alcohol consumption in Poland increased by 30 %, half of which was beer. In 2011 beer consumption per capita amounted to almost 94 l. As a result, the domestic beer market is currently the fifth biggest one in Europe, right after Germany, Britain, Russia and Spain (Okrzesik 2003).

Approximately 80 % of beer produced in Poland is made at breweries belonging to the three foreign concerns: SABMiller (Kompania Piwowarska), Heineken (Grupa Żywiec) and Carlsberg. Such a large degree of market concentration does not exist in any other European country. However, regional beer made at contract breweries (beer is brewed on the basis of their own formulas in the leased part of a large brewery's production line) or craft breweries (tiny production plants where small amounts of beer are produced) is enjoying growing popularity (2014).

Table 1 Beer consumption in Poland (adopted from Beer statistics 2012)

	2008	2009	2010	2011	2012	2008–2012
Total consumption in hectoliters	35,861,000	34,384,000	34,484,000	36,236,000	38,142,000	+6.4 %
Total consumer spending (in million Euro)	5,996	5,434	5,202	5,340	5,342	−10.9 %
Consumption of beer per capita (in litres)	94	91	91	95	98	+4.3 %
Beer consumption on-trade (hospitality)	20 %	15 %	15 %	13.5 %	10 %	−10 %
Beer consumption off-trade (retail)	80 %	85 %	85 %	86.5 %	90 %	+10 %

Beer production and sales are strongly dependent on seasonality. That is why breweries are forced to keep considerable production surpluses because they would not be able to cope with the increased demand during the summer season from May until August for technological reasons (Okrzesik 2003) (Table 1).

In Poland there are over 100 breweries, most of which are small breweries of local importance. As a result of numerous takeovers and mergers, three main brewing groups can be distinguished, i.e. Kompania Piwowarska, Grupa Żywiec and Carlsberg, which are united in the Union of Brewing Industry Employers—Polish Breweries (2014).

The leader of the domestic brewing industry is Kompania Piwowarska, whose owner is one of the largest beer producers in the world—the SABMiller concern. In the financial year 2013 the sales volume of Kompania Piwowarska amounted to 14.5 million hectolitres, which translated into a 38.2 % market share for the Group. It currently includes breweries in Białystok, Poznań and Tychy. The Group mainly owes its positive results to three brands that remain undisputed market leaders, i.e. Tyskie, Żubr and Lech (Kompania Piwowarska Sustainable Development 2013).

The vice leader of the Polish beer market is Grupa Żywiec with a market share of about 30 %. The shareholder of Grupa Żywiec is the Dutch brewing concern Heineken. In the first half of 2013 the capital group Żywiec sold 5.3 million hectolitres of beer, compared to 5.7 million hectolitres the year before. The most important brands of the Group are Żywiec, Warka and Tatra. Special beers such as wheat Paulaner and Warka Radler also enjoy great popularity. At present, Grupa Żywiec includes breweries in Żywiec, Leżajsk, Warka, Elbląg and Cieszyn (2013).

The third biggest company in the brewing industry is Carlsberg Polska with an approximately 14 % share in the Polish beer market and annual production exceeding 4 million hectolitres. The company was initially called Carlsberg Okocim S.A. After the takeover of all the shares by the Dutch concern Carlsberg in 2004 the name of the enterprise was changed into Carlsberg Polska S.A. The most popular brands of the Group are Carlsberg, Harnaś, Okocim, Karmi, Kasztelan, Bosman and Piast. Three breweries are part of the Carlsberg Polska Group, namely Okocim Brewery, Kasztelan Brewery and Bosman Brewery (Carlsberg Polska 2014).

In 2013 annual beer production in Poland increased by 0.7 % in relation to 2012 and amounted to 39.56 million hectolitres. Beer consumption, in turn, decreased in Poland in 2013 by 2 % to 37.2 million hectolitres, which resulted from the economic situation in the country and unfavourable weather conditions as well as quite a high basis from the previous year when the Euro 2012 championship took place, driving beer sales. According to data from the Central Statistical Office Główny Urząd Statystyczny, (GUS), in January 2014 annual beer production in Poland declined by 1.1 % compared to the same period of the previous year and was 2.79 million hectolitres (2014).

The falling sales on the domestic market is partly compensated by export. The year 2013 ended in a rise in export for the brewing sector. According to data from GUS, beer export increased by over 360,000 hl (16.7 %) in comparison with the previous year, reaching a level of more than 2.5 million hectolitres. These data provide a basis for forecasting a continually growing share of export in the total beer sales in 2014.

Beer sales at the current level of 37 million hectolitres proves market stabilisation. The expected improvement of consumer attitudes and continuous introduction of beer novelties may contribute to a small increase in sales. What might also improve sales in forthcoming years is a wider and wider range of special beers: non-pasteurised and flavoured ones (shandies and radlers), which are offered to consumers by all breweries in Poland. This reflects the tastes of the present enthusiasts of the beverage, who are characterised by openness to novelties, a search for new flavours and experiences. The trend for increasing demand for new flavours can be noticed by both corporate producers and small local breweries. The sales results from 2013 suggest that it is exactly this segment in which beer producers see a potential chance for the growth of the market which is perceived as already saturated (a statistical Pole drinks about 96 l of beer per year) (2014).

3 Case Studies

3.1 Responsible Sourcing

At the level of enterprise management, responsible supply chain management (RSCM) represents the conception of corporate social responsibility. The aim of a sustainable supply chain is to create, protect and strengthen environmental, social and economic values for all the parties engaged in supplying products and services

to the market. The brewing sector may contribute to expansion of the conception of sustainable development by co-operating with its suppliers and demanding similar involvement in environment protection aspects from them (UN Global Compact 2010).

3.1.1 Kompania Piwowarska

Kompania Piwowarska purchases from local suppliers, thanks to which new workplaces are created in the region, in addition to new opportunities for employees and their families as well as the local community. Furthermore, it contributes to taxes coming into local budgets and an improvement in healthcare and education quality. The company encourages suppliers and clients to treat their operation responsibly, especially in the field of ethical and ecological practices. Responsible and effective operation of partners in the supply chain brings them all such benefits as high product quality, cost reduction and competitiveness. All of these actions contribute to joint effort in aid of sustainable development.

Moreover, Kompania Piwowarska creates a sustainable supply chain due to its participation in the Ethical Trading Initiative (ETI) organisation. It is an alliance of companies, non-governmental organisations and trade unions that promotes responsible actions and behaviours of companies in the whole value chain, which can significantly contribute to better working conditions and life of employees who make different kinds of products. ETI has prepared an essential code of ethical conduct called ETI Base Code. The standard is currently popularised worldwide for audits at enterprises. Follow-up audits are performed in accordance with the SEDEX methodology. It is a non-profit organisation uniting many different organisations to work on improving ethical standards. Post-audit reports are placed on an internet platform, thus allowing every company to check if a given supplier realises actions in aid of sustainable development or not (Kompania Piwowarska Sustainable Development 2013).

3.1.2 Grupa Żywiec

In order to build a sustainable supply chain and support its partners, Grupa Żywiec has created a Supplier Code of Grupa Żywiec which defines important actions in the field of sustainable supply. According to the Code, a supplier's task is to "build and maintain relations based on honesty, trust, respect for human rights, observance of the law, respect for the environment and business practice consistent with the principles of sustainable development and the Social Responsibility Policy". All suppliers with whom contracts are signed as a result of a tendering procedure as well as those who raise doubts about the respect for the standards adopted by the company need to sign a declaration of being familiar with the Supplier Code and willing to obey the rules contained in it. Nearly 1,400 suppliers of the Group signed the document in 2012.

3.2 Reverse Logistics

In the modern economy there are few plants that may be called wasteless, which usually results from technological constraints. However, enterprises of high environmental awareness are trying to approach the assumptions of wasteless production. In order to do this, they are trying to increase material durability, select appropriate raw materials and optimise their use, and re-use the same materials. If it is not likely to avoid waste production, all possible effort should be made to recycle it.

Breweries are complex units, where processes of beer production are accompanied by both management-related processes and secondary processes, without which the enterprises would not be able to realise the primary processes. The secondary processes taking place at breweries include, among others, reverse logistics. Appropriate use of a brewery's capacity and effective action taken by its management in the face of changes resulting, for instance, from amendments to the "Waste Disposal Act" may decide on efficiency of the activity in this area. Breweries are specific organisations in that respect as two types of activity may be distinguished within reverse logistics (see Fig. 4), namely:

- activity connected with recycling individual packaging used to package and distribute beer,
- and activity connected with management of waste understood as "all substances or objects whose holders dispose of, intend to do so or are obliged to dispose of" (Lisiecka-Biełanowicz et al. 2014).

All around the world, breweries generate relatively large amounts of waste. An appropriate approach to waste management, however, makes it possible to treat the waste produced as by-products because a lot of this waste is valuable for farmers, recycling plants and other companies. Waste minimisation and finding alternative ways to use it are key methods of environment protection. Waste management is

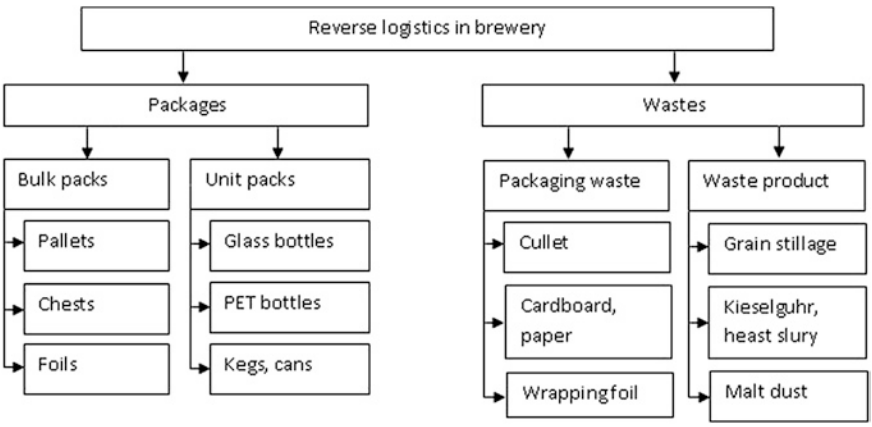

Fig. 4 Types of reverse logistics in a brewery

becoming a crucial issue, while traditional methods, i.e. storage, have a negative impact on the environment.

3.2.1 Kompania Piwowarska

As part of waste management optimisation, Kompania Piwowarska concentrates on three aspects: separating post-production waste intended for recycling, limiting the amount of waste taken to landfills, managing waste as harmlessly for the environment as possible. All waste from the production process, such as brewer's grains or waste yeast, are practically 100 % re-usable in farming, the pharmaceutical and cosmetic industries. Other waste, such as glass, metals, paper, cardboard, foil or wood, are segregated and passed on to specialist companies in order to be recycled. To reduce the volume of waste, breweries have introduced, for example, can crushers and pressing containers for other waste. Temporary landfill and segregation sites are prepared in such a way that safety is ensured and no waste can permeate into the soil (Kompania Piwowarska Sustainable Development 2013).

3.2.2 Grupa Żywiec

The brewery in Elbląg, belonging to Grupa Żywiec, has shown initiative to regulate the management of the waste produced at the brewery, in accordance with the country's and concern's policy on ecology. The 3R (Reduce, Reuse, Recycle) rule has been applied at the brewery. The main aim of the programme is to reduce the cost of non-segregated waste storage.

As a result of this initiative, the cost of non-segregated waste storage at the city landfill has been significantly minimised, waste treatment principles defining how to handle it ensuring people's life and health protection as well as environment protection have been introduced, in addition to principles of waste recycling and neutralisation.

Employees are trained in the obligation to segregate waste, which is aimed at increasing awareness and establishing good practices when handling waste. Employees of all external companies, subcontractors at the brewery's premises have also been trained in the ISO requirements, particularly those concerning dangerous waste handling.

The non-segregated waste production rate for the year 2010 was the following:

- for the brewery in Elbląg: 0.025 kg/hl (kilogram per hectolitre of beer produced)
- for Grupa Żywiec: 0.035 kg/hl

The amount of waste to be recycled is also controlled:

- 99.92 % of waste produced at breweries of Grupa Żywiec is subjected to recycling.
- 0.08 % of non-segregated waste produced at breweries of Grupa Żywiec is stored at the city landfill. At the brewery in Elbląg the rate is 0.01 %.

The initiative has resulted in limiting the increase in the costs of storing waste at the city landfill (Grupa Kapitałowa Żywiec S.A. 2012).

3.3 Sustainable Packing

Packaging is essential to the brewing sector, because it provides safe and fresh delivery of beer to consumers. In recent years there has been a move to reduce the amount of materials in packaging, i.e. light-weighting, for example by minimising the amount of glass used in glass bottles. There is a balance between reducing the weight of packaging/recycled content to reduce environmental impact and ensuring product safety and minimal waste due to breakages. Figure 5 shows that there is a variation in packaging materials and volumes in the EU. This is a reflection on consumer preference, culture, climate and the geographical area where the beer is being consumed. All materials which are used are recyclable and some are reusable. The materials most commonly used are steel, glass, aluminium and plastic polyethylene terephthalate (PET). Every country has a different approach to packaging for serving beer. However, the challenges each country faces are still largely the same in minimising the environmental impact of packaging. The main focus areas are in using reusable packaging, recycling, light weighting and increasing the proportion of recycled materials in newly made packaging (Donoghue et al. 2012).

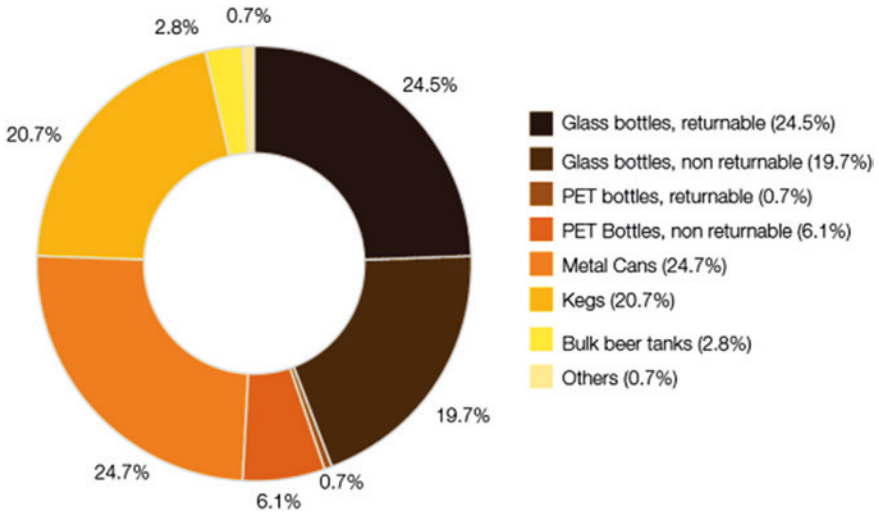

Fig. 5 Packaging used by European breweries (adopted from Berkhout et al. 2013)

3.3.1 Kompania Piwowarska

In order to ensure constant availability of returnable packaging for production, Kompania Piwowarska is continuously increasing effectiveness of gathering it from the market. The vehicles that come back to a distribution centre or a brewery after having delivered beer to a client should always do so with returnable packaging, regardless of the amount of the packaging available at the address of the delivery.

The company also tries to educate the market in the field of sorting packaging. Leaflets and posters that inform which bottles are returnable and in which crates they should be returned have been prepared for retail shops. When sorting quality is raised, production capacity on bottle lines is increased—and it is the packaging that is the most desired and, at the same time, most difficult element in the season because of reverse logistics (Kompania Piwowarska Sustainable Development 2013).

3.3.2 Grupa Żywiec

In 2010, in co-operation with one of the key packaging suppliers, Grupa Żywiec realised a project whose aim was to reduce the thickness of the metal sheet used to produce plain cans for Grupa Żywiec. The decrease in the metal sheet thickness from 260 to 245 μ translated into a decrease in the weight of the cans and made it possible to reduce the amount of the material used. The weight reduction by as little as 0.3 g enabled to decrease CO_2 emission by 1,310 kg and cut the amount of energy used by nearly 1.33 % for every million of new/lighter cans. In 2012 Grupa Żywiec bought 924,963,560 cans, which meant CO_2 emission savings at the level of 1,211 t (Grupa Kapitałowa Żywiec S.A. 2012).

3.4 Energy and Greenhouse Gases

Economic development causes an increasing demand for energy worldwide. It is satisfied to a large extent by burning fossil fuels such as coal, oil or gas. When burning fuels, huge amounts of carbon dioxide (CO_2), which, apart from other greenhouse gases such as methane, contributes to global warming and climate changes, are released into the atmosphere. Energy consumption and carbon dioxide emission have already ceased to be the subject of scientific theories only. Governments in the whole world are starting to exert pressure to introduce appropriate solutions by tax tools and fees for emission. In 2010, the average specific energy consumption of breweries was 116.8 MJ/hl (calculated on a LCV basis). This represents a decrease of 3.8 % since 2008 (see Fig. 6) (Donoghue et al. 2012).

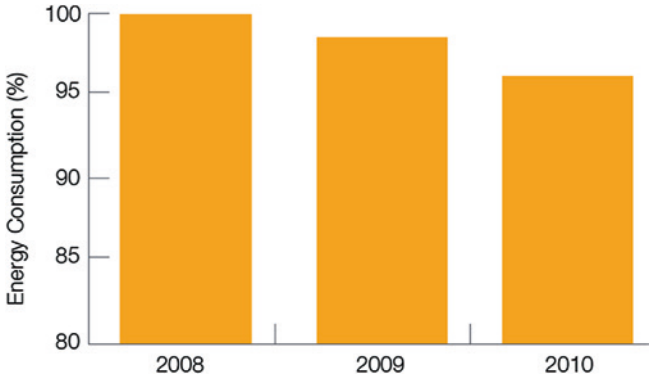

Fig. 6 Specific energy consumption of breweries in UE (adopted from Berkhout et al. 2013)

3.4.1 Kompania Piwowarska

At all breweries of Kompania Piwowarska, electric and thermal energy consumption is continuously monitored, which allows to identify the efficiency of the production processes. Additionally, at the breweries in Tychy and Poznań constant monitoring of fuel consumption in the boiler rooms is carried out, which, in turn, enables to regularly estimate the size of CO_2 emission to the atmosphere. At the same time, work connected with improvements in the technological processes and modernisation of the existing systems never stops at all the premises.

These actions have led to a significant reduction in the energy intensity indicators in recent years. The consumption rate of the thermal energy produced per a unit of beer made at the brewery in Poznań has gradually fallen from the value achieved in 2013 which was equal to 57.68 MJ of energy per hectolitre of beer. In the case of the electric energy consumption, the global rate for the entire Kompania Piwowarska was 5.84 kWh/hl of beer. The reference indicator of electric energy intensity determined in Best Available Technology (BAT) for the brewing sector ranges from 8 to 12 per hectolitre of beer. Therefore, the rate accomplished by Kompania Piwowarska suggests a high degree of commitment to limiting energy consumption in the production processes.

The use of renewable energy sources is mainly conditioned by technical limitations and availability of the "clean" fuels. The technical conditions of the brewery in Tychy allow to use renewable energy in the form of biogas produced at the premises of the factory's sewage treatment plant. Biogas, due to its composition, is burnt together with natural gas. Application of this innovative solution brings both economical and environmental benefits. Wanting to decrease the environmental burden, in 2006 Kompania Piwowarska eliminated the boiler room burning coal that was exploited at the brewery in Poznań and replaced it with a modern gas and oil boiler room. Thanks to the conversion of coal into gas and oil, a considerable reduction in the emission of, among others, carbon compounds

Table 2 Electric energy consumption in Kompania Piwowarska (adopted from Kompania Piwowarska Sustainable Development Report 2013)

Budget year (hl)	2011	2012	2013
Production output (hl)	14,364,997	13,646,374	14,740,165
Electricity consumption (kWh)	87,579,223	80,687,663	86,118,109
Indicator (kWh/hl)	6.1	5.91	5.84
Consumption of heat from non-renewable sources (GJ)	88,4049	81,3127	823,277
Consumption of heat from renewable sources (GJ)	56,597	43,265	50,036
Indicator (kwh/hl)	64.12	66.31	60.94

into the atmosphere was achieved. The boiler room is also additionally powered with biogas produced at the sewage pre-treatment plant. In 2013, the amount of heat used by the breweries in Poznań and Tychy from the so-called own sources produced from gas, oil or biogas was 760,412 GJ. Besides, the truck fleet which carries out Kompania Piwowarska's distribution processes is subjected to actions aimed at converting to fuels of low carbon compounds content. The result is replacing 20–30 % of the consumed diesel oil with natural gas (LPG). This technology makes it possible to reduce emission of particulate matter (Kompania Piwowarska Sustainable Development 2013) (see Table 2).

3.4.2 Grupa Żywiec

Grupa Żywiec is also trying to rationally use energy at individual breweries and technological processes. The company is trying to achieve one of the environmental objectives that it sets itself, connected with the necessity to reduce CO_2 emission, in two ways: by reducing the total energy consumption and increasing application of energy from renewable sources. In 2012, Grupa was successful in improving the renewable sources share in the thermal energy consumption (see Table 3). Simultaneously, the total thermal and electric energy use at Grupa Żywiec rose to 1,313,715,021 MJ (i.e. by 1.1 %), which was, however, mostly connected with an increase in production. The breweries in Elbląg and Warka

Table 3 Direct and indirect energy consumption in Grupa Żywiec in 2012 by energy sources (adopted from Plzenský Prazdroj Sustainable Development Report 2013)

	2011	2012
Purchase of electric energy (in kWh)	68,390,026	69,889,418
Purchase of heat (in MJ)	694,389,978	684,710,260
Sale of heat (in MJ)	12,978,396	13,222,373
Consumption of natural gas (in Nm^3)	10,972,982	10,691,016
Consumption of biogas (in Nm^3)	1,904,952	1,896,218
Consumption of oil (in kg)	55,215	54,337
Consumption of LPG (in kg)	549,123	485,502
Consumption of diesel oil (in kg)	15,942	10,693

noted a fall of the total energy consumption by 7.3 and 2.2 %, respectively. At present, the breweries in Elbląg and Żywiec enjoy the lowest energy consumption per 1 hl of beer. It amounts to 104 and 112 MJ/hl, respectively. The use of thermal energy at the breweries in Żywiec, Warka and Elbląg was also reduced. The results achieved in this area are connected, for example, with the following:

- the change of the type of beer produced at the brewery in Żywiec, which now requires lower thermal energy consumption (by 0.3 MJ/hl),
- the implementation of actions in the field of optimisation of processes in the brewhouse (Żywiec brewery), on the line of washing bottles (lowering the washing temperature from 84 to 80 °C),
- the optimisation of solutions in the field of heat recovery at the brewery in Żywiec,
- the replacement of selected technologies in the boiler room and water treatment plant in the boiler room at the brewery in Warka (Corporate Social Responsibility Report of Grupa Kapitałowa Żywiec S.A. for 2012).

3.5 Water and Wastewater

Brewing beer is a process requiring enormous quantities of water, which constitutes as many as 92 % of the beer volume. It is also used in production for cleaning, in steam production, cooling water and in heat exchangers for temperature control. A shortage of water poses, then, a potential threat not only to certain fields of brewery operation, but also to the communities among which they operate. One of the priorities for breweries is to increase beer production and, at the same time, reduce water consumption. The specific water consumption dropped by 4.5 % between 2008 and 2010. The specific water consumption, according to national production data, varied from 2.5 to 6.4 hl/hl with an average of 4.2 hl/hl in 2010 (Donoghue et al. 2012).

Water use in technological processes is inseparably connected with wastewater production. Breweries aware of the dangers resulting from uncontrolled movement of polluted water supervise the circulation of the wastewater produced and strive for reduction thereof. In 2010, every litre of beer produced in the EU translated into 2.7 l of wastewater on average, which constituted a 5.9 % fall in relation to the year 2008 (see Fig. 7) (Donoghue et al. 2012).

3.5.1 Kompania Piwowarska

As part of the co-operation between Water Futures and WWF and GIZ (a German international agency for development), SABMiller participates in developing new conceptions of water management. SABMiller engages in co-operation in aid of watershed protection on a global scale, and Kompania Piwowarska successfully

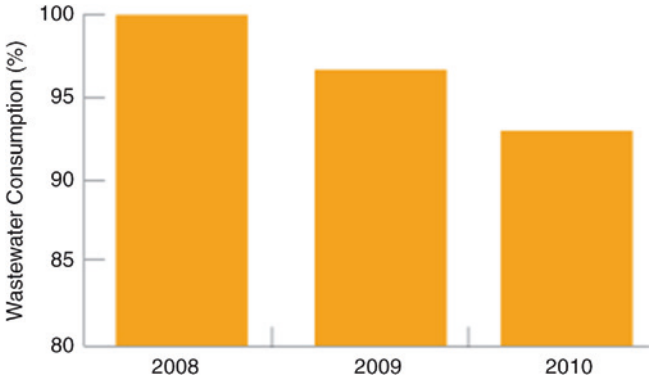

Fig. 7 Wastewater production by Breweries in Europe (adopted from Berkhout et al. 2013)

realises the priority of decreasing the amount of water used for beer production with a simultaneous increase in production. At every brewery of Kompania, water consumption calculated for a unit of the beer produced is monitored. The observations are carefully analysed and, on that basis, new solutions are introduced thanks to which the values keep decreasing. In 2013 the water consumption indicator for the whole company was 2.96 hl of water per a hectolitre of the beer produced (data for 2013). By contrast, 10 years ago the indicator was 4.6 hl per a hectolitre of beer. Water is supplied to individual breweries of Kompania Piwowarska from its own intake stations (underground water) or from the city water supply. In order to adjust its parameters to the beer production requirements, it is subjected to treatment processes (Table 4).

All three plants of Kompania are successful in reducing the amount of wastewater produced. In the last few years each of the breweries has managed to decrease the quantity of wastewater by a few dozen per cent. In Białystok, the amount of the wastewater generated has fallen by as many as 51 % in 7 years. The wastewater treatment principle is obeyed by every brewery before it releases it to the environment. When the existing infrastructure allows to do so, the treatment process is carried out at the brewery's premises. The one in Tychy has a modern wastewater pre-treatment plant at its disposal. It is based on anaerobic methods of treatment with granules. As a result of anaerobic fermentation, biogas is made, stored and, then, used as fuel of standard value to heat boilers. Wastewater from the other breweries is directly sent to the municipal treatment plants.

Table 4 Water consumption in Kompania Piwowarska (adopted from Kompania Piwowarska Sustainable Development Report 2013)

	2011	2012	2013
Total water consumption	46,134,680 hl	41,045,198 hl	43,595,926
Municipal water supply	33,056,450 hl	28,990,628 hl	29,840,036 hl
Water drawn from own wells	13,078,230	12,054,570 hl	13,755,890 hl

Kompania Piwowarska is striving for a decrease in the amount of the wastewater produced by partial re-use of water. It is possible thanks to the following (Kompania Piwowarska Sustainable Development 2013):

- using water from the brew kettle condensate to pre-rinse whirlpools,
- using water from the final rinsing at the clean in place for external rinsing,
- using the excess water from the bottle wash to wash empty crates,
- feeding conveyor sprinklers with water returning from can and bottle washes,
- using cascade water for foam fractionators.

3.5.2 Grupa Żywiec

The Heineken Group, which owns breweries in 70 countries worldwide, is also trying to increase effectiveness of using this material in production. The corporation has committed itself to lowering the water consumption rate to 3.7 l per 1 l of the beer produced before 2020. It will mean a 25 % reduction in comparison with the result achieved in 2008. In 2012 the average water consumption at 165 breweries of the Heineken group was decreased to 4.2 l per 1 l of beer.

The breweries of Grupa Żywiec which are part of the Heineken concern have for many years consistently been cutting the consumption of water used in beer production and currently belong to the most ecological and efficient ones in the world. Grupa's breweries in Żywiec, Warka, Elbląg, Leżajsk and Cieszyn use, on average, 2.9 l of water to produce 1 l of beer. In terms of water consumption, as many as 4 out of 5 breweries of Grupa Żywiec are in the top ten most ecological ones among 165 plants of the Heineken Group. An effective way of limiting water consumption applied by the Group has been implementing semi-dry and dry lubrication systems on the lines where beer is poured into bottles at the breweries in Leżajsk and Warka. Trials conducted at the Leżajsk production brewery have shown a decrease in the amount of water and wastewater on this production segment by 70 and 85 % in Warka in contrast with the traditional method. These systems are among the most advanced ones in the world (Corporate Social Responsibility Report of Grupa Kapitałowa Żywiec S.A. for 2012) (Table 5).

In 2012 the total amount of wastewater produced at the breweries of Grupa Żywiec constituted 60 % of the water used. Wastewater from the plants in Żywiec and Warka is partially deprived of pollution in the pre-treatment plants operating at the breweries before it gets to the municipal treatment plant. Due to increasing beer production, wastewater emission rose at all breweries apart from the one in Warka where the wastewater quantity fell by 2.8 % in relation to 2011. The plant

Table 5 Consumption of water in individual breweries of Grupa Żywiec (in m^3) (adopted from Corporate Social Responsibility Report of Grupa Kapitałowa Żywiec S.A. 2012)

	Cieszyn		Elbląg		Leżajsk		Warka		Żywiec	
Year	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Water consumption	21,040	21,621	701,458	701,082	375,776	446,417	838,791	845,968	1306,660	1374,866

in Żywiec maintained the 2012 value at a level close to the previous year, whereas at the other breweries the amount of the emitted wastewater grew (Corporate Social Responsibility Report of Grupa Kapitałowa Żywiec S.A. for 2012).

4 Conclusions

The European brewing industry undertakes actions in response to a range of objectives connected with energy efficiency, limiting carbon dioxide emission and water consumption as well as changes in packaging ways. This is an element of the policy realised by the European Union in aid of sustainable development. Investments made in co-operation with scientific institutions lead to a decrease in natural resources consumption, reduction of the amount of waste produced and consistent recovery of secondary raw materials created during beer production processes (Jirovec and Calleja 2013).

Breweries in the whole world, including the two largest beer producers in Poland, i.e. Kompania Piwowarska and Grupa Żywiec, demonstrate commitment to natural environment protection. The brewing sector has been working on guidelines concerning the Best Available Techniques (BAT), which emphasise the role of sustainable management and which may serve as a point of reference for engagement in achieving environment protection aims (Jirovec and Calleja 2013). The brewing sector in Spain has produced a comprehensive document of Best Available Techniques (BATs). The brewing sector and the Ministry of Environment combined their expertise to design the most accurate and up-to-date BATs possible. In addition to providing guidance on best techniques, the document also makes the point that sustainable management is important to be included in any economic growth plan and should be a factor in any decisions going forward. Further benefits of BAT documents are that they can be used as common reference resources to make realistic commitments to environmental targets in the future (Donoghue et al. 2012).

Supply chain management in a sustainable way is a great challenge for brewing enterprises. A trend towards replacing the classical supply chain with a value chain is currently being observed. The latter make it possible for breweries not only to reduce business and image-related risk, but also to improve the quality of products and build stable relationships with stakeholders. Breweries that want to develop a responsible supply chain system have numerous tools at their disposal. Apart from the Supplier Codes of Conduct, used, among others, by Grupa Żywiec, there are also many platforms and IT tools which index potential suppliers (Corporate Social Responsibility Report of Grupa Kapitałowa Żywiec S.A. for 2012). Kompania Piwowarska uses the SEDEX platform, which enables to gather and report information from suppliers, which is divided into four categories: work standards, health and safety, environment, and business ethics (Kompania Piwowarska Sustainable Development 2013). Another IT solution allowing to manage a responsible supply chain within which a brewery produces and delivers

its products is the CSRware's Sustainability Supply Chain. This programme makes it possible to benchmark individual suppliers. In addition, it evaluates suppliers on the basis of various indicators and allows to create one's own supplier ranking (Zrównoważony łańcuch dostaw: trendy i innowacje 2013).

The beer industry is the only one in which unit packaging is used. Packaging management in such a way that the greatest recycling degree is ensured constitutes one of the largest challenges for breweries. The two biggest beer producers in Poland conduct numerous campaigns and programmes aimed for ensuring the best packaging return system possible. The present system, however, is not sufficiently supported by the law, so a bottle makes, on average, 8–10 cycles. This type of returnable packaging, though, is prepared for a larger number of cycles, even more than 20 times. The deposit and return of beverage packaging system applied in Denmark seems a comprehensible solution. The initiative undertaken in 2002 by retailers and producers in agreement with the Danish Environmental Protection Agency was the first enterprise of this type and aimed for unifying the system of packaging return. Its main assumption was and is for one entity to be responsible for collecting and segregating packaging and paying deposits on a domestic scale. This entity operates as an external non-profit organisation which assures shops that they will obtain the due funds for sorting and returning packaging (Kacprzyk 2010). The costs of the whole system are reduced by installing machines enabling to return both returnable glass bottles and disposable packaging which is then recycled in retail outlets. As a result, the packaging does not re-circulate, which would have disastrous consequences for the environment. As a rule, the system is supposed to be self-sufficient; accordingly, producers and importers are obliged to cover part of the operational costs (Kacprzyk 2010).

Some valuable by-products are made during the brewing process from the raw materials used for beer production. They are appreciated and used in other industrial processes or as raw materials for specific aims or products, such as pharmaceuticals, healthy food, renewable energy sources, industrial application, feed for animals and farming products, cosmetics or spa products. The importance and value of the brewing by-products has persuaded breweries to sign long-term contracts concerning deliveries with traders and end-users. The production waste reuse indicator is close to 100 % both at Kompania Piwowarska and Grupa Żywiec's breweries. Similar results are achieved by many European brewing concerns. For example, the brewery Plzenský Prazdroj from the Czech Republic has collaborated with a local university to create a tool for making the best use of its secondary products. It is currently being used for the Plzeský Prazdroj brewery and, if successful, will provide a blueprint for other breweries. About 98.6 % of waste is used in a secondary way. Prazdroj has sought ways to further reduce the volume of waste that cannot be re-used with partners and suppliers of Plzenský. Plzeňský Prazdroj is a member of the EKO-KOM association, which deals with the issue of packaging recycling and re-use in line with the applicable Czech legislation (Plzenský Prazdroj Sustainable Development Report 2013).

In recent years, the European brewing sector has been trying to reduce water and energy consumption for beer production. As a result, water and energy consumption

has been decreased by 4.5 and 3.8 % per 1 hl of beer produced, respectively. It is estimated that CO_2 emission has also been limited by 7.1 %. Proper water and energy management by suppliers and breweries is necessary to guarantee the sustainable character of beer production. Kompania Piwowarska and Grupa Żywiec use, on average, 2.9 hl of water per 1 l of beer. The energy consumption rate per 1 hl of beer is, however, more varied—57.68 MJ for Kompania Piwowarska and 104 MJ for Grupa Żywiec. Beer producers in the whole Europe seek new solutions to improve these results all the time. Some enterprises not only reduce energy consumption, but also use energy from renewable sources. For example, the Clemens Härle brewery from Leutkirch produces all of its beer using 100 % of renewable energy. It has been the first brewery in Germany that has made all its beer with the use of green energy. Achieving this level of environmental performance has taken over 15 years. The first step was producing a document detailing a lifecycle assessment of the brewery, which could then be used to formulate a plan to move towards the ambitious goal. The largest investment the brewery has made was installation of a combustion plant which uses wood chips to provide all the brewery's heat. What is more, they have installed photovoltaic panels on the plant, which makes up to 12 % of the electricity needed. The remaining electricity required is purchased from renewable sources, including water, sun and wind. In total, the brewery has removed 900 t of CO_2 emission per year (Donoghue et al. 2012).

Enterprises of the European brewing industry are dependent on the quantity and quality of natural resources to a huge extent. This sector is, however, an example of great ecological awareness. Breweries all over Europe, including those in Poland, especially Kompania Piwowarska and Grupa Żywiec, continue working on decreasing their negative impact on the environment. Thanks to numerous investments in new technology and co-operation with all stakeholders, they protect the environment and contribute to development of the conception of social responsibility.

References

Beer statistics 2012 edition (2012) The Brewers of Europe

Berkhout B, Bertling L, Bleeker Y, Wit W, Kruis G, Stokkel R, Theuws R (2013) The contribution made by beer to the European Economy. A report commissioned by the Brewers of Europe and conducted by Regio Plan Policy Research and EY

Carlsberg Polska (2014) wzrost szybszy niż rynek. http://www.Carlsbergpolska.pl/media/najnowsze/pages/carsbergpolska_wzrosyszybszynizrynek.aspx. Accessed 25 Aug 2014

Corporate Social Responsibility Report of Grupa Kapitałowa Żywiec S.A. for 2012

Donoghue C, Jackson G, Koop JH, Heuven AJM (2012) The environmental performance of the European Brewing sector

Gadomska-Dzięcioł P, Stankiewicz J, Pezda M (2012) Komunikacja działań CSR w Polsce. http://effectivepr.pl/Image/pdf/komunikacja-dzialan-CSR.pdf. Accessed 25 Aug 2014

Henzelman T, Schaible St, Stoever M, Meditz H (2011) Geneza zielonej rewolucji ekonomicznej i spodziewane korzyści [in] Zielony wzrost, zielony zysk, Kluwer Wolters, Warszawa

Informacja prasowa Związku Pracodawców Przemysłu Piwowarskiego w Polsce (2014) Piwowarzy: rok 2014 zapowiedzią stabilizacji sprzedaży. http://www.browary-polskie.pl/artykulPlik/file_150.pdf. Accessed 25 Aug 2014

Jirovec L, Calleja E (2013) Opinion of the European economic and social committee on incentivising the growth potential of the European beer industry

Kacprzyk M (2010) Duński system depozytu i zwrotu opakowań napojów. http://copenhagen.trade.gov.pl/pl/analizy-rynkowe/article/detail,3378,Dunski_system_depozytu_i_zwrotu_opakowan_napojow.html. Accessed 06 June 2014

Kompania Piwowarska Sustainable Development Report 2013, (2014). http://www.kp.pl/documents/article/KP_raport_SD_2013.pdf. Accessed 25 Aug 14

Lichota J (2012) Beer statistics 2012 edition. The Brewers of Europe

Lisiecka-Biełanowicz M, Dusza J, Wawrzyniak J (2014) Odpady opakowaniowe w modelach gospodarowania odpadami niemedycznymi w szpitalach, Opakowanie, nr 3

Obszary zrównoważonego rozwoju w przedsiębiorstwie (2012). http://ksb.uek.krakow.pl/klub-ksb-alumni-mba/wyklady-goscinne/artykul/zobacz/obszary-zrownowazonego-rozwoju-w-przedsiebiorstwie.html. Accessed 25 Aug 2014

Okrzesik J (2003) Branża browarnicza, Boss Gospodarka, nr 7, s. 83–92

Plzenský Prazdroj Sustainable Development Report 2013. http://www.prazdroj.cz/data/web/spolecenska-odpovednost-2013/PP-SD-report-21x21-AJ-VERZE.pdf. Accessed 25 Aug 14

Produkcja piwa w Polsce lekko spadła w styczniu (2014). http://www.portalspozywczy.pl/alkohole-uzywki/wiadomosci/gus-produkcja-piwa-lekko-spadla-w-styczniu,97844.html. dostęp: 06 June 2014

Rynek piwa—analiza Equinox Polska (2013). http://gieldaspozywcza.pl/Wiadomo%C5%9Bci/Rynek-piwa-analiza-Equinox-Polska-60220.html. Accessed 25 Aug 2014

Skórski R (2012) Niszowe piwo podbija rynek. http://pierwszymilion.forbes.pl/niszowe-piwo-podbija-rynek,artykuly,31602,1,1.html. Accessed 25 Aug 2014

UN Global Compact Management Model (2010) Delloite

Zachęcające wyniki KP pomimo trudnych warunków rynkowych (2013). http://www.kp.pl/wyniki/wyniki-kp/. Accessed 25 Aug 2014

Zrównoważony łańcuch dostaw: trendy i innowacje (2013) Forum Odpowiedzialnego Biznesu

Żywiec sprzedał mniej piwa (2013). http://www.parkiet.com/artykul/1335499.html. Accessed 25 Aug 2014