Worldwide Brewing Alliance

REPORT ON ENVIRONMENT AND UTILITIES SUSTAINABILITY

Brewing Sector Initiatives in Environmental Sustainability

SEPTEMBER 2011

Worldwide Brewing Alliance

REPORT ON ENVIRONMENT AND UTILITIES SUSTAINABILITY

Brewing Sector Initiatives in Environmental Sustainability

Contents **Page**

Introduction

The worldwide brewing sector demonstrates its commitment to preserving and protecting the environment each day through a variety of initiatives. Brewers have a long history of implementing sustainable practices in all aspects of their business and continue to be at the forefront in this arena. Members of the brewing sector share a dedication to improving the environment through conserving energy and water, efficiently consuming raw materials, using products from the brewing process, reducing greenhouse gas emissions, establishing comprehensive recycling programmes, and supporting conservation organizations. While the specific efforts in this regard vary from brewer to brewer and country to country, the brewing sector has asserted itself as a leading environmental steward around the world.

All over the world, breweries are demonstrating their involvement in efficiency improvement programmes as part of an ongoing strategy of economic, environmental and social sustainability. This report does not attempt to include all the numerous initiatives undertaken in this area but, instead, seeks to indicate overall trends and give examples of voluntary schemes. It is clear from these examples that different strategies are needed, and that no single solution could be utilised on a worldwide basis. Whilst there is a trend towards increasing legislation, the brewing sector believes that any legal framework geared to sustainable development must provide sufficient flexibility to allow companies to continuously optimise brewing processes and operations which improve environmental performance without creating barriers to innovation.

The brewing sector has a tradition of sharing good practice and transferring knowledge and know-how. See **www.WorldwideBrewingAlliance.org** for other good practice publications. Members of the sector hope that the examples contained in this report will educate other brewers and sectors.

The information has been collected by the Worldwide Brewing Alliance[1] (WBA) from national brewing associations, some of whom have collected data from their members over a number of years.

Due to the individual features and conditions, it is difficult to compare breweries. Some form of benchmarking is required to do so. An international example on page 11 shows how this has been successfully undertaken by a large number of major brewing sites and shows trends which are replicated by all of the WBA members who have provided comparative data for this report.

[1] The Worldwide Brewing Alliance represents the brewing sector in Australia, Canada, China, Europe, Japan, Korea, Latin America, Russia and the USA (representing 88% of the world beer production). Its members are listed below:

The Beer Institute;
The Brewers Association of Australia & New Zealand Inc.;
The Brewers Association of Canada;
The Brewers Association of Japan;
The Brewers of Europe (whose membership encompasses 27 European brewing trade associations);
The British Beer & Pub Association;
Cerveceros Latinoamericanos (whose membership includes South American brewers and trade associations);
China Brewing Industry Association;
Korea Alcohol & Liquor Industry Association; and
The Union of Russian Brewers.

1 - Overall Trends in the Efficiency of Utilities

1.1 Energy Conservation *(See page 16 for detailed examples)*

Brewers recognize the need to operate efficiently and are committed to developing and adopting innovative ways to save energy. In recent years, electricity use has increased as a proportion of total delivered energy due to increased automation and refrigeration, but many brewers have successfully reduced their overall energy needs.

Alternative Sources of Energy
Brewers are increasingly embracing alternative sources (forms) of energy. For example, some brewers have found that utilising natural gas has contributed considerable environmental benefits. Others have achieved significant reductions in carbon dioxide (CO_2) and other emissions by using liquefied natural gas (LNG).

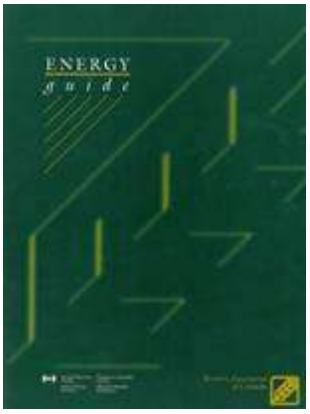
Others have turned to renewable sources of energy such as wind, sunlight, water or fuel cells to help power their operations, or use biowaste, such as rice husk, as fuel. Organic by-products of the brewing process can be refined to produce ethanol which can be blended with gasoline to save natural resources. In addition, breweries are installing co-generation plants which utilise energy, such as heat, which would otherwise be wasted.

Energy Efficiency Initiatives
Many brewers can demonstrate reduced energy usage over time. Several have harnessed employee awareness to identify and implement energy savings.

Through constant energy use monitoring and reporting, maintenance of facilities and adoption of technologically innovative techniques and equipment, brewers are able to ensure that beer is produced with improving energy efficiency. For example, boiling hops separately from the wort and utilising innovative refrigeration designs can reduce energy usage. Other energy-saving techniques include heat recovery systems that capture steam and condensation from kettle boiling during brewing for reuse to pre-heat process water and absorption cooling techniques that recover and reuse surplus heat and CO_2. Some breweries in cooler climates have also developed systems to save energy using induction fans that pull cool winter air into refrigeration units to chill beer.

Brewers also encourage sustainability in their suppliers. For example, a malting company recovers biogenic heat, which is generated by the germinating grain, and uses it to heat its malt houses. In some of their sites, it is the only heating source, removing all dependency on external energy.

Examples of Country Specific Initiatives:
The Brewers Association of Canada has produced an energy efficiency guide, "Energy Efficiency Opportunities in the Canadian Brewing Industry". The Guide, a joint project between the Association, its members and Natural Resources Canada, identifies energy efficiency opportunities for large and small brewers, as well as presenting data, new ideas, tips for improvements and opportunities for reducing CO_2 emissions.



The European Union is committed to increasing the proportion of renewables in energy supply to 20% by 2020, and the brewing sector across Europe is taking steps to achieve this.

In the Netherlands, brewers participate in several government-led, voluntary long-term agreements (LTA) on energy efficiency, which aim to promote energy savings in the Netherlands. The smaller brewers participate in an agreement signed by the national government, the provincial authorities, the participating companies and relevant trade associations and product boards. The aim is to reduce energy use by 30% by 2020 (2% each year from 2005). So far, the participants are on track in delivering these commitments. The larger brewers, part of the Emission Trading Scheme (ETS), participate in a separate agreement with the government. Currently parties are working on a long term programme which identifies possible targets for the participants.

1.2 Water Conservation *(See page 23 for examples of good practice)*

Water is the primary resource used in the making of beer. It is needed for two distinct purposes - the main ingredient of beer itself and as part of the brewing process for steam raising, cooling and washing. Traditionally, the amount of water needed to brew beer is several times the volume actually brewed. Brewers work daily to reduce this ratio, and water use has declined dramatically over the past few decades.

A proportion of the water used for brewing is extracted from private wells and springs. The remainder is taken from public supply. Worldwide brewers recognise the need to protect and conserve water supplies for the future and are achieving sustainable water management by constantly striving to find innovative and creative ways to manage water usage. Many are assessing their water footprint and have set targets for water usage reductions.

In addition to consistently improving the overall efficiency of the brewing process to reduce water usage, brewers implement several specific water-saving practices. For example, regular maintenance of taps and piping allows brewers to quickly identify and repair leaks, while installation of controls on equipment cleaning systems and water meters helps monitor overall water usage. Employee awareness schemes often help identify these and other water saving opportunities.

Several major brewers have built on-site water treatment plants that not only reprocess and purify water for the brewing process, but also often assist in the treatment of water for local municipalities. In addition, many plants recapture and treat wastewater generated in the brewing process, using aerobic (with air) and anaerobic (in the absence of air) treatment methods. Biogas captured through anaerobic and other wastewater treatment methods is used to produce electricity and heat for the brewing process with less carbon dioxide (CO_2) and other gas emissions than using fossil fuels, reducing brewers' reliance on non-renewable energy sources. The solid waste created through aerobic wastewater treatment is often used to fertilize local farms, and the lime from the wastewater treatment plant is reused as a soil conditioner. Both are rich in nitrogen and enrich the soil for agricultural use. The anaerobic treatment of wastewater reduces its strength and volume while creating a renewable biogas that helps fuel breweries. In some places, biogas energy is also being recovered from brewers' grains. This can be used internally, or fed into the central gas distribution network.

Other brewers have implemented systems to collect and purify rain water for use in the brewery, reducing demand on the public water supply. Water savings are also being achieved by increasing use of winter barley for beer production which requires less water and energy due to the off-peak growing cycle.

Water and energy efficiencies go hand in hand. Reduced usage means less pumping demand and lower heating and cooling loads. Reductions in water usage also lead to reduction of discharge of trade effluent.

1.3 Emissions Reduction *(See page 30 for examples of good practice)*

Greenhouse gases can occur naturally in the environment but are increased by many human activities. Breweries use energy, refrigeration and agricultural products; all of these can lead to the emission of greenhouse gases. The brewing sector is committed to the reduction of its emissions through a variety of initiatives.

Carbon footprinting estimates the total life-cycle of greenhouse gas (GHG) emissions caused by an organization or product. It is measured in units of carbon dioxide (CO_2). Generation of CO_2 in the brewing sector arises from combustion of fossil fuels - either at the brewery itself (direct emissions) or in the generation of electricity at power stations (indirect emissions). GHGs are also generated throughout the supply chain, from raw material and packaging production to transportation of finished goods to the ultimate fate of packaging materials after consumer use. Many of the examples already mentioned, such as use of alternative forms of energy, contribute to reduction in emissions and the carbon footprint of the beer being brewed.

Many brewers have introduced a dedicated carbon reduction programme. Some have developed projects which significantly reduce the emissions of fossil fuels and climate-relevant CO_2 from the production of beer. Others are tracking carbon dioxide emissions or working to estimate the carbon footprint of key brands. This can help to identify opportunities for further reduced emissions in the supply chain.

An emerging trend in brewing is recapturing the CO_2 which is produced naturally during the fermentation process, for example, by using CO_2 Advance Purification Systems (CAPS), and recycling it for use in packaging operations. This has the dual benefits of reducing emissions and the amount of CO_2 purchased for carbonation.

Examples of Country-Specific Initiatives:
Members of the Brewers Association of Australia and New Zealand operate within a number of voluntary and regulatory codes. These include the *International Carbon Disclosure Project*, a database of corporate climate change information; the *National Greenhouse and Energy Reporting Framework*, a mandatory reporting system for Australian corporate greenhouse gas emissions, energy consumption and production; and the *National Pollutant Inventory*, an Australian national database of pollutant emissions.

The Canadian Brewing sector is an active participant in the Canadian Industry Program for Energy Conservation (CIPEC), a voluntary industry-government partnership. CIPEC's mandate is to achieve energy reductions across industrial sectors, leading to a decline in greenhouse gas emissions. The brewing sector has initiated various programmes and activities to reduce energy use at the plant level, in transportation, in distribution and in retail. Company education and awareness programmes seek to create an "energy efficiency culture" among brewery employees. The use of a refillable and reusable standard mould bottle (SMB) by Canadian breweries is also an important measure in achieving these reductions.

The Canadian Industrial Energy End-Use Data Analysis Centre (Simon Fraser University), produces data on emissions based on energy use (by fuel type) collected by Statistics Canada. These data are made available through a publicly accessible database and include emissions for the brewing sector, among many others, on an in-plant basis.

In the Czech Republic, the brewing sector is working towards the country's long term energy and emission reduction goals in line with EU policy which aims to reduce greenhouse gas emissions by 20% and increase the use of renewable energy by 20% by 2020. The main projects are focused on decreasing energy and water consumption for beer production. Other projects include CO_2 collection in the area of primary fermentation and use of anaerobic wastewater treatment plants to eliminate high organic pollution of wastewater from breweries with low-energy demanding technology and potential use of biogas.

In the UK, the brewing sector is currently working on a project with the Carbon Trust and consultants CAMCO that aims to "bring about a step change reduction in CO_2 from industrial processes by accelerating innovation in process control and the uptake of low carbon technologies". Five sites in the sector have signed up for the first phase, which started in the summer of 2010. The main focus is on packaging (in kegs, casks, bottles and cans) and the boiling stage of production. These will be metered and measured to help gain a deeper understanding of the key causes of carbon emissions. The project is collaborative with results being shared across the sector. It will investigate alternative technologies and quantify potential energy savings. A benchmarking exercise of the wider industry will also run alongside the more detailed on-site work to establish which technologies are being used across the sector and any potential barriers to wider uptake.

In Japan, Product Category Rules (PCRs) for the beer sector were authorised on 25th January 2011.

2 - Packaging: Recycling and Efficiency

(See page 33 for examples of good practice)

Packaging is a critical component of the beer production process, and brewers are conscious of its impact on the environment. Beer comes in one of three main forms of packaging; large containers (such as kegs and casks), bottles and cans. Kegs and casks require no secondary packaging. Bottles and cans are transported individually in cardboard containers or in multi-pack packaging, cardboard, etc. Across the sector, brewers and brewer suppliers are constantly improving and reducing packaging and setting up business practices to increase the recycling rates of glass, plastic, paper and aluminium, both at their facilities and in the marketplace. For example, recycled glass now accounts for a significant percentage of the materials used to produce new bottles. Utilising aluminium also remains a prime consideration as it has the most recycled content of any beverage container, at approximately 68%. Since the early 1970's, can manufacturers in the USA have reduced the weight of the aluminium can by approximately 40%, and it is also the most widely used and recycled beverage packaging material. Through the recycling process, a previously used aluminium can can be back on store shelves within 60 days. Some brewers even have their own recycling facilities and are included among the world's foremost recyclers of aluminium cans.

The need to reduce packaging waste whilst maintaining food safety and quality is particularly challenging, but the brewing sector has been working with their partner suppliers to make their containers (glass, can and keg) more lightweight to save natural resources and energy in their production and transportation and minimise the impact on the environment. For example, a government-funded project in the UK, in which several brewers participated, led to 31,800 tonnes of beer and cider bottles being removed from the waste stream

Brewers are also reducing packaging weight and cardboard content. They have worked to not only utilise a significant amount of recycled cardboard in packages but have also reduced the overall amount of cardboard used.

The brewing sector also recognizes the importance of recycling and conserving paper products. This includes switching from conventional paper to custom stationery containing recycled material. Educating employees on the importance of recycling efforts and making small changes in day-to-day business practices - such as converting to electronic forms and filing systems - also assists in reducing paper waste.

In addition to their own corporate recycling programmes and schemes to reduce the amount of waste being sent to landfill, brewers and brewer suppliers encourage the communities they serve to recycle and to help grow community participation in residential curbside recycling.

In many countries, draught beer is sold in reusable kegs and casks which can last as many as 30 years before being crushed and recycled. In the UK and the Czech Republic, half of consumption is still delivered in draught format.

Examples of Country-Specific Initiatives:
Australian brewers support the Australian National Packaging Covenant, which has a packaging recycling target of 65% by 2010. As part of the Covenant, brewers have made voluntary funding contributions to various projects under the Packaging Stewardship Programme, which includes resource recovery and education programmes.

In Canada, beer is mainly sold in refillable and reusable bottles - the vast majority of brewers in Canada, large and small, now use a common standard bottle produced in an industry Standard Mould Bottle (SMB). Refillable bottles can be used approximately 15 times before being crushed and sent to glass makers to be made into new bottles. The return rate on industry glass is 99%.

The Canadian brewing sector takes the Extended Producer Responsibility (EPR) approach to packaging. This means that industry takes full responsibility (including costs) for packaging and other materials, from “cradle to grave”. The Canadian Council of Ministers of the Environment (CCME) is consulting on a Canada-wide “Sustainable Packaging Strategy” and “Extended Producer Responsibility” (EPR).

In 1997, Cerveceros de España launched a packaging waste prevention plan. Since then, the plan has been regularly updated and aims at preventing packaging waste as part of a continuous development process also involving other environmental goals. These goals are monitored every year, with high compliance rates.

3 - Other Initiatives

3.1 Environment Protection and Education *(See page 37 for examples of good practice)*

Brewers continuously strive towards sustainable use of resources throughout the supply chain. From the harvesting of beer crops to the selling of its products, the brewing sector aims to lead by example in the protection of the environment.

Brewers and brewer suppliers strive to expand their positive impact by creating more eco-friendly packaging and other materials. A US-based brewer supplier created non-toxic, photodegradable ring carriers. These carriers are broken down by sunlight, not only preventing them from becoming a hazard to wildlife but also reducing pollution. Increased recycling of ring carriers has diverted more than 1,000 tonnes of waste from landfills. Also in an effort to create a safer environment for wildlife, can manufacturers are using more environmentally sound water-based can coatings.

Many breweries have recognised the importance of employee awareness to help reduce carbon emissions and energy and water consumption. Examples include:

- Simple education messages;
- Data collection and monitoring to identify savings;
- Competitions and/or rewards for improvement suggestions; and
- Sustainable development initiatives within the brewery or the community.

Some brewers have also appointed environmental management teams who, together with beer suppliers, work with leading environmental organizations. From organising and participating in community clean-ups, to funding wildlife rescue centres, brewers worldwide are increasingly involved in environmental preservation and education initiatives. Beer companies financially support wildlife and habitat conservation programs around the world and seek to educate on the importance of maintaining a healthy environment.

3.2 Targets and Commitments *(See page 40 for examples of good practice)*

Many brewers have specific environmental targets for energy, water and/or emissions reduction. Some brewers have set sustainability targets or installed objective sustainability tracking systems. Targets demonstrate commitment not only to achieve more sustainable business practices but also to ensure that monitoring and tracking systems are in place to record progress and inspire additional savings.

3.3 Reports

Many brewers publish and widely distribute information on their sustainability programmes. For example, Foster's Group Heineken, Lion Nathan Limited, SABMiller and MillerCoors all publish annual sustainability reports on their websites. Carlsberg has an Environmental Focus Area. AB InBev includes managing environmental performance in their Citizenship Report, and Coopers Brewery has reports on individual initiatives on their website. Information on the Canadian brewing sector's environmental record and specific initiatives can be found on the website of the Brewers Association of Canada. In 2007, The Brewers of Europe contributed to a publication issued by the European Food & Drink Federation: Managing Environmental Sustainability in the European Food & Drink Industries. Many of the details included can be found in the examples below.

In 2005, a guidance document on the best available technologies of the brewing industry in Spain was jointly published by Cerveceros de España in conjunction with the Ministry of Environment. Since then, competent authorities at the regional level and breweries conform to the same rules in a clear context.

4 - Examples of Benchmarking

Americas, USA, MillerCoors, Tracking Sustainability Progress
MillerCoors utilises the Sustainability Assessment Matrix (SAM), a measurement tool and benchmarking system based on inputs from the Global Reporting Indicators G3 guidelines and UN Global Compact Principles, to track its progress. Twice yearly, a SAM assessment on 10 global sustainable development priorities is completed, and the results are shared publicly on the website. Each priority has a 'stairway' that plots a course through four levels of performance from minimum standard to best practice. During the most recent reporting period, MillerCoors overall SAM score improved by 3.5%, from 3.08 to 3.19. More than 60% of MillerCoors' scores are at a level three or higher.

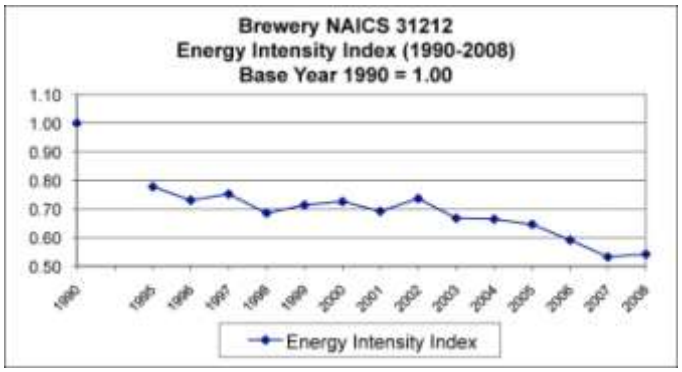
Americas, Canadian Statistics
In Canada, energy consumption data is compiled by the Government of Canada, Statistics Canada, through the annual Industrial Consumption of Energy (ICE) Survey. This Data is made available to the public through the Canadian Industrial Energy End-Use Data Analysis Centre (CIEEDAC, Simon Fraser University), an independent, non-profit organization, through an arrangement with the Government of Canada. CIEEDAC also produces data on carbon dioxide and other greenhouse gas emissions on a sector basis.

Figures from CIEEDAC show that the Canadian brewing sector, on an in-plant basis, reduced its greenhouse gas emissions (carbon dioxide equivalent) from 339 kilotonnes to about 141 kilotonnes between 1990 and 2008. Per hectolitre of beer produced, this represents a decline of 60% in GHG emissions due to introduced energy efficiencies and new technologies. Anti-idling measures and technologies for delivery vehicles have also proved effective with respect to reductions, while a reusable Industry Standard Bottle (ISB) helps avert GHG emissions.

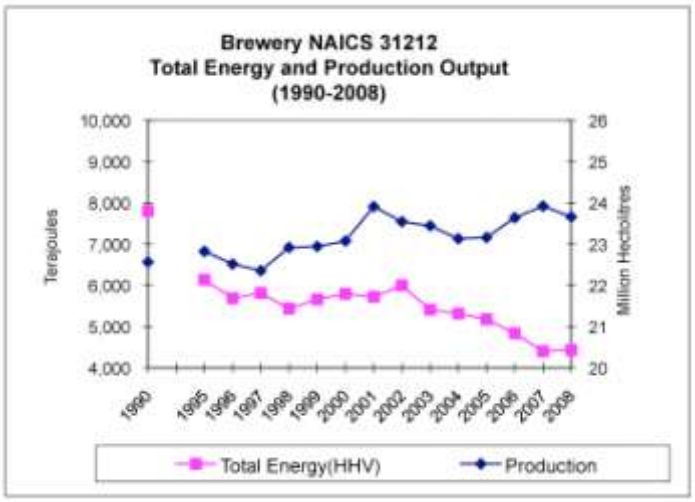
During the same period, the brewing sector reduced its energy use from 7,804 terajoules to 4,434 terajoules, while increasing production by over 1 million hectolitres. This translates into a remarkable change in energy intensity, from 0.346 gigajoules/hectolitre in 1990 to 0.187 in 2008. Natural gas remains the key fuel source for the Canadian brewing sector, accounting for 65% of energy used, followed by electricity at 24%, with the remainder from other fuel sources such as heavy fuel oil, middle distillates and propane.

The CIPEC (Canadian Industry Program for Energy Conservation) 2010 Annual Report highlights the achievements of the Canadian brewing industry which reduced its energy use, while at the same time increasing production. The following graphs from the Annual Report illustrate this progress:

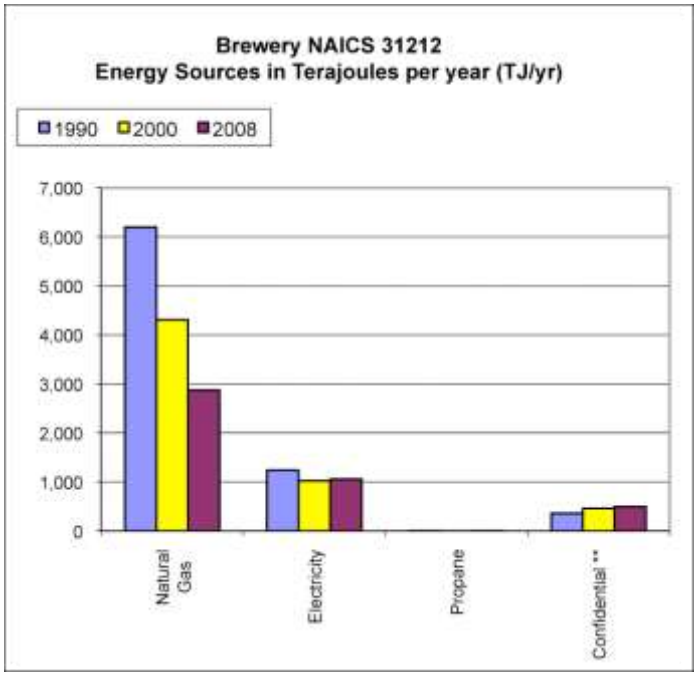
Graph 1



Graph 2



Graph 3



Global, [Beverage Industry Environmental Roundtable]

The Beverage Industry Environmental Roundtable (BIER) is a technical coalition of 16 leading global beverage companies working together to advance the standing of the beverage industry in the realm of environmental stewardship. Brewers involved in the initiative are AB InBev, Carlsberg, Diageo, Heineken, MillerCoors, New Belgium Brewing Company and MolsonCoors. BIER focuses on water conservation and resource protection plus energy and climate change mitigation. As a technical coalition, the group has worked to develop common methods for beverage companies to report on their greenhouse gas emissions and water footprint. BIER has released specific beverage sector guidance in these areas. BIER has also issued best practice guidance regarding water use and

conservation and greenhouse gas emission reduction. Recent BIER publications include: *World Class Water Stewardship in the Beverage Industry, 2010* report which defines elements exhibited by leading water stewards; and *Water Use Benchmarking in the Beverage Industry: Trends and Observations, 2010* which identified an overall improvement in industry-wide water use ratio between 2007 and 2009 within four main facility types including breweries. The data from the 117 breweries included in the survey, showed an improvement of water use ratio of 14%, with 70% of the facilities showing an improvement in this period.

Global, International Energy Benchmarking

Results from the third in a regular series of "International Energy Benchmarking" published in 2010[2] show that the global brewing sector is leading the way in the reduction of carbon emissions with an 11% reduction in a four-year period. This has been supported by a growing number of breweries (143 in the 2007 survey) from all over the world.

The benchmark has been performed three times, on data from 1999, 2003 and 2007. The funding has been provided by the Dutch Brewers' Association (CBK, Centraal Brouwerij Kantoor) with the aim of supporting continuous improvement. It has been undertaken by a partnership between KWA Business Consultants (Netherlands) and Campden BRI (UK).

From the first benchmark in 1999, it has been possible to identify "Normalisation (or "Correction") Factors" that enable breweries to be compared fairly, whatever the circumstances in which an individual brewery operates. Such factors must essentially be outside the control of the brewer (by definition of circumstance or product quality requirement) and be of such significant effect that the data is able to prove the existence and quantify the factor. Four normalisation factors are employed:

- Climatic conditions: this affects the heating requirements for buildings, the temperature of incoming raw materials and water and the condensing pressure of refrigeration plants;
- Packaging mix: returnable bottles have to be sorted and washed on return, so there is an increased need for both thermal and electrical energy. Kegs require washing and therefore the thermal energy requirement is higher than for single trip bottles and cans;
- Wort boiling evaporation rate: the boiling operation may account for as much as 30% of the thermal energy requirement of the brewery. Therefore, a product that requires particularly high or low evaporation rates will have a significant effect on energy usage;
- Brewing at high gravity: reduction of process volumes enables reduced energy demands and losses in a variety of ways.

Individual brewery's energy consumption figures are "normalised" using the following formula.

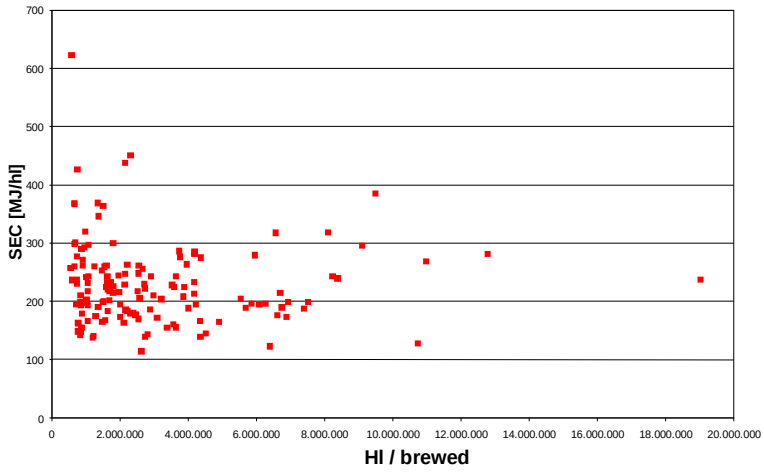
$$\text{Specific Energy Consumption} = \frac{f3 \times \text{Thermal Energy}}{((f5 \times f6 \times \text{Brewed Volume}) + (f1 \times \text{Packaged Volume}))\ /\ 2} + \frac{f4 \times \text{Electrical Energy}}{(\text{Brewed Volume} + (f2 \times \text{Packaged Volume}))\ /\ 2}$$

Normalisation Factors:
f1, f2 for packaging mix, e.g. f1 = 1.00 for returnable bottles, 0.63 for single trip.

[2] Freeman G, Pennartz F and Jackson G. (2010). "Benchmarking Success. Worldwide Energy Benchmark: Increased Efficiency". Brewer and Distiller International.

f3, f4 for climactic conditions on “degree days”, calculated from time to time at different ambient temperatures.
f5 for wort boiling evaporation rate.
f6 for high gravity brewing, e.g. f6 = 1.00 for ≤14P, 0.83 for ≥17P.
Graph 4 shows the distribution of energy consumption figures (normalised) from the 2007 benchmark.

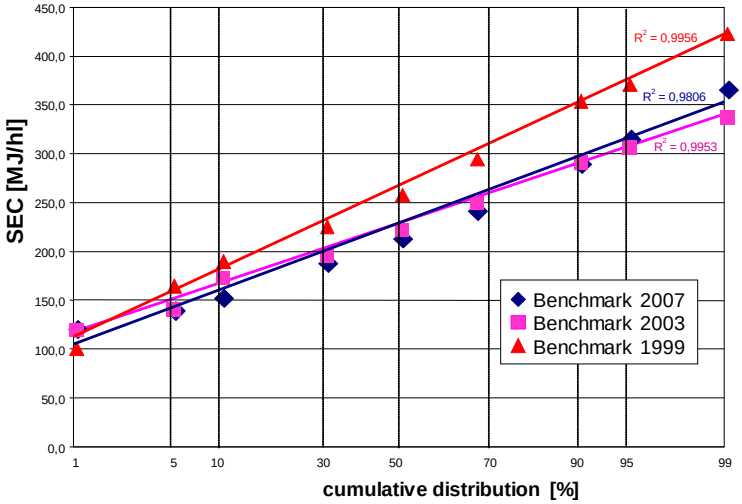
Graph 4



The benchmark is limited to large (more than 500,000 hl / annum) lager breweries, which is why the effect of economy of scale is less pronounced than one might expect.

Graph 5 plots the energy consumption figures from the three benchmarks on probability paper enabling visualisation of mean and best practice figures.

Graph 5



For a normal (bell-shaped) distribution of data the result is a straight line, and this is confirmed for the three benchmarks. The plot enables one to see the values that correspond to good practice. In particular, the highest value to be in the top 10%, which may be regarded as “best practice”, can be read from the plot.

A summary of the results from the three international energy benchmarks, showing the demonstrable performance improvements by the sector is given in table 1.

Table 1

Year of data collection	Number of participating breweries	Specific Energy Consumption (normalised) / MJ / hl			% improvement in top 10%
		Mean	Median	Decile (top 10%)	
1999	88	271	261	193	
2003	158	239	233	176	9
2007	143	229	220	156	11

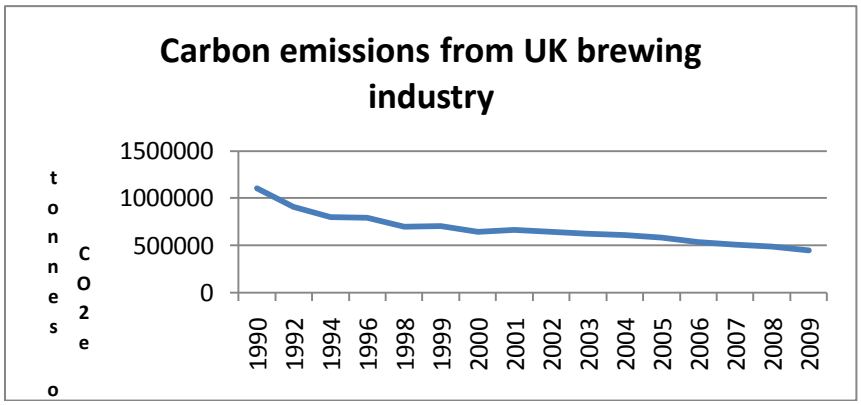
It can be seen that the specific energy consumption level, considered to be "best practice", is still continuing to fall significantly. in the period 1999 to 2003 the top 10% improved by 9% (193 to 176 MJ/hl), in the next 4 year period, 2003 to 2007, the top 10% improved by 11% (176 to 156 MJ/hl),

United Kingdom Benchmarking

In the UK, the British Beer & Pub Association (BBPA) has undertaken a biennial environment and utilities survey since 1976. This allows breweries to track their specific energy consumption (MJ/hl) against the industry average and also against breweries of a similar size. These data were also useful when the UK government introduced Climate Change Agreements in 1999 as a means of encouraging a reduction in energy usage. In return for meeting sector targets, members of the sector agreement received an 80% discount on the Climate Change Levy, an energy tax. The targets are bi-annual and, to date, the brewing sector has met every one, leading to an estimated saving to the sector of £40 million - and 172,000 fewer tonnes of CO_2 in 2009 compared to 1999.

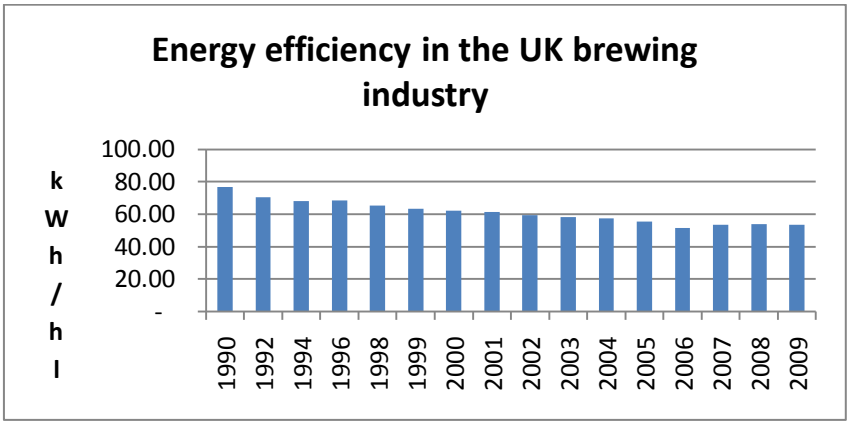
The survey results show that carbon emissions from the UK brewing sector (graph 6) have fallen by 60% from 1990 - 2009. While these reductions have partly been the result of falling beer production, they have mostly been achieved through large-scale investment in more efficient plants and savings through rationalisation. In 2010, the sector committed to a 67% reduction in CO_2 emissions by 2020.

Graph 6



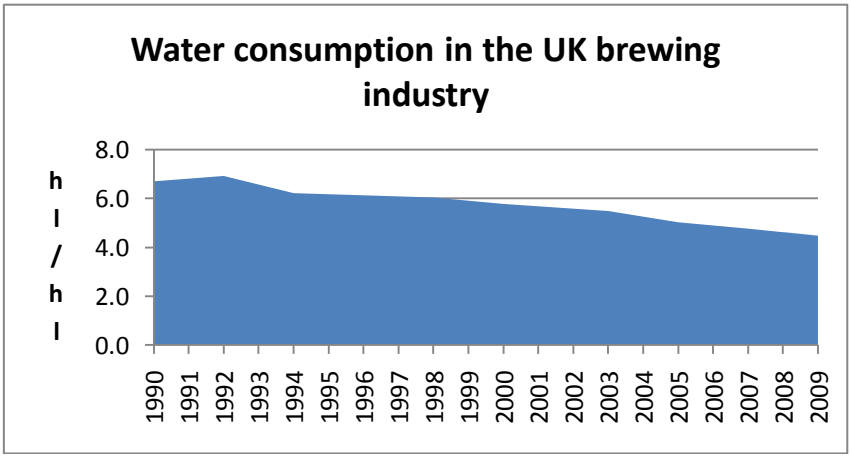
Graph 7 shows that the declines in energy efficiency seen in recent years have levelled off. This is due to a number of challenges facing the industry including the decline of production volumes, the consumer's move away from draught beer and the need to retrofit new technology into what are often historic buildings.

Graph 7



Since 1990, water efficiency has increased dramatically, by 33% (Graph 8). This has been achieved despite additional legislation on food safety which has required further water to be used for cleaning. In 1990, producing a typical hectolitre of beer required 6.7 hectolitres of water. This had fallen to 4.5 hectolitres by 2009, with some brewers achieving even greater efficiencies - the industry's reduction in water use equates to over 7,000 Olympic swimming pools at 2009 production levels. In 2010, the sector committed to a target of using less than four hectolitres of water per hectolitre of beer by 2020.

Graph 8



A wider definition of waste has led to a nominal increase in waste volumes from breweries between 2006 and 2008. However, despite this increase, the amount of waste sent for disposal has more than halved, as the percentage of waste recovered has risen sharply, from 71% to 89%. Figures for waste will continue to improve, through increased use of technology and innovation.

5 - Examples of Good Practice

This section includes almost 110 examples from 28 countries, including initiatives from global brewers, large breweries and small independent operations.

5.1 Brewery Efficiency - Energy Conservation

5.1.1 Use of Alternative and Renewable Energy Sources

Americas, Canada, Yukon Brewing Company, Utilising Spare Hydro Capacity
Yukon Brewing Company utilises spare hydro capacity to reduce use of carbon-based fuels.

Americas, USA, Anheuser-Busch, Use of Solar Panels
Anheuser-Busch uses solar photovoltaic systems at their breweries in Newark, NJ, and Fairfield, CA. In Newark, the company has completed the second phase of a rooftop installation, which now has more than 7,000 photovoltaic solar panels and covers 130,000 square feet. In total, more than 1.1 million kWh could be produced annually, and at peak production, the array will be capable of satisfying nearly 10% of the brewery's electricity demand. When combined with the solar array at the Fairfield, CA, brewery, Anheuser-Busch is now one of the largest users of solar power in the US brewing industry.

Americas, USA, Brooklyn Brewery, Using Wind Power
On September 1, 2003, Brooklyn Brewery became the first New York City company to operate solely on wind-generated electricity, with the brewer choosing to pay a premium for the alternative power source.

Americas, USA, MillerCoors, Providing Ethanol for Fuel
Since 1995, the Golden, Colorado brewery, in partnership with another company, has operated an ethanol plant that in 2008 produced 1.7 million gallons of fuel-grade ethanol by refining organic by-products from the brewing process. The 200-proof ethanol is blended with gasoline and sold throughout the Rocky Mountain region. A recent expansion has doubled the refining capacity to 3 million gallons a year, helping the environment while decreasing dependence on oil from overseas.

Americas, USA, New Belgium Brewing Company, Power from Biogas
New Belgium Brewing Company supplements 14% of its energy needs with power generated from biogas it captures through wastewater treatment. In January 2010, the company commissioned a 200 kW array of solar photovoltaic panels on the roof of its packaging hall that contributes more than 3% of its electricity needs. New Belgium Brewing also pays a premium for wind power for much of its additional electrical needs. As an employee-owned company with profit-sharing, the decision to increase energy costs had to be approved by employee vote. The vote was unanimous in favour of the increased costs.

Americas, USA, Sierra Nevada Brewing Company, Use of Solar Panels
Sierra Nevada Brewing Company provides a majority of its electrical energy needs with clean power produced by its on-site fuel cell and solar panel installations. Both are one of the largest installations of their kind in the United States. The brewery operates a 1.2 megawatt (MW) fuel cell plant and has nearly 11,000 solar panels, capable of producing 1.9 MW of DC power, or 1.4 MW of AC power. During peak usage times, the company is able to sell surplus energy generated back into the general power-grid.

Asia, Australia, Coopers Brewery, Co-generation Plant

Most of Coopers Brewery's electricity and steam requirements are drawn from a 4.4 megawatt (MW) natural gas-powered co-generation plant located on site. The co-generation plant was built in 2002 in partnership with the Australian Gas Light Company (AGL), as part of a 20-year energy supply agreement. A dedicated 4km natural gas supply line was also built to supply the necessary gas at high pressure. This is burned in a gas turbine to drive the electrical generator. Waste heat from the gas turbine is harnessed to produce steam which is used in the brewing process.

80% of the fossil fuel energy is converted, in the co-generation plant, into useful energy (power and steam), approximately 2.5 times greater than a conventional coal-fired power station. This has reduced carbon dioxide emissions by up to 15,000 tonnes per annum compared with using grid electricity and conventional gas-fired boilers.

The co-generation plant produces 24,000 Megawatt hours (MWh) of power per year, but the brewery only uses about 6,500 MWh. The excess power is fed into the South Australian power grid through a high voltage underground power line. The plant also generates 50,000 tonnes of steam a year, used for heating in the brewing, evaporation and packaging processes. Steam was previously generated at the brewery by gas-fired boilers. An absorption chiller unit has also been installed, which uses surplus steam from the co-generation plant to produce chilled water for brewing.

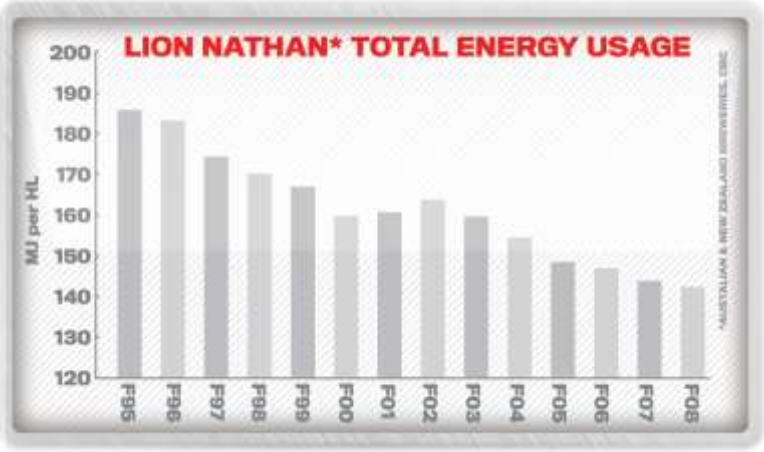
Asia, Australia, Lion Nathan, Conversion to Natural Gas

Conversion from coal to natural gas at the Castlemaine Perkins Brewery was not a short-term economic advantage for Lion Nathan, as coal is much less expensive, but one made due to the company's commitment to environmental sustainability. The benefits of conversion to natural gas include:

- Water savings: savings of up to 40 kilolitres of water per week due to the gas boiler's ability to closely follow the brewery's requirement for a varying steam load. Previously, the coal boilers vented steam to meet varying demand;
- Electricity saving: the gas boilers provide an electricity consumption saving of around 384,000 kilowatts per annum compared to the coal boilers due to a reduction in energy required for the coal handling process, including pumps and fans. The gas boilers also provide a reduction in carbon dioxide emissions of around 401,000 kilograms per annum;
- Reduction in carbon dioxide emissions: in addition to the reduction in CO_2 emissions due to reduced electricity usage, the use of natural gas reduces carbon dioxide emissions by up to 10,000 tonnes per annum; and
- Disposal of coal combustion products: the use of natural gas removes the requirement for disposal of ash and clinker from the coal boilers.

Overall, Lion Nathan usage rates of energy per hectolitre of beer packed are now 25% less than they were in 1995, and the downward trend continues (Graph 9).

Graph 9



Asia, India, SABMiller, Using Renewable Energy from Biowaste
SABMiller India has invested in renewable energy sources including biowaste. Over the last few years, rice husk boilers have been installed in three breweries; Rochees, Haryana and Charminar. The boilers use biowaste, typically rice husk, as fuel. The many benefits include: reducing manufacturing and fuel costs; reducing the brewery's dependence on scarce fossil fuels; and generating extra income for local farmers from the sale of the husks. In addition, rice husk ash can be sold on for use as a cement filler, an insulator in steel mills and an input for activated silica extraction. The initiative is now working successfully at all three breweries and is now the default choice for all greenfield projects in India.

Europe, Czech Republic, Měšťanský Pivovar v Poličce, a.s., New Wastewater Treatment Plant
Usage of Polička´s communal wastewater treatment plant (WWTP) was evaluated as insufficient and expensive for the brewery, so an in-house independent WWTP has been implemented. The new WWTP was constructed using an upflow anaerobic sludge blanket (UASB) reactor and additional water treatment with activated sludge and co-precipitation of phosphorus. Biogas produced in the process is used to generate heat for the UASB reactor. Operation costs are lower than the standard of commercial municipal WWTPs.

Europe, Czech Republic, Radegast, Anaerobic Wastewater Treatment
Radegast brewery was the first to install an anaerobic wastewater treatment plant in the Czech Republic in 1994. This demonstrated how to eliminate high organic pollution of wastewater from the brewery with low-energy demanding technology and potential use of biogas.

Europe, Norway, Ringnes Norway (Carlsberg Group), Using Liquefied Natural Gas
Ringnes EC Dahls was the first brewery in Norway to use Liquefied Natural Gas (LNG) as an energy source to produce beer and mineral water, thereby creating environmental improvements and reducing overall energy costs. Ringnes EC Dahl uses about 15.8 GWh annually to produce beer and mineral water. The new gas plant was installed in December 2009. The change from oil to LNG results in a NOx reduction of 59%. It also equates to a 24% reduction in CO_2 emissions. Furthermore, the emission of SO_2, soot and other particles will be eliminated with the transition to LNG as an energy source.

Europe, UK, Adnams Brewery, Gas Production from Anaerobic Digestion
In July 2010, Adnams Bio Energy Limited announced the completion of the construction phase of an anaerobic digestion (AD) plant. It is the first in the UK to use brewery and local

food waste to produce renewable gas for injection into the national gas grid as well as providing gas for use as a vehicle fuel. In partnership with British Gas and the National Grid, the facility will generate up to 4.8 million kWh per year - enough to heat 235 family homes for a year or run an average family car for 4 million miles. In the future, the facility will produce enough renewable gas to power the Adnams brewery and run its fleet of lorries, while still leaving up to 60% of the output for injection into the National Grid. Through the generation of biomethane, the plant will make a contribution to de-carbonising the gas grid by delivering renewable heat to households through the existing gas network and central heating boilers. It will also prevent the release of highly-polluting methane to the atmosphere, through diverting the waste from landfill.

Europe, UK, Diageo, Using Wind Power
All the Belfast packaging plant's electricity needs are met by wind power.

Europe, UK, Molson Coors, Energy Production from Wastewater Treatment
The site in Tadcaster generates biogas through the further purification of waste water. This energy is then used to power the site boilers. Estimates suggest that this has reduced natural gas use by up to 10%.

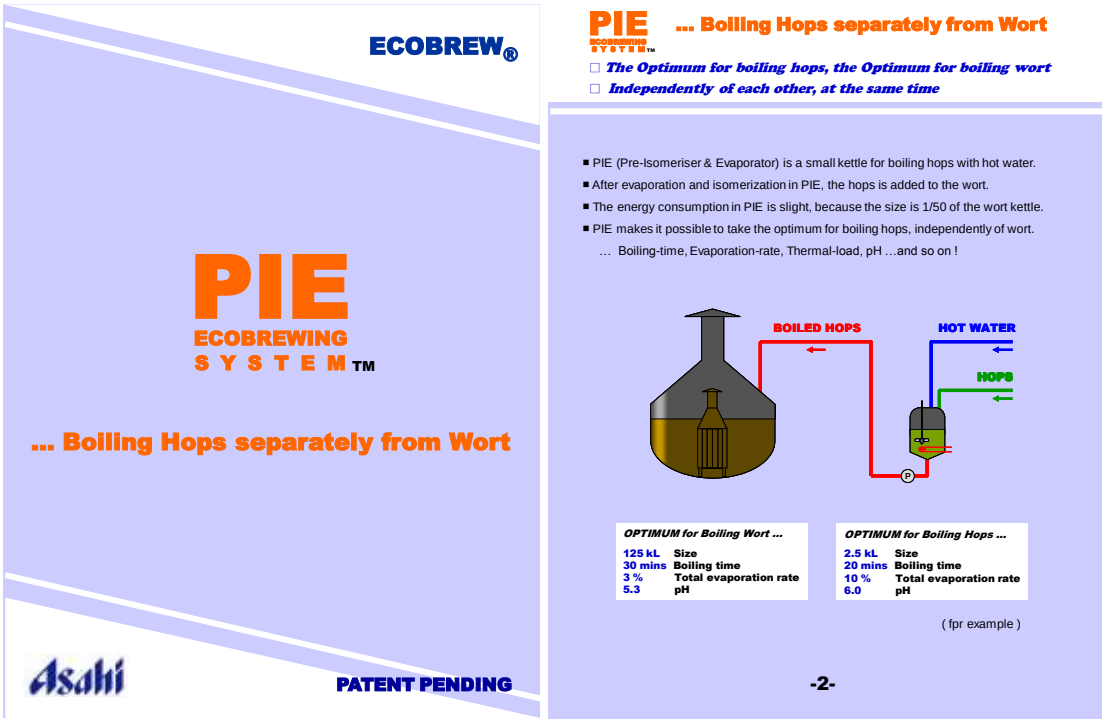
Europe, UK, Royal Brewery (Heineken UK), Green Power From Effluent Treatment
Installation of a new effluent treatment plant at the Royal Brewery, Manchester has significantly reduced the site's discharge of suspended solids and chemical oxygen demand by 96% and 97.5% respectively and adjusted the pH to a neutral level which has helped to reduce the site's environmental impact.
In addition to the treatment performance of the plant, the BIOPAC® reactor design converts most of the organic components of the effluent into methane. This biogas is then collected and used as a replacement for natural gas in the site's boilers - thus saving finite environmental resources and cutting the site's emissions. Similar plants have been set up at other Heineken UK sites.

Global, Carlsberg Group, Biogas Production
Carlsberg is committed to finding alternatives to fossil fuels to reduce their carbon emissions further. An example of this is biogas recovery from wastewater treatment plants in breweries in Sweden, Malaysia, Switzerland, France, Russia, Ukraine and China. The biogas generated corresponds to 5-15% of each brewery's energy intake.

5.1.2 Energy Efficiency Initiatives

Asia, Japan, Asahi Breweries Ltd., Boiling Hops Separately from Wort
In the production of beer, wort is boiled in order to evaporate undesirable flavours from malts and hops and to solubilise bitter substances from hops. Wort boiling is the process that requires the greatest consumption of energy in the brewery, 21% in one brewery. In conventional methods, hops are added to the wort kettle and boiled together with the wort. However, the optimum boiling times for wort and for hops are not always the same. For example, a shorter boiling time leads to a higher level of foam stability, but also, unfortunately, a higher level of undesirable hoppy flavours and a lower rate of solubilisation of hop bitterness.
New equipment, Pre-Isomeriser & Evaporator (PIE), has been developed for boiling hops with hot water, separately from the wort. The energy consumption of PIE is slight because the size is 1/50 of the wort kettle. After evaporation and solubilisation in PIE, the boiled hops are added to the wort. PIE makes it possible to take the optimums of both boiling wort and hops at the same time and independently of each other. It has reduced the energy consumption in wort boiling by 30% without increasing undesirable flavours or

decreasing utilisation of hop bitterness. Eight sets of PIE were applied to the Suita, Ibaraki, Nagoya, Fukushima and Hakata breweries in 2010.



Americas, Canada, Moosehead Breweries Limited, Employee Awareness
Moosehead Breweries Limited, recognized by the Canadian Industry Program for Energy Conservation (CIPEC) as an Industrial Energy Innovator, has been serving up a successful employee awareness programme for more than 10 years. As the cornerstone of Moosehead's energy efficiency initiatives, the employee awareness programme helped bring about change and energy savings. Combined with various other initiatives, Moosehead saved 236 terajoules (TJ) of energy - enough to run the brewery for one-and-a-half years.

Americas, Canada, Great Western Brewing Company, New Cooling System
Great Western Brewing Company in Saskatoon uses a newly designed cooling system to cool boiling wort (liquid barley mash). Heat recovered from this system is used to produce the exact amount of hot water needed in the brewing process.

Americas, USA, MillerCoors, New Ammonia Compressor
At the Milwaukee brewery, installation of a new ammonia compressor that conserves energy through automated controlling of pressure and temperatures is producing annual energy savings of 3.3 million kilowatt hours. An upgraded ammonia refrigeration system at the Texas brewery has eliminated energy-wasting pressure drops and ensures that the evaporative condenser is used effectively. This has reduced annual energy use by 3.6%.

Europe, Czech Republic, Brewery Holba, CO_2 Collection
Technologies for CO_2 collection have been installed in the area of primary fermentation.

Europe, Czech Republic, Brewery Zubr, New Brewhouse
A new brewhouse with more efficient production and heat recuperation by vapour (steam) collection has decreased total energy consumption.

Europe, Hungary, Dreher (SABMiller), Absorption Cooling to Save Energy
At Dreher, an absorption-cooling project was initiated to utilise surplus waste heat recovered from the boiling process. The primary use of this recovered energy is to preheat the wort on the way to the kettle where it is boiled. It was found that there was approximately 350kW of "surplus heat" which is used to power an absorption cooling process. The refrigeration energy provided is used to pre-cool water used in the process and save electrical energy normally used to refrigerate this water. Through the project, Dreher has reduced its emissions with a net electrical saving of 82kW, it is estimated that CO_2 emissions have been reduced by 260 Tonnes per year.

Europe, Poland, Bosman Brewery (Carlsberg Group), Wastewater Treatment
The brewery's wastewater treatment plant (WWTP) was developed with state-of-the-art technology and has a unique setup. The Bosman WWTP is, due to the compact size and the many levels in the facility, one of the smallest of such plants in Europe but has the same capacity as larger plants. The anaerobic treatment process saves a substantial amount of electricity otherwise used for effluent aeration and reduces by a factor of three the sludge production of the plant. The wastewater sludge residual can be used safely as a soil improver. This has meant the brewery is a substantial contributor to pollution reduction in the Oder River and the Baltic Sea.

Europe, Spain, Grupo Mahou San Miguel, Energy Conservation Initiatives
As part of a sustainable development strategy launched in 2000, Grupo Mahou San Miguel (MSM Group) has reduced energy consumption by 39% between 2000 and 2009. This has been achieved through the: introduction of energy recovery systems for boiling; use of cleaner fuels; thermal circuit unification and use of higher performance thermal fluids like overheated water; implementation of an energy management system with specific hardware and software; and the reuse of biogas from wastewater treatment for heat generation. As a result, MSM Group consumed 9% less energy in 2009 than in 2000 even though production increased by 30%, thus reducing the annual emission of over 30,000 tonnes of CO_2.

Europe, The Netherlands, Grolsch (SABMiller), Optimising Ventilation and Lighting Systems
Apart from the brewing process itself, ventilation and lighting consume the largest amount of energy at the Grolsch brewery in the Netherlands with its 29 ventilation units and hundreds of lights. Traditionally, most lighting and ventilation systems ran at fixed times during the day, regardless of whether the plant was in operation or not. Since January 2009, Grolsch has been optimising its control systems to link the ventilation and lighting systems to the operation times of the brewery. As a result, the brewery has saved more than 100,000 kWh a month without significant capital investment.

Europe, UK, Adnams Brewery, Energy Recovery System
"East Green" brand is brewed in Adnams' groundbreaking new brewery, which has an Energy Recovery System that recycles 100% of the steam created during the brewing process and uses it to heat 90% of the following brew. The beer is made with high yielding barley, grown locally in Suffolk, which greatly minimises CO_2 emissions from transportation. Boadicea Hops are also used - they are naturally aphid-resistant and reduce the use of pesticides significantly. To ensure that carbon emissions were as low as possible, Adnams worked with The University of East Anglia's carbon reduction CRed Team throughout the project.

Europe, UK, Marston's Brewery, Refrigeration Plant Design Innovation
Bank's brewery (Marston's plc) has replaced a refrigeration plant using reciprocating ammonia compressors, air cooled condensers and calcium chloride brine for secondary heat transfer with a new design using half the energy. In the new equipment, variable speed drives on the condensers and the ammonia compressors allow the optimum ammonia condensing pressure to be set so that the combined power input for the compressors and the condenser fans is at a minimum value for all system loads and ambient temperature conditions. Condensing pressures vary constantly so that the system always operates at minimum power. Energy flows (heat potential) are calculated to estimate the temperature and humidity of the air entering and leaving the evaporative condenser, and these values are used in establishing the required condenser fan speed for the plant to operate.
All thermodynamic processes result in an increase in entropy, therefore, for maximum efficiency, entropy increases can be minimised by reducing heat exchanger temperature differences. The first liquid ammonia plate heat exchanger cools brine for the lowest temperatures. A second heat exchanger cools chilled water for fermentation control and air conditioning.
A Supervisory Control and Data Acquisition system and comprehensive instrumentation allows remote monitoring of all areas of the refrigeration plant and cooling across the site, making this one of the most efficient and reliable refrigeration systems possible.

Europe, UK, John Smith's Tadcaster Brewery (Heineken UK), New refrigeration Plant
In 2008, work started to replace a refrigeration plant that was over 30 years old. The 20-month project delivered a system that consumes about half the energy of its predecessor. The new refrigeration plant has a capacity of 5.2MW and resulted in savings in excess of £70K in electricity consumption in the first year. It is electronically controlled and sequentially shuts down parts of the plant when they are not required. Energy-efficient motors are used where appropriate and chemical consumption for the cooling towers has been reduced.

Global, AB InBev, Energy Conservation
Environmental key performance indicators (KPIs) and targets are fully integrated into AB InBev's Voyager Plant Optimization (VPO) global management system, which is designed to bring greater efficiency to brewery operations and generate cost savings, while at the same time improving quality and ensuring safety. VPO includes metrics, targets and best practice sharing and requires regular self-assessments and audits to ensure consistency and high standards. VPO delivered company-wide energy savings of 7% in 2009 and nearly 11% since 2007.

5.2 Brewery Efficiency - Water Conservation

Africa, Ghana, Accra Brewery (SABMiller), Using Water More Efficiently
During the financial year 2009/10, Accra Brewery has implemented a number of measures and embarked on innovative ways to use water more efficiently, including the installation of new water meters in all user departments to allow for more accurate monitoring and control of water usage. A new brominator was installed which removes slime in pasteuriser water to reduce the frequency at which pasteuriser water is dropped and replaced with fresh water. In addition to these installations, the brewery has purchased a cooling tower to recycle pasteuriser water which is expected to reduce water consumption by 10-15%.

Africa, Tanzania, Tanzania Breweries (SABMiller) Water Conservation Initiatives
Dar es Salaam, the capital of Tanzania, is facing long-term water shortages, exacerbated by problems with the water distribution infrastructure. Water quality can also be poor with

high levels of groundwater salinity. In response to these local conditions, Tanzania Breweries have launched an intensive, on-going, in-house campaign to use less water to brew beer. In addition, they have set themselves a target to use 4.5 hectolitres of water to brew a hectolitre of beer.
The company recently installed a state-of-the-art, electronic energy-management system and implemented a brewery-wide awareness campaign for its employees. The campaign includes a specially designed comic to bring water-saving messages to everyone and aims to involve employees in both water awareness and data collection. Tanzania Breweries are part of the Water Futures partnership with the World Wildlife Fund (WWF) which aims to engage with local stakeholders and build schemes to protect water in Dar es Salaam.
As well as improvements in water efficiency, Tanzania Breweries have also set up water points at their breweries so that the communities living nearby have access to a clean and reliable water supply. Currently, it is estimated that more than 10 m^3 of water is collected daily by residents from these points.

Americas, Brazil, AmBev (AB InBev), Water Stewardship
On World Water Day, March 22, 2010, AB InBev's Latin America North zone launched a partnership in Brazil called the "Cyan Movement" - "Whoever looks at water sees how much it's worth", a campaign to mobilize awareness around water conservation. As part of the effort, AmBev is partnering with the World Wildlife Fund on the project "Water for Life - Conservation and Management of Fresh Waters". Through this initiative, the company will adopt hydro-graphic basins that service its plants to develop studies on the best utilization of water by industries and the local community, and contribute financial resources to its preservation. The initiative's first project is in the Corumbá-Paranoá Basin, which supplies the Gama branch, in Brasília/DF.

Americas, Brazil, Jaguariuna Brewery (AB InBev), Optimisation of Water Use
The Jaguariuna brewery has implemented a programme to optimize utilisation of water across all steps of the production process. This has resulted in a 9% reduction in water use from 2007 to 2009, saving more than 1.7 million hectolitres of water.

Americas, Canada, Labatt Breweries of Canada (AB InBev), Labatt's Energy Challenge
Labatt Breweries reduced the amount of water needed to produce a hectolitre of beer by 45% between 2002 and 2009. Through Labatt's Energy Challenge initiative, employees identified numerous water improvement ideas leading to substantial corrective actions.

Americas, Canada, Sleeman Breweries Ltd., Water Conservation Initiatives

An eco-efficiency audit identified several cost-saving improvements to reduce water consumption and wastewater discharge including the installation of automatic shut-off valves on all high-pressure hoses used in floor washing, the diversion of water from the pasteuriser overflow for reuse in keg and floor washing, and the replacement of all flexible hosing with permanent lines. Additionally, in March 2006, Sleeman Breweries commissioned the installation of a wastewater treatment facility, lowering the wastewater load by up to 90% and reducing the demand on city treatment facilities. Due to water conservation efforts, while beer production increased in the last six years, water consumption has remained the same.

Americas, El Salvador, Industrias La Constancia (SABMiller), Water Conservation Initiatives

During the last 9 years, Industrias La Constancia has made investments in projects which resulted in a considerable reduction of water consumption. These projects, along with environmental awareness programmes, have supported the development of activities to improve water efficiency, including:

- Re-designing the breweries and investing in equipment with efficient consumptions of water and energy;
- Improving the sanitation and cleaning processes of equipment and facilities;
- Utilising cooling towers for the re-circulation of water in the refrigeration, pasteurisation and other systems; and
- Certification in environmental management systems ISO 14001:2004 which helped to identify the significant environmental impacts for each brewery.

As a result of these activities, Industrias La Constancia improved their water efficiency by 68% from 11.42 hl/hl in 2001 to 3.65 hl/hl in 2010. It is estimated that over this nine-year period, more than half a million m^3 of water have been saved. This project has been recognised externally and won two awards in 2009. It was selected as the best clean production project applied to the industry in El Salvador and as one of the best projects of clean production in the Central American and Caribbean Region.

Americas, USA, Cartersville Brewery (Anheuser-Busch), Process Improvements

The Cartersville, Georgia, brewery is already ahead of AB InBev's 2012 stated water use goal. Cartersville achieved an annual water use level of 3.04 hectolitres of water per hectolitre of production in 2010 compared with a company-wide average of 4.04 hectoliters in the same period. This was achieved primarily through process improvements identified and implemented by brewery employees.

Americas, USA, MillerCoors, New Pasteuriser

Installation of a new pasteuriser at the Leinenkugel brewery will reduce water usage by 25%, producing an annual saving of 15-20 million gallons of water. At the Virginia brewery, water reduction projects saved nearly 5.3 million gallons of water annually, reducing water usage by nearly 16% in 2009 from 2008.

Asia, Australia, Coopers Brewery, Use of Water for Aquifers

Nearly all Coopers' water requirements originate from aquifers beneath the brewery, reducing the demand on Adelaide's reticulated water supply. This underground water is clean but saline and is purified by reverse osmosis. Extraction rates are carefully monitored to ensure they do not affect the long-term viability of the aquifers.
Approximately 70% of the water fed into the desalination plant is used in the brewing process. The remaining 30% contains salt wastes and is pumped through a 7km long dedicated pipeline into the inter-tidal zone at the Barker Inlet Wetlands, under the terms of a licence with the Environment Protection Authority.
Environmental scientists say the water from the pipeline has a similar salt concentration to the brackish environment observed in the inter-tidal zone, where sea water mixes with fresh water. Water from the reverse osmosis plant is mixed with bore water to irrigate the high salt tolerant lawns around the brewery.

Studies into ways to further reduce overall water usage are ongoing and have already resulted in significant water savings during the pasteurisation process for packaging.

Asia, Australia, Foster's Brewery, Efficient Waste and Water Management
The manager and staff at Foster's Abbotsford brewery are leaders in waste and water management. Over the last eight years, Abbotsford has realised the following efficiency gains:

- 46% reduction in trade waste discharge;
- 35% reduction in mains water used; and
- 77% reduction in sodium discharge.

These results have been achieved through comprehensive waste mapping and initiatives such as collection and recycling of processed water, bottling line efficiency measures, a solid waste recycling programme and minimisation of chemical use. A major focus for waste reduction across the Group is to share the good practice from their leading breweries to reduce the waste and water impacts at other facilities.

Asia, China, AB InBev, Water Conservation Initiatives
In China, AB InBev reduced their water usage by 17% from 2009 levels. The Ningbo brewery borrowed many of the lessons learned from the annual AB InBev energy and water global conference from high-performing plants and is on track to achieve the 2012 water usage target one year ahead of schedule. Central to its improvement were the implementation of many basic innovations, such as narrowing bottle-washing nozzle diameters, reusing reclaimed water for general cleaning and integrating utilities planning into the production scheduling process. In addition, the Wuhan brewery has reduced their water usage by 35% from 2009 levels, reaching a 3.6 hectoliters per hectoliter of production water usage rate by December 2010 and achieving the largest improvement in water usage from 2009 levels of any of their plants.

Europe, Belgium, The Jupile Brewery (AB InBev), New Water Purification Plant
AB InBev's Jupile brewery is located in a water-protection zone. Some of the site's water is supplied by three springs, and some comes directly from a water reservoir in Eupen. The brewery initiated a project focused on three objectives: optimizing the efficiency of water usage; improving the quality of residual water; and protecting the purity of spring water. The Jupile brewery has achieved a 20% decrease in water usage since 1993. To achieve further objectives, the brewery built a water purification plant in 2008 with a capacity to treat wastewater for a city of 260,000 people. For comparison, the nearby city of Liège, the fifth-largest city in Belgium, has about 193,000 inhabitants.

Europe, Belgium, The Leuven Brewery (AB InBev), Improved Cleaning System
The Leuven brewery has reduced water usage by 18% since 2003. This decrease can be attributed in part to investments made in automated, more cost-effective, cleaning systems - most notably a system called "Cleaning In Place" (CIP) - and to water consumption being checked weekly as a key performance indicator. Water is also being reused in several processes, and studies are conducted to expand the reuse of effluent water for steam production and cooling. Water audits and specific motivational campaigns also seek to reduce the waste of water. To optimize wastewater quality, the Leuven brewery invested in a new anaerobic water purification station in 2003. The brewery is also searching for cleaning products that are low in phosphorus and is monitoring draining parameters.

Europe, Belgium, Brewery Liefmans, New Cooling Tower
In the past, water used for cooling flasks after pasteurisation was drained to the purification installation. Now, a cooling tower cools the water and allows recuperation. Water usage in the pasteurisation unit has decreased from 5.5m^3/hour to 3.5m^3/hour, corresponding to a water saving of 20% of total usage.

Europe, Belgium, Brewery Timmermans, Adjustment of the Bottle Washer
By closing the water tap on the bottle washer a little more, the water usage of this device was reduced from 44m^3/day to 35m^3/day, without loss of efficiency. Water savings of 5% of total usage were achieved.

Europe, Germany, Wernigerode Brewery (AB InBev), Water Conservation Solutions
In 2009, the Wernigerode brewery exceeded its water conservation goal, achieving an annual water use level of 3.09 hectolitres of water per hectolitre of production through a combination of engineering solutions and ongoing training sessions that help: identify key environmental issues; ensure the economical use of resources; and fine tune procedures.

Europe, Spain, Grupo Mahou San Miguel, Automation of Processes
As part of a sustainable development strategy launched in 2000, production increased by almost 30% between 2000 and 2009 but the ratio of water consumption decreased over the same period by 30%. This was made possible by the complete automation of cleaning and production processes, as well as the reuse of water from vacuum pumps to wash crates.

Europe, The Netherlands, Heineken, Upgraded Osmosis Facilities

A programme was launched in 2009 to discover where additional water savings could be made. The aim was to reduce the amount of water used without causing damage to the water treatment installations and without disturbing production. The Company worked with its Group Supply Chain specialists to uncover saving possibilities and hired an external organisation to conduct further research. As a result, the brewery's two osmosis facilities were upgraded to allow 10% more water to flow through the system and be used in the production process, rather than being released into the sewers. The improvements have also saved electrical energy as previously both reverse osmosis installations ran all week. Now one installation runs from Monday to Friday and the other one at weekends only. The project has increased the amount of water coming out of the reverse osmosis installation reducing the water used from the wells.

Europe, UK, Wells & Young's Brewing Company, Water Recovery System
A review of water usage at the brewery indicated that a nine-year-old Tekmi bottle pasteuriser was using excess water (total water use 20,000 cubic meters per annum). A new recovery system was designed to collect the water overflowing from some units and feed it into a two cubic metre under floor recovery tank. Level probes and automatic fill valves ensured that only the tanks which needed topping up were filled. The recovery system showed initial savings of water of 50% worth over £20,000 per annum. Further water and monetary savings came from the use of the recovered warm water to reduce the steam requirement.

Europe, UK, Royal Brewery (Heineken UK), Process Improvements
This brewery has achieved a very low water usage ratio, (about 3.2 hectolitres of water for every hectolitre of beer it produces) by implementing numerous process improvements since 1980. A system to recover the water used in the brewing process was first installed in the 1980s and has been continually improved since. It currently supplies water to the air

compressors, refrigeration plant compressors and refrigeration plant defrost system and saves more than 62,000 cubic metres of water every year. The site also recovers 70 to 80% of the steam it produces which saves a further 67,500 cubic metres of water each year. In the canning department, water recovery was first installed in 1999. Further improvements have been made since, including the replacement of the two pasteurisers in 2006.

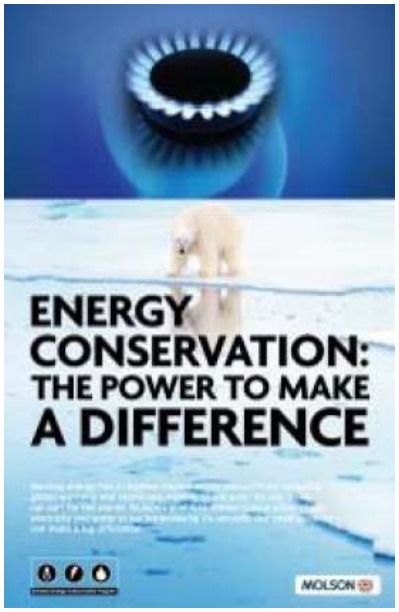
Global, UN CEO Water Mandate

The UN CEO Water Mandate is a public-private initiative designed to assist companies in the development, implementation and disclosure of water sustainability policies and practices. It was launched in 2007 and covers six elements: Direct Operations; Supply Chain and Watershed Management; Collective Action; Public Policy; Community Engagement; and Transparency. CEO's of the following companies have signed up to the mandate: AB InBev; Carlsberg; Diageo; Heineken; Molson Coors; and SABMiller.

5.3 Combined Energy and Water Efficiencies

Americas, Canada, Molson Coors Canada, Employee Awareness

Employees are the primary agents of change with many energy reduction measures being implemented as a result of their suggestions. Molson Coors Canada is bolstering its commitment to sustainable development by focusing on increased employee awareness with the help of three initiatives: Défi Climat, Earth Hour and Energy Efficiency Week. Since installing an energy-metering system in 2004, Molson Coors Canada has cut power consumption by 23%, natural gas by 38% and water by 34%. In 2008, Molson Coors Canada used a Government of Canada ecoENERGY incentive and an incentive from a natural gas company, to conduct a process integration study - a holistic vision of energy use in large and complex industrial facilities - which identified annual energy reductions that translated into cost savings of $1.8 million.



Americas, Canada, Labatt Breweries of Canada (AB InBev), Labatt's "Energy Challenge

Labatt is making significant contributions towards achieving AB InBev's aggressive 2012 environmental targets. Ambitiously, the company launched a comprehensive, six-week initiative to reduce energy consumption at every brewery in Canada. Labatt's "Energy Challenge Initiative" focused on:

- Identifying and correcting utilities leaks and misuse;
- Identifying and communicating effective process and lighting shutdown;
- Creating awareness of energy consumption and costs within employees' area of influence; and

- Creating a sustainable mechanism for ongoing employee engagement in utilities reduction.

The project was extended by two weeks as a result of widespread and overwhelmingly positive response. The results were impressive with a total year-over-year reduction in energy consumption of 8% and a reduction in water consumption of 17.8%. Each of the seven participating breweries exceeded the challenge target of implementing at least one corrective action for every two employees. Overall, employees identified and implemented more than 1,350 corrective actions.

Asia, China, Carlsberg China, Efficient and More Environmentally Friendly Production

To further improve efficiencies in the production processes, Carlsberg has developed and implemented a focused Production Excellence (ProdEx) programme in China, aimed at more effective maintenance processes, lower energy consumption and reduced water usage. A key component of ProdEx is the sharing of best practice across several breweries and the joint approach to problem solving. As alternative energy sources are not widely available, the programme focuses on improving coal efficiency.

Europe, Italy, Heineken Italia, Environmental Responsibility Schemes

Since 2006, strategic programmes to reduce water and thermal energy when producing beer and reduce waste production have been instigated (Aware of Water, Aware of Energy). For example, in 2007 a 28-page booklet was distributed to Supply Chain staff, to provide them with practical information and advice concerning the efficient consumption of energy at the brewery. The booklet features short descriptions of how energy is used in the brewery and focuses on a wide range of basic activities which can be applied in order to save energy or make use of alternative energy sources. It also features in-depth information on water usage, CO_2 recovery systems, waste-water plants and an analysis of boiler energy use. Another initiative aims to improve the air quality and reduce CO_2 emissions by using electrical delivery vans for distributing beer to bars in historic city centres.

Europe, Russia, St Petersburg Brewery (Heineken), Employee Awareness

In 2009, employees at the Heineken Brewery in St Petersburg were encouraged to be energy efficient in the office as part of a new campaign known as "Simple Saving". The campaign was launched on World Environment Day - 5 June - and prompted staff to consider the environmental and economic benefits of saving electricity and water. "Simple Saving" involves straightforward measures to raise awareness of the importance of energy efficiency, including posters to remind people to switch off lights, computers and electrical appliances and stickers attached to bathroom mirrors to remind people to turn the taps off completely. Statistics showing the cost of not complying with these messages helped to reinforce the message. In 2010, Heineken Russia expanded the Simple Saving campaign to all other breweries and sales offices across the country.

Europe, Spain, Heineken España, New Brewery
The new brewery in Seville reached full operation in March 2008 making it the most modern and technologically advanced in Europe at that time. Its production capacity is 30% more than the old brewery (450 million litres per year) but uses 30% less water and 25% less electricity and thermal energy than the old brewery to achieve these higher production levels.

Europe, Slovakia, Heineken Slovakia, Investing in Water Treatment
The existing 20-year-old waste water treatment plant (WWTP) in the brewery at Hurbanovo City has been made modern, efficient, environmentally-friendly and compliant with Slovakian and EU waste water discharge limits. A biological cleaning process (anaerobic treatment) has been installed to provide a more efficient solution to pre-treating the waste water. Anaerobic systems require less nutrients and electrical input and generate far less sludge than aerobic treatments. Previously the WWTP worked as a two-step aerobe cleaning process, but now the second stage is no longer used. The new anaerobe process removes more than 70% of pollution, with the rest eliminated in the aerobe treatment. In addition, the methane-rich biogas produced in the anaerobe treatment, can be burnt to produce 'green' electricity and then supplied to the national grid.

Europe, UK, Coors Brewers Ltd., Optimisation of Yeast Handling CIP Systems
Coors Brewers Ltd. implemented a data-monitoring unit (In-Site Management Information System) which interfaced with the individual site's automated Cleaning In Place (CIP) system to record all actions which were carried out during cleaning over a two-month period.
The monitoring produced a number of reports including the cost of utilities involved in the process, verification of quality standards and the environmental impact of each clean in terms of electrical energy used. This enabled the company to improve the existing programme and this, in turn, led to many water-efficiency benefits including:

- Optimisation of the demand for water and thus reduction in effluent discharge;
- Optimisation of the use of chemicals;
- Recycling of the last cycle of rinse water as pre-rinse water;
- Identification of system errors; and
- Further water savings from elimination of aborted cleans and re-starts.

As a result of these actions, the use of mains water has fallen by 54%. Overall, water use has decreased by 37%. The project paid for itself in nine weeks and resulted in additional savings in CO_2 emissions (by 132kg per annum) and chemical requirements.

5.4 Reduction in Emissions

Americas, Canada, Storm Brewing in Newfoundland Ltd., Eliminating Pollution
The goal of Storm Brewing is to turn every single product from the beer-making process into a value-added product which can be sold, as well as increasing productivity, creating more employment, generating higher revenues and eliminating pollution. For these efforts, Storm Brewing was identified by the ZERI (Zero Emissions Research Initiative) Foundation as a role model and a pioneer.

Americas, USA, Anheuser-Busch, Bio-Energy Recovery Systems
Through the use of Bio-Energy Recovery systems at 10 US breweries and landfill gas at the Houston brewery, the equivalent of one in every six beers made by Anheuser-Busch's US breweries is brewed and packaged using alternative fuels. In addition, the company has reduced total water use in US breweries by more than 38% between 2000 and 2010 - saving 25.5 billion liters of water - the equivalent of more than 164 million showers.

Americas, USA, MillerCoors, Conserving Energy and Reducing Emissions
The company has an accomplished track record in this area, as Coors Brewing Company was recognized for already exceeding its goal, reducing emissions 20% per production index from 2005 to 2008.
This is partly due to efficiency improvement in every mode of transportation the beer takes to reach consumers. Examples include:-

- Reconfiguring railway shipments to increase the amount of beer each railcar carries reduced the number of railcars by nearly 40%, an estimated saving of 3,000 metric tonnes of carbon dioxide;
- Increasing the number of kegs and pallets distributors put on return trucks reduced the number of trucks on the road by 13%, or 1,400 trucks per year;
- Consolidating inventory from nine warehouses that store beer before being sent to distributors down to five saved energy, emissions and costs; and
- Replacing non-recyclable, single-use wood structures that secure beer in trucks with 100% recyclable plastic separator pads, which are lighter, easier to use and carry an average lifespan of eight years.

Additionally team efforts are being undertaken by employees across the company. Examples include:

- Raising awareness of energy conservation by employees in Georgia. This was achieved by charting usage and creating checklists for shutting down equipment; and
- Celebrating “ECAA Madness” (Energy Conservation Awareness Activity) at the North Carolina brewery in conjunction with an annual national college basketball tournament. Employees submitted energy savings ideas for the brewery, and the company paid the electric bill of the winning employee.

In 2009, the company reduced its greenhouse gas emissions by 1.2% across all operations and facilities.

Asia, Australia, Foster’s Group, Carbon Reduction Programme
Foster’s has recorded an almost 30% absolute reduction in emissions between 2000 and 2008 across its Australian beer business production sites. In 2008, the company created a comprehensive Carbon Reduction Program that identifies actions and initiatives across the business that actively seek to reduce the emissions directly and those from within the supply chain. An "Energy & Water Efficiency Program" focuses on efficiency improvements from within the largest production sites and assesses opportunities to reduce energy consumption and carbon emissions, in addition to reducing water consumption and waste generation. This program focuses on reducing absolute energy consumption, fuel switching and looking at energy sources with a lower carbon intensity, through to improving the efficient use of energy. Examples of anticipated reductions in metric tonnes of CO_2 emissions in the financial year 2010 are as follows;

- 2,247 from biogas recovery in one brewery;
- 5,703 from replacement of a boiler fuel switch on one brewery;
- 558 from a steam audit in two breweries;
- 538 from air compressor control in one brewery; and
- 418 from lighting control in one brewery.

Asia, Australia, Lion Nathan Group, Reusing CO_2
Lion Nathan goes to great lengths to manage its local emissions. They collect and re-use more than 90% of the CO_2 generated during fermentation for carbonating their beer. They strictly control the dust created by malt handling operations by using extraction systems, dust collection services and enclosed conveyors. They also have fitted pollution controls, such as low nitrogen oxide burners, economisers and monitoring equipment, to boilers to reduce emissions from the stacks in each of their breweries. Additionally, they have

replaced or modified equipment at all their breweries to eliminate substances which are harmful to the ozone layer, such as chlorofluorocarbons (CFCs).

Asia, Japan, The Brewers Association of Japan, "Keidanren Action Plan on the Environment"

The Brewers Association of Japan have joined a programme, the "Keidanren Action Plan on the Environment", started by the Nippon Keidanren (the Japan Business Federation). This programme consists of two sets of measures - "Global Warming Measures" and "Waste Disposal Measures". The target is to suppress the CO_2 emissions in 2010 from industry and energy-converting sectors to below its 1990 level. Each of the 34 industries sets numerical targets for CO_2 emissions reduction.

The five members of the Brewers Association of Japan: Kirin Brewery, Sapporo Breweries, Suntory Liquors, Asahi Breweries and Orion Breweries report the following overall trends:

- The ratio of CO_2 emissions to production output: The results achieved, compared to 1990 levels (where 1990 = 1), were 0.8 for 2004, 0.73 for 2006 and 0.57 for 2008;
- The rate of energy consumption (based on calorific consumption of heavy oil, electricity and gas); The results achieved compared to 1990 levels (where 1990 = 1), were 0.82 for 2004, 0.79 for 2006 and 0.66 for 2008; and
- Reduction efforts and technical developments contribute to steady reduction in CO_2 emissions. Production demands, such as high-mix, low-volume production negatively impact emission reduction results. However, energy-conservation initiatives in the production process and efforts to reduce CO_2 emissions through co-generation and fuel conversion are being continued.

Europe, Austria, Brau Union Österreich (Heineken), "The Green Brewery"

Working with a number of partners, the Brau Union Österreich has developed a project entitled "The Green Brewery". Within this project, the emissions of fossil and climate-relevant CO_2 from the production of beer is being significantly reduced and even set to zero, by development and implementation of a methodological optimisation approach. There are two parts to the project: innovative energy concepts developed on a brewery-by-brewery basis and a calculation tool used throughout the group, which measures all the key elements and points to the most efficient methodology. For example, in the Brewery Göss, the total fossil gas demand has been substituted by efficiency measures and the integration of renewable energy sources. This corresponds to a saving of 1,200,000 Nm^3 fossil gas (basis 2007) and a reduction of fossil CO_2 emissions of 2,670 tonnes per annum.

At the Brewery Puntigam, it has been calculated that the proposed measures can reduce 1.100 MWh/annum of the thermal energy demand and 1.000.000 Nm^3 fossil gas can be balanced as CO_2 neutral gas when biogas is produced from the brewers' grains of this brewery and fed into the central gas distribution net in Leoben.

Additionally at the Brewery Schladming, an extensive change to renewable energy supply is saving 278 tonnes of CO_2 per annum.

Europe, Austria, Brewery Göss (Heineken), Green Brewery Project

The world's first plant for energy recovery (biogas) from brewers' grains and waste water from the treatment plant was put into operation at this site in 2002. In 2008, the plant launched a project which changed the heat supply in such a way that no CO_2 emissions are released during the brewing process. The current initiative aims to make the brewery

CO_2 neutral by the end of 2010. The technology involved in the project creates closed-cycles of energy at the brewery, using a variety of 'green' energy sources including solar energy and 'green' fuel for the solid matter furnace, for example wood, waste labels and dried fermentation residue. In addition, the project involves optimising the brewery's energy flows and reducing its overall energy consumption.

Europe, Spain, Compañía Cerveceria de Canarias, Reducing the Environmental Footprint
High standards have been maintained to ensure the efficient consumption of natural resources, resulting in a 9% reduction in total electricity consumption, the equivalent of the annual consumption of 457 homes. The overall 10% drop in fuel consumption has prevented 698 tonnes of CO_2 being pumped into the atmosphere. Water consumption has decreased by 15%, the equivalent of the annual consumption of 455 homes.
CCC manages both its waste and packaging by encouraging the consumption of returnable formats because of their numerous advantages, including saving raw materials and reducing environmental impact and air pollution. After an investment of approximately one million euro, CCC fills 64% of its products in returnable formats-a figure which is far higher than the average for the Spanish beer sector (51%).

Europe, The Netherlands, B.V. Gulpener Bierbrouwerij, Environmentally Friendly Beer
The ecological brewer Gulpener produces environmentally friendly beer brewed entirely with local/regional ingredients. In addition, their efforts to reduce CO_2 emissions and improve their environmental footprint includes the use of solar panels, buying renewable energy from watermills and a comprehensive recycling policy. This overall policy has greatly reduced the energy used to transport ingredients to the brewery and improved the quality of their beer.

Europe, UK, Heineken UK, Establishing Carbon Footprint
Heineken UK is working with the Carbon Trust to manage the carbon footprint of two of its leading brands. This detailed analysis is helping to target significant carbon reductions. The manufacturing processes account for about 15% of total carbon emissions, and they continue to improve energy efficiency and reduce water usage in this area. They are also working with suppliers to reduce the footprint of bought-in products that are used to make their brands.

5.5 Recycling / Packaging Efficiency

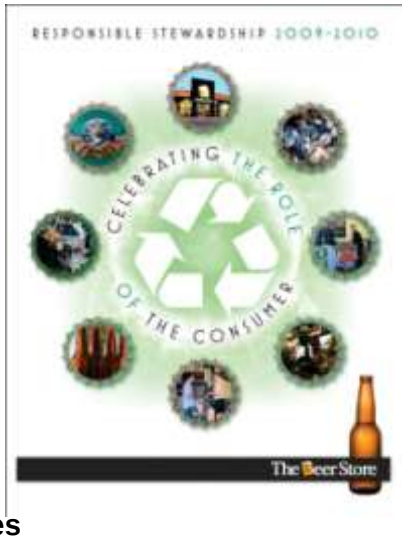
Africa, South Africa, SAB Ltd. (SABMiller), Producing Compost from Brewery Waste
The Prospecton brewery in Durban, South Africa, illustrates how waste from the brewing operation, in this case effluent, can be reused and processed into soil-boosting compost. Waste sludge in the effluent balance tanks was tested and found to be suitable for a fertiliser-type additive in compost. The sludge is residue from the malted barley, hops and yeast and was previously removed from the brewery three times a week and disposed of to landfill. As the sludge is now being reused as a source of nutrients for agricultural soil, its disposal as waste has reduced to once a week, resulting in savings of approximately US$39,000 a year.

Americas, Canada, Brewers Distributor Limited (BDL), Recycling
BDL is responsible for the wholesale distribution of beer and the collection of returnable, refillable and recyclable beer containers within the four Western Canadian Provinces, as well as territories. BDL recycles consumables - materials used in daily operations - such as plastic shrink wrap used in shipping and cardboard beer cases. Pallets are collected, repaired if required, and re-used. All BDL branches participate in local paper recycling

programmes. http://www.env.gov.bc.ca/epd/recycling/bev/reports/pdf/brewers-stewplan-nov09.pdf

Americas, Canada, Sleeman Breweries Ltd., Certificate of Environmental Sustainability
On May 11, 2009, Sleeman Breweries Ltd. was awarded a Certificate of Environmental Sustainability from corrugated supplier Atlantic Packaging Products. By choosing to utilise recycled, sustainable corrugated products for its beer outer packaging and inserts, it is estimated that Sleeman Breweries Ltd. has helped preserve over 36,408 mature trees - a saving that represents the diversion of nearly 61 truckloads or 1,517 tonnes of waste that would otherwise be destined for landfill.

Americas, Canada, The Beer Store (TBS), Recycling
The Beer Store is the primary distribution and sales channel for beer in Ontario, selling 85% of the beer sold in the province. Ontario beer consumers returned to TBS over 1.85 billion of the 1.95 billion beer containers sold (TBS listed beer) in the province for a 95 percent return rate. Of this total sold, refillable glass bottles amounted to about 1.3 billion with a recovery rate of 99.9%. Wine and spirits containers can also be returned at any of TBS's retail outlets or agency stores as well as secondary packaging like empty corrugated cases, plastic bags, six-pack plastic rings and bottle caps.



Americas, Brazil, Ambev (AB InBev), Recycling Initiatives
Ambev reconstitutes spent kieselguhr - a naturally occurring soft rock used in filtration - and sells it to local companies to produce bricks. They are also engaged in a variety of activities to encourage recycling at the consumer level and work with NGOs and local officials to strengthen the recycling infrastructure in communities. For example, Ambev developed the Solidarity Recycling Project, in partnership with the NGO Ecomarapendi. The project promotes increases in income for all cooperatives participating in the program, increases the volume of recyclable materials collected in the states of Rio de Janeiro and Paraná, and minimizes environmental problems caused by garbage in the communities. The project has resulted in 2,500 tons of materials collected and $483,300 of income generated, which directly benefited 20 cooperatives and 395 people.

Americas, Colombia, Bavaria, (SABMiller), Recycling Partnership
Bavaria is part of a ground-breaking partnership to establish a recycling programme for post-consumption packaging. Working with CEMPRE, a not-for-profit association financed by large companies to promote a culture of reduction, reuse and recycling, the partnership will install 15 recycling centres in a major supermarket chain in Bogotá and Medellin. Local recycling companies will collect material brought in by consumers and take it to the existing recycling facilities in each city, encouraging enterprise in this area. The programme will be accompanied by a communication campaign to encourage consumers to bring the recycling material to the centres.

Americas, Panama, Cervecería Nacional (SABMiller), Nearing Zero Waste to Landfill
In 2004, 17% of the solid waste such as cardboard, paper, plastic, PET bottles, wood pallets, aluminium cans, paper and plastic bags and various metals produced at Cervecería Nacional's brewery in Panama was sent to municipal solid waste landfills. With a target to achieve 0% of waste being sent to landfill, Cervecería Nacional embarked on a campaign to further reduce, reuse and recycle the waste produced by their brewery.

This began with an inventory of the brewery which helped to identify the recyclable potential of waste produced. This helped to reveal the quantities, the types of wasted product, the size and the site for collection of the materials.
The main result of this initiative has been the significant reduction of waste produced at the brewery. In 2009, only 1.05% of the waste produced was sent to the municipal landfill. This is estimated to equate to a reduction of 1,000 tonnes of landfill waste a year. In addition to landfill savings, the initiative has also helped the creation and growth of the recycling industry in Panama and has allowed Cervecería Nacional to gain additional income from selling recyclable materials.

Americas, USA, Anheuser-Busch, Packaging
Since January 2007, package innovations in their US operations have reduced the amount of solid waste generated by more than 141,000 metric tonnes. This is equal to offsetting the annual carbon impact of 1,400 American families, based on a usage rate of 30 tonnes per year for a family of four, according to calculation methodology used by the US Environmental Protection Agency. In 2010, they made changes to several secondary packages, resulting in a net savings of 22,350 tons of fiberboard.

Americas, USA, Anheuser-Busch, Recycling
Anheuser-Busch joined Keep America Beautiful and communities across the country in recognizing Nov. 15, 2010 as America Recycles Day. To mark the occasion, Anheuser-Busch granted a $500,000 gift from the Anheuser-Busch Foundation to Keep America Beautiful to support their national recycling programs. This gift will assist the organization in their ongoing efforts to educate the public on the importance of recycling and litter prevention. In addition, the donation will fund a grant program to assist event recycling by providing approximately 3,000 recycling bins to local communities across the country.

Americas, USA, MillerCoors, Reducing Waste Sent to Landfill
In 2009, MillerCoors exceeded their 2015 goal of reducing the total amount of waste sent to landfill by more than 20%. Two of their breweries - Virginia and Ohio - achieved their goals of zero waste to landfill. This was achieved by reducing solid waste by cutting usage, recycling and finding creative ways to reuse brewery materials. Any remaining non-recyclable materials, ranging from 0.2-0.4%, are sent to a nearby waste-to-energy facility, where they are used beneficially to produce steam.

Asia, Japan, Kirin Brewery, Bottle Lightweighting
Coating the outsides of glass bottles with ceramics has allowed the development of a bottle weighing 21% less than a conventional bottle. Not only does this reduce the use of resources, but more significantly, it also reduces CO_2 emissions throughout the distribution cycle.

Asia, Korea, Hite Breweries and Oriental Breweries, Reducing Packaging
Hite Breweries and Oriental Breweries, which represent 99% of the domestic beer market in Korea, implemented a Memorandum of Understanding with alcohol and beverage producers in December 2008 to reduce the use of packaging for their products.

Europe, Czech Republic, Plzeňský Prazdroj (SABMiller), Taking an Integrated Approach to Packaging Reduction
Plzeňský Prazdroj recycles or reuses 92% of its packaging material (the Czech average is 69%). This has been achieved mainly through the use of returnable bottles, kegs and beer tanks. The remaining 8% consists of non-returnable bottles and cans. Between April 2009 and March 2010, the business completed a lightweighting exercise to reduce the average weight of its glass bottles to 0.64g/ml.
Plzeňský Prazdroj has also taken part in a project conducted by the Ministry of the Environment to analyse the life cycle of its packaging. Packaging was tested against criteria such as global warming, ozone layer damage and acidification. Composite packaging, usually made of more than one material, had the lowest overall environmental impact, followed by returnable glass bottles. The findings of this environmental impact study will be used to evaluate the current packaging mix and identify further areas for improvement.

Europe, UK, Adnams Brewery, Award for Environmental Innovation
Adnams Brewery was honored as a “Winner of the Carbon Trust Innovation Awards 2007”. Winning innovations included creating one of the lightest beer bottles in the UK beer market and cutting carbon emissions by 415 tonnes per year, together with a new low carbon distribution centre built with lime and hemp, complete with a 'living' roof lined with plants which catch most of the water needed on site and help regulate internal temperature.

Europe, UK, AB InBev, Packaging
AB InBev is advancing in its re-use of recycled material. Stella Artois cans are made up of 50% recycled aluminium, and bottles are made from 75% recycled glass, above a very high industry average of 71%. All cardboard and paper point-of-sale material, as well as all corrugated packs, are made from 100% recycled material.

Europe, UK, Carlsberg, Bottle Lightweighting
Carlsberg reduced the weight of its bottles by approximately 17% compared to the old design, reducing the amount of glass used by the brewery by approximately 7,300 tonnes per year.

Europe, UK, John Smith’s Tadcaster Brewery (Heineken UK), Waste Recycling
For some time, the Brewery has been recovering or recycling more than 95% of the waste it produces. These operations include spreading organic materials separated from beer during maturation to agricultural land as a soil improver and recycling packaging waste. In spring 2009, a project to analyse the waste sent to landfill to identify further recycling opportunities was begun with a waste management contractor. This led to the recycling of plastic strapping and increased quantities of cardboard. The remaining unsorted waste, which was previously sent directly to landfill, is now sent to a waste transfer station where 50% is now segregated for recycling and the remainder incinerated for energy recovery. The outcome of the project is that the site has reduced general, unsorted waste by 31%, from 242 tonnes in 2007 to 168 tonnes in 2009.

Europe, UK, Molson Coors, 'Red Tractor' Certification
This certification has been achieved for the barley used in the production of its Carling lager. It acknowledges the use of locally sourced products which reduces food miles with consequent carbon implications.

5.6 Other Initiatives

5.6.1 Environment Protection and Education

Africa, Zambia, National Breweries Plc, (SABMiller), Campaign to Clear up the Streets
Litter is a common problem in many communities in Zambia, a situation that is compounded by the public attitude towards litter that is difficult to change. National Breweries Plc supplies their product, Chibuku Shake Shake, in one-way traditional beer cartons which are often thrown into the streets once the beer has been consumed. In response to this, National Breweries Plc has initiated an anti-litter campaign which has included the placement of anti-litter posters in English and two other local languages. In addition, the campaign has included radio programmes and radio jingles in three languages in a bid to further sensitise people to the need to throw rubbish in designated areas. For this campaign, National Breweries have worked closely with the Ministry of Local Government and Housing, the local councils and the Environmental Council of Zambia.

Americas, Canada, The Beer Store (TBS), Reducing Resource Use
On the basis of recommendations from an environmental study reviewing its operations, Big Rock Brewery hired an environmental management team. These employees are responsible for ensuring environmental sustainability and reducing resource usage and utility costs. In addition, at the many Big Rock Brewery music festivals across the country, patrons consume their beer from compostable cups as part of the company's environmental initiatives.

Americas, Canada, Moosehead Breweries Limited, Protecting Natural Habitats
Moosehead Breweries Limited is helping to protect some of the most threatened natural habitats in the Maritimes. Instead of sending holiday cards to its Moose Light customers for Christmas 2009, Moosehead Breweries Limited donated $4,000 to the Nature Conservancy of Canada to celebrate the season. The money will be earmarked specifically to help protect ecologically significant land in the Maritimes.

Americas, USA, Anheuser-Busch, Conserving Resources
Anheuser-Busch has been a charter member of the US Environmental Protection Agency's (EPA) WasteWise program since its inception in 1993. WasteWise is an EPA partnership program that recognizes exceptional performance by an organization for reducing its environmental footprint through innovative and efficient materials management practices. There are currently more than 2,400 WasteWise Partners in the US. Through its involvement with WasteWise, the company not only shares its best practices with other companies, but also learns how to operate their facilities in a more efficient and environmentally responsible way. Since becoming a member, A-B has reported significant waste reduction results, won multiple WasteWise awards and promoted the program to other organizations. In addition, Anheuser-Busch has also been inducted into the WasteWise Hall of Fame, of which there are only 15 members.

Americas, USA, MillerCoors, Growing Winter Barley
In conjunction with the American Malting Barley Association, MillerCoors continues to seek additional regions to grow winter barley, which requires less water and energy due to the

off-peak growing cycle. After completing a successful trial of the crop in 2009, savings of five million gallons of water and 3,000 kilowatt hours of electricity are estimated in 2010.

Asia, Australia, Foster's Brewery, Environmental Awareness Campaign
Coinciding with World Environment Day in 2009, Foster's launched a week-long global environmental awareness campaign. Employees across the business were provided with information about the environmental goals, objectives, initiatives and achievements over five days. Key topics were energy, carbon, water, waste, product stewardship and leadership and advocacy. In addition to this, 32 of their Victoria-based employees were part of Sustainability Victoria's Greenhouse Games. The Games saw their people competing with other teams and organisations from across Victoria. Foster's employees participated in activities to help reduce the carbon emissions and energy and water consumption from their respective homes.

Europe, Spain, Heineken Spain, Cleaner Water
In 2009, new measures were introduced to reduce the amount of phosphorous the company's breweries discharge into the environment. In breweries, phosphorous is used as a cleaning agent. It is also a substance that is naturally found in raw materials such as malt which therefore requires pH levels in beer to be adjusted. During the course of the year, the company identified two ways to reduce phosphorous discharge. The first involved substituting its use, where possible, with other natural compounds such as citric acid. The second incorporates a biological and chemical phosphorous removal process in the waste water treatment plant (WWTP), prior to it being discharged into the environment. This additional stage was put into operation in Heineken's breweries in Madrid, Valencia and Jaén. These steps have led to a 65% reduction in the amount of phosphorous discharged, which will have a positive impact on the surrounding aquatic environment.

Europe, The Netherlands, Heineken, Global Workshop
In 2008, the company held an Energy Workshop. 25 internal and external stakeholders, including senior management from an oil company, the Dutch government and the Dutch Institution of Weather, Climate and Seismology (KNMI) were invited. The event brought together experts from across all areas of the business to discuss energy issues, gain a clear understanding of how these affect the Company and contribute towards a long-term strategy.

Europe, UK, Marston's, Meeting Globally Recognised Corporate Responsibility Standards
Brewer and pub owner Marston's has joined the FTSE4Good financial index. This international index measures the financial performance of companies that "meet globally recognised corporate responsibility standards". Inclusion in the index is dependent on meeting a number of standards with an emphasis on the environment, with regular reporting requirements. Marston's used this opportunity to more closely monitor energy use throughout its pub estate and implement more stringent environmental management tools at brewery sites.

Global, AB InBev, Environmental Awareness
AB InBev leverages the ingenuity of its talented workforce by celebrating World Environment Day (WED), an initiative of the United Nations Environment Programme (UNEP), across its operations each June. As part of WED in 2010, AB InBev employees developed and executed 567 projects in 21 countries, more than double the number of projects from the inaugural celebration in 2009, generating best practices that have been scaled across its global operations. More than half of these projects were focused on water conservation and watershed protection programs. For example, in the United

States, Anheuser-Busch and its Budweiser brand donated $150,000 to River Network to support river and watershed conservation projects in 11 US brewery cities. Projects included river cleanups, native vegetation plantings, invasive species removal and environmental education initiatives.

Global, Heineken, Mapping the Biodiversity Impact of Operations
Heineken benchmarks its environmental performance by using the Global Reporting Initiative (GRI) guidelines. In 2006, reporting processes were brought into line with two key GRI performance indicators concerning biodiversity. This required reporting the number and scale of operating sites situated inside or adjacent to protected areas and unprotected areas of high diversity value - and to define the most significant biodiversity impacts.
In 2007, a study focusing on production sites and selecting water management as a key parameter was commissioned at Leiden University. Using a range of analytical tools, including the World Database on Protected Areas (WDPA), the study established the precise locations of all 154 production sites and matched them to protected areas listed by WDPA. This exercise produced a definitive list of 108 sites located in or near WDPA areas. Of these, 14 did not have a waste-water treatment plant. The study has allowed the Company to match both GRI indicators concerning biodiversity and also to prioritise the waste-water management programme. Heineken is now conducting detailed feasibility studies into the construction of water treatment plants at all 14 highlighted production sites.

Global, SABMiller, Water Futures Partnership with WWF
In November 2009, SABMiller and the World Wildlife Fund (WWF) launched Water Futures, a global partnership for tackling water scarcity. The partnership, which is funded partly by Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), acting on behalf of the Federal German Ministry of Economic Cooperation and Development, builds on existing work undertaken by SABMiller and WWF in South Africa, Colombia, Honduras and El Salvador.
The partnership examines new approaches to water management, particularly developing a robust approach to evaluating water risks throughout SABMiller's value chain and sharing best practice throughout their global operations on how to tackle these risks. Work has already begun in Peru, Tanzania, South Africa and Ukraine. The partnership will also seek to share the lessons learned with other stakeholders to promote better management of water across the world.

5.6.2 Targets and Commitments

Asia, Australia, Foster's Group, Energy and Water Reduction Targets
Foster's Group has specific targets for energy reduction that seek a 10% reduction in energy use per unit of production by 2011 (from 2007 levels) and can already show significant progress towards this target. Specific targets for water reduction also seek a 10% reduction in water use per unit of production by 2011 (from 2007 levels).

Americas, USA, MillerCoors, Environmental Sustainability Strategy Targets for 2015
MillerCoors set tough targets for environmental improvements by 2015 and renewed their commitment to the US Environmental Protection Agency's Climate Leaders programme, pledging to reduce corporate-wide greenhouse gas emissions by 8% by 2015. The strategy identified to achieve these targets includes the following:

- To reduce water usage by 15% to achieve a 3.50:1.00 water-to-beer ratio, This will be achieved by completing water supply assessments, including a 10-year forward look at water-scarce regions, conducting capital improvements for water reduction projects and exploring packaging and water reuse opportunities;
- To reduce total energy use by 15% by incorporating transportation-related GHG emissions into US Environmental Protection Agency (EPA) Climate Leaders goals,

increasing the percentage of renewables in the energy portfolio and exploring anaerobic wastewater treatment technologies at two additional breweries;
- To reduce retail packaging by 2% by translating research results into potential packaging changes, continuing consumer research into new sustainable packaging and collaborating with industry coalitions to proactively influence the recycling regulatory environment; and
- To reduce waste to landfill by 15% by further improving waste collection methods at all breweries to increase recycling rates, setting new, aggressive, waste reduction targets for 2015 and achieving zero waste to landfill at one additional brewery.

Europe, UK, British Beer & Pub Association, Commitments

In 2010, the British Beer & Pub Association (BBPA) published a booklet, "Brewing Green/Our Commitment Towards a Sustainable Future for British Beer". This highlights what the sector has done over the last three decades and commits to targets for achievement over the next ten years. These include:

- To reduce carbon emissions by 67% by 2020 compared to 1990;
- To achieve an industry average of less than four hectolitres of water for each hectolitre of beer produced, a reduction of 42% by 2020 compared to 1990;
- To increase the use of renewable energy within the sector;
- To continue to reduce the amount of waste sent to landfill year on year and increase recycling;
- To play a part in the reduction of packaging waste from products;
- To minimise the use of packaging without compromising the safety and quality of products - through lightweighting and working with the wider supply chain;
- To continue to improve the efficient use of raw materials;
- To ensure appropriate environmental management systems are in place, covering carbon, energy, water, effluent, waste minimisation and packaging to reduce the environmental impact of brewing and in support of brewers' environmental policies and operating permits;
- To develop plans to ensure the sustainable future of brewing in the UK by monitoring and managing potential supply-side risks; and
- To produce an annual report that sets out progress against agreed plans and targets, and to enhance the quality and quantity of data available to monitor progress against all targets.

Global, AB InBev, Global Environmental Goals

AB InBev has set aggressive three-year global environmental goals as part of its "Better World" commitment, including a water usage goal for plants of 3.5 hectolitres of water for each hectolitre of production by the end of 2012. The new usage level will represent a 30% reduction per unit of production in the company's water usage worldwide since 2007, saving enough water to fill 25,000 Olympic-size swimming pools.

In addition, the company has set an ambitious global environmental goal of achieving a 99% recycling and reuse rate by the end of 2012 - up from 97.2% in 2007, 98.0% in 2009 and 98.3% in 2010. In this effort, it's facilities work to eliminate material losses, improve packaging efficiencies and find cost-effective alternative uses for raw materials and byproducts. It will also achieve a 10% reduction in carbon dioxide emissions and energy use for every hectolitre of production.

AB InBev reduced its energy use per hectolitre of production by 3.7% in 2010, and by 14% since 2007. In 2010, they used 6% less water per hectolitre of production than in 2009, and AB InBev has reduced water use per hectolitre of production by 19.7% since 2007.

Global, Carlsberg Group, Environmental Strategy
In 2009, Carlsberg Group developed a new environmental strategy with three main objectives:

- Sustaining industry leadership in water and energy use and gas emissions;
- Reducing packaging and promoting reuse and recycling of packaging material; and
- Supporting communities in managing their watersheds to reduce water supply problems.

To achieve this, the company has set targets for 2012: to reduce water consumption from 3.7hl/hl in 2009 to 3.3 in 2012; and reduce CO_2 emissions from 8.9 kg CO_2/hl in 2009 to 8.5 in 2012; and is implementing efficiency programmes in every part of the operation

Global, Heineken, Aware of Energy, Aware of Water Programme
The “Aware of Energy” programme reduced energy consumption across the business (i.e. thermal energy and electricity) by 17 per cent per hectolitre exceeding the goal of 15% reduction between 2002 and 2010.
The “Aware of Water” programme set a target of 7 hectolitres of water per hectolitre of beer brewed. In 2010, 82% of their breweries complied with this target an improvement on the 2009 figure of 80%. This programme has now been incorporated into the "Brewing a Better Future" programme.

Global, SABMiller, Targets to Reduce Fossil Fuel Emissions and Reduce Water Use
The company climate change strategy goes beyond energy efficiency and switching to renewable energy sources. It also embraces the question of how to help reduce greenhouse gas emissions across the entire value chain in relation to packaging manufacture, transport and refrigeration.
SABMiller has a target to reduce fossil fuel emissions from onsite energy use by 50% per hectolitre of beer between 2008 and 2020. Between April 2009 and March 2010, they used 23 Terajoules (TJ) of energy, equivalent to 139 MJ per hectolitre of beer produced, a 3% improvement on the previous year. This equates to 2.3 million tonnes of CO_2 per hectolitre of beer produced - an improvement of 4% on the previous year. The greater reduction in emissions compared to energy reflects a shift from using fossil fuels to cleaner forms of energy.
They continually evaluate and use new processes to reduce water consumption, including recycling it in secondary processes such as cooling and cleaning. In the financial year 2009/10, they used 722 million hectolitres to produce their beer. They have set a demanding target to reduce water use per hectolitre of beer by 25% between 2008 and 2015. This equates to an average water consumption of 3.5 hectolitres per hectolitre of beer. In 2009/10, the average figure was 4.3 hectolitres, a 4% improvement on the previous 12 months.

6 Terms and Definitions*

6.1 Glossary

Aerobic	Conditions in which air (oxygen) is present.
Anaerobic	Conditions in which there is no air (oxygen) present.
BERS	Bio-Energy Recovery Systems. A method of capturing methane from water arising from steam production.
Biodegradable	Capable of undergoing anaerobic or aerobic decomposition.
Biodiversity	The variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. Source: Article 2 of The Convention on Biological Diversity (CBD)
Biogas	A gas produced by the biological breakdown of organic matter in the absence of oxygen.
CAPS	CO_2 Advance Purification System.
CFC	Chlorofluorocarbon, a class of chemical compounds that depletes ozone.
Carbon Footprint (CF)	Environmental impact of operations on generation of greenhouse gases expressed as the weighted sum of greenhouse gas emissions and greenhouse gas removals of a process.
CO_2	Carbon dioxide.
Co-generation	A process in which an industrial facility uses its waste energy to produce heat and electricity.
Economiser	A heat exchanger that recovers energy from flue gas.
EMAS	Eco-Management and Audit Scheme.
Emission	The direct or indirect release of substances, vibrations, heat or noise from individual or diffuse sources in the installation into the air, water or land.
Greenhouse Gas (GHG)	Gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere and clouds. Implicated in global warming.
Greenhouse Gas Emission	Total mass of a GHG released to the atmosphere over a specified period of time.
IPPC	Integrated Pollution Prevention Control.
KPI	Key Performance Indicator.
Lightweighting	Reducing the use of raw materials in packaging.
LNG	Liquefied Natural Gas.
NOx	Oxides of nitrogen.
Recycling	The reprocessing in a production process of the waste materials for the original purpose or for other purposes including organic recycling but excluding energy recovery.

SCADA	Supervisory Control and Data Acquisition.
Specific Energy Consumption (SEC)	SEC is calculated by dividing total energy usage by total beer production (Mega Joules per hectolitre).
Specific Water Consumption (SWC)	SWC is calculated by dividing total usage by total beer production (hectolitres of water purchased per hectolitre of beer sold).
SO_2	Sulphur dioxide.
Sustainability	Able to be sustained for an indefinite period without damaging the environment, or without depleting a resource.
Water Footprint	An estimate of water use that includes both direct and indirect water use of a consumer or producer.

* The definitions in this glossary explain the terms as they are used in this document. There may be other regional definitions which are not identified here.

6.2 Units of Measurement

Joule (J)	One joule is defined as the amount of work or energy exerted when a force of one newton is applied over a displacement of one metre. One joule is the equivalent energy of one watt of power radiated or dissipated for one second.
Watt (W)	Power is the rate at which work is done, or the rate at which energy is expended. One watt is equal to one joule per second.
Watt Hour (W·h)	A unit of work or energy, representing the energy delivered at a rate of one watt for a period of one hour. This is equivalent to exactly 3.6 kilojoule (kJ) of energy.
Pascal (Pa)	Equivalent to one newton per square metre or one kilogram per metre per second per second.
Tonne (t)	A metric unit of mass equal to 1000 kilogram. Also called the metric ton.
Bar (bar)	A unit of pressure, equal to 10^5 Pascal. One bar is roughly the same as the average pressure of the Earth's atmosphere (atm), which is 1.01325 bar.

6.3 International System of units (SI) Prefixes

tera	T	1 000 000 000 000	= 10^{12}
giga	G	1 000 000 000	= 10^{9}
mega	M	1 000 000	= 10^{6}
kilo	k	1 000	= 10^{3}
hecto	h	100	= 10^{2}
deca	da	10	= 10^{1}
----------	----------	1 ----------	----------
deci	d	0.1	= 10^{-1}
centi	c	0.01	= 10^{-2}
milli	m	0.001	

6.4 Unit Abbreviations

Cf	cubic feet
GJ	Gigajoules
GWh	Gigawatt hour
Hl	hectolitre
Kg	Kilogram
Kl	Kilolitre
Kt	Kilotonne
kW	Kilowatt
kWh	kilowatt hours
m^3	cubic metre
m^3/h	cubic metre per hour
MT	Metric Tonne
MW	Megawatt
MWh	Megawatt hours
MWh/a	Megawatt hours per annum
MJ/hl	Mega Joules per hectolitre
Nm^3	Normal cubic meter
Therms	a non-SI unit of heat energy. It is approximately the energy equivalent of burning 100 cubic feet of natural gas
TJ	Terajoule