
Case Study: UK Drinks Sector

Resource efficiency in the UK whisky sector



Reducing water, material and packaging use in the whisky sector.

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Front cover photography: Whisky bottling line

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Research Summary

There are several types of whisky produced in the UK, with the main distinction being malt or grain, though these can either be single or blends. Variation occurs between whisky produced in Scotland, Ireland, England and Wales, and whilst all these are considered within the document, Scotch whisky is dominant by volume, and some data refer to this sector specifically.

Resource Maps have been produced for both malt and grain whisky showing the key inputs at each production stage and the waste and loss streams that result. These Maps are included at the end of this review.

This review highlights some of the hotspots of resource consumption, and provides guidance for improving resource efficiency.

Key opportunities

- 546 tonnes of stretch wrap conserved equates to a sector saving of £781,000
- A total glass saving of over 174,000 tonnes per year could be made
- Water monitoring at different stages of the production process to help reduce use

Packaging

The Scotch whisky industry bottles around 1.2 billion 70cl bottles of whisky per year, equating to over 520,700 tonnes of glass. Whisky is a premium product and is often packaged heavily, with 4.44kg of packaging per 9 litre case on average (493g per litre). The Scotch Whisky Association (SWA) aims to reduce the amount of packaging by 10% by 2020.

There is an opportunity for lightweighting the glass bottles as well reducing the amount of outer packaging – however, this is sometimes perceived as reflecting a lower-quality product and therefore more work is needed to encourage brands to move to lighter bottles.

There have been several successful examples such as Co-op own brand whisky reducing glass bottle weight to below 300g. Consumer perception research carried out during a trial period suggested no negative impact associated with the lighter bottle, when compared with whisky of a similar standard in a heavier bottle, though several caveats were noted as the bottles compared were not identical¹. The bottle is a significant reduction to the 540g average mass given by DHL in 2007, and could offer a total glass saving of over 174,000 tonnes per year if rolled out to the whole of the whisky sector.



Image 1: **Bottling line.** Whisky is a premium product and is frequently packaged in heavy glass bottles

¹ WRAP (2007) *Container Lite – Opportunities for the Co-op to lightweight glass packaging*

An additional target for packaging reduction is the secondary and tertiary materials consumed in transportation and for on-shelf promotion. Packaging that has been developed for one market may not be optimum in another. For example Chivas Brothers have saved over 200 tonnes of cardboard per year by removing the outer gift pack on their Chivas Regal 12 years old, sold into the Chinese market, after determining that the majority of sales were for the on-trade, with customers never seeing the outer packaging. The potential savings opportunity for the whisky sector was not clear however as further evaluation of end markets for all exports would be required.

Stretch wrap is a common material for stabilising pallet loads and used at each stage of transportation, whether ingredient transport to distillery, or bottles/boxes delivered from distillery or bottling plant to distribution centres and finally to the retailer. Stretch wrap is often applied inefficiently and within the whisky sector, an estimated 546 tonnes of material could be saved by more efficient practice, achievable by ensuring staff are trained and machinery is handled correctly. Based on April 2011 price of virgin plastic film, 546 tonnes of wrap conserved equates to a sector saving of £781,000.

Water use

The SWA has stated that water use is one of the focus areas for its environmental policy. Over 61 billion litres are used for the production of Scotch whisky, though 75% (85% for malt whisky) of water used is cooling water, which is returned, under discharge consent, to the environment un-contaminated. Based on SWA figures of 524 million litres of pure alcohol (LPA) equating to 1.3 billion litres of product² in 2009 this gives an average of 46.9l/l of product, reduced to 11.7l/l of product if cooling water is excluded.

Best practice is difficult to assess, as companies providing data were typically unable to report specific figures for the production of whisky and give a clear breakdown of what the water was used for. Many companies report only at parent company level rather than at site level, or else cannot differentiate between multiple products that might be produced on site.



Image 2: **Mash tun.** Malted barley or grain is mixed with hot water in a mash tun

A critical first step to improve water efficiency is to install meters, including sub- meters where applicable. This will help identify the hotspots of usage to target, but also may identify leaks in the system (a significant potential hidden loss). Better water monitoring will also aid industry in understanding where support and innovation is needed. All staff should be trained and made aware of water conservation practices,

² LPA taken as 3.57 bottles, from Scotch Whisky Regulations 2009 - Explanatory Memorandum, Office of Public Sector Regulation Available from http://www.legislation.gov.uk/uksi/2009/2890/pdfs/uksiem_20092890_en.pdf

and a management system implemented to continue to review and improve water consumption and disposal.

Although a breakdown of water use is unavailable, the processes using water are well understood. Improved recycling of water for low value uses offers much opportunity for example cleaning water can often be reused, and cooling water in particular, has no contamination, so can be used for other processes around the plant, though not in product³.

Clean in place (CIP)

Washing of equipment is a significant use of water. This can represent up to 70% of drinks sector water consumption⁴ and is considered a critical focus for water savings. Producers of whisky can be more risk averse compared with other sectors leading to increased water use.

Methods for optimising CIP may include:

- incorporating the internal recycling of water and chemicals;
- carefully setting operating programmes, which coincide with the real cleaning requirements of the process;
- using water efficient spray devices; and
- by removing product and gross soiling prior to cleaning.

Diageo has investigated the optimisation of its CIP systems in a number of its sites, such as Leven packaging plant which reported potential savings of 222,000 litres of water per annum through more efficient CIP procedures for vessels and pipes between bottle runs⁵. Using WRAP data for water carbon conversion, this equates to 220 tCO₂e⁶. A process of continuous analysis and improvement delivered a 25% improvement in water efficiency at the Cameronbridge grain distillery during 2010 as compared to 2009.

³ SWA Scotch Whisky Industry Environmental Strategy Report 2010

⁴ Federation House Commitment Reducing water use within the UK food and drink industry 2010 report

⁵ www.scotch-whisky.org.uk/swa/files/cswater.pdf

⁶ See WRAP Water efficiency in the drinks sector - carbon conversion factor from the Water UK Sustainability Indicators report which states that every 1m³ (1,000 litres) of water saved equates to a CO₂e saving of 1kg

Waste water

Much of the organic matter in effluent is recovered before discharge, as there is significant value to be gained from separation. Organic content can be sent for animal feed along with the spent grain and yeast, or sent for recovery via innovative technologies such as anaerobic digestion (AD). The remaining liquid has low nutritional value and becomes more of a problematic issue, often discharged under consent to sea or treated on site before discharge elsewhere (via public sewage systems for example). Wetland systems are a possible pathway to treat metal contaminated water, with reed beds a proven system for distillery effluent⁷, using natural ecological filters to remove the high copper levels present from distillation in copper stills. The Glenfiddich, Benrinnes and Glenallachie distilleries have all incorporated wetland systems into water treatment, removing up to 95% of copper residues.⁸



Image 3: **Stills.** Water can be optimised by considering advanced CIP for cleaning of equipment on site

⁷ Murphy et al (2009) *The application of wetland technology for copper removal from distillery wastewater: a case study.* *Water Science and Technology*

⁸ www.scotch-whisky.org.uk/swa/files/cswater.pdf

Organic resource

Spent grain produced alongside the whisky itself has historically been used for animal feed, though alternative options are being developed. Spent grain is treated as a by-product, not a waste. No examples were found where spent grain is sent to landfill.



A significant proportion of liquid output is in the form of pot ale – the residue from the still after distillation. This contains solid content of approximately 4.0-4.5% and may be evaporated to pot ale syrup, to be sold on as liquid animal feed (or blended with draff and processed to dark grain). The remaining condensate is low in nutrients and may be high in copper.

Alternative treatments of pot ale are available, and new technologies and innovations offer expanding opportunity. Bioenergy facilities, such as biomass and AD plants, can convert pot ale into renewable energy, though organic matter from either spent grains or other sources is needed to ensure high enough organic content for this to be viable.

Loss of product is minimised across the sector, with filling efficiencies, shelf life and other typical beverage loss factors not being applicable to the whisky sector⁹, resulting in less than 1% losses¹⁰. This is considered to be largely due to the extended production process and inherent value of the product itself.

Conclusions

The whisky sector, with support from the Scotch Whisky Association (SWA) has produced an Environmental Strategy that lead to resource efficiency improvements within the sector. Further opportunity lies in rolling out the best practice across the sector as a whole.

There are several focal points for maximising resource efficiency within whisky manufacture in the UK, listed below

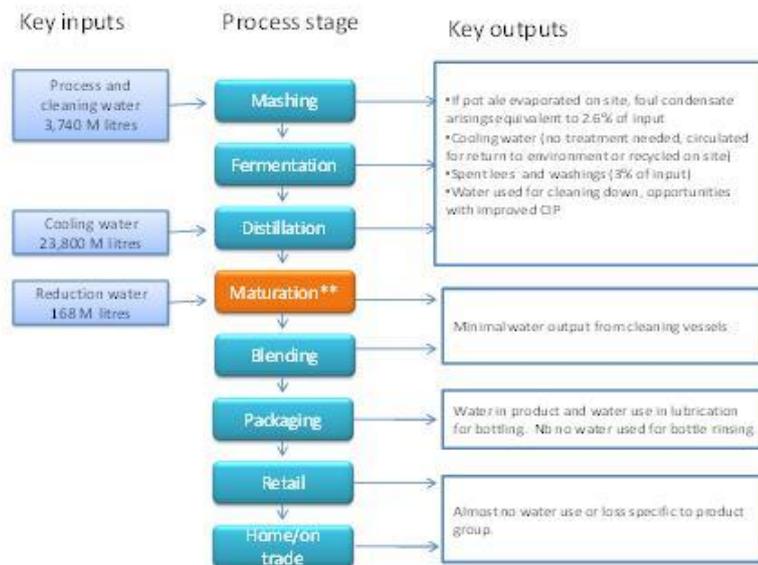
- **Effluent disposal.** The low nutritional value, and high copper content often results in low value disposal, yet treatment through wetland systems or onsite technologies offers improved output.
- **Water consumption.** This should be considered a key focus for the sector, with opportunity for improved CIP and recycling of water on site. The first step should be to install meters and monitor usage – these should be in place at numerous points across the process, to ensure leaks and inefficient processes can be identified.
- **Primary packaging.** Consideration of lightweighting where this will not influence brand quality perception.
- **Secondary packaging.** Assess target markets and review packaging formats for distribution and optimise use of stretch wrap.

⁹ WRAP (2011) *Product losses in the UK drinks sector*

¹⁰ *Confidential industry reviews 2011*

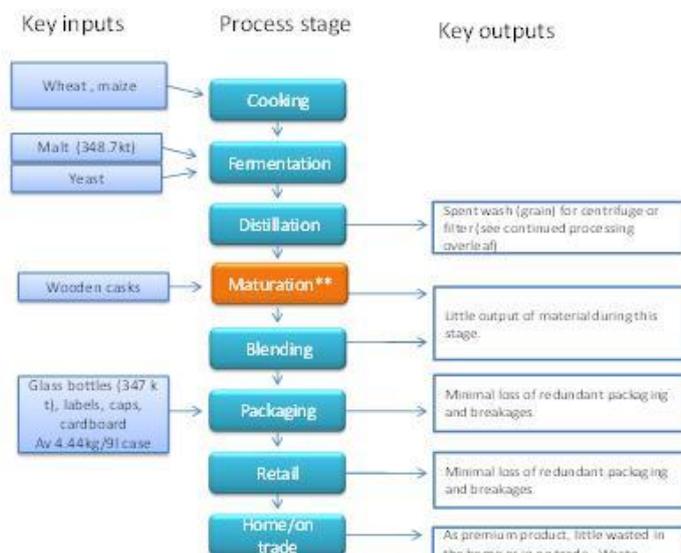
Whisky Resource Maps

Malt whisk(e)y – water



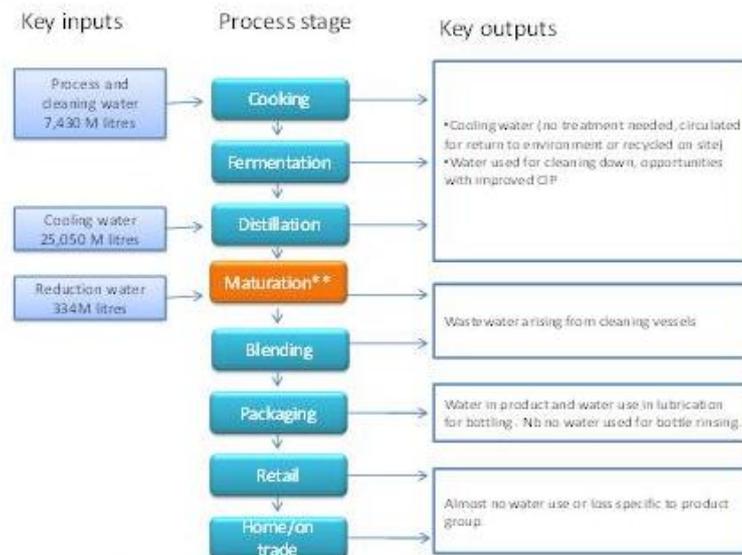
**Important note: Maturation takes a minimum of 3 years, but often takes 10 to 20 years or longer. Figures are not recorded by litre of product, rather the inputs based on 2010 production – therefore caution should be used as the inputs used are not directly relating to the outputs of saleable whisk(e)y released in that year.

Grain whisk(e)y -material



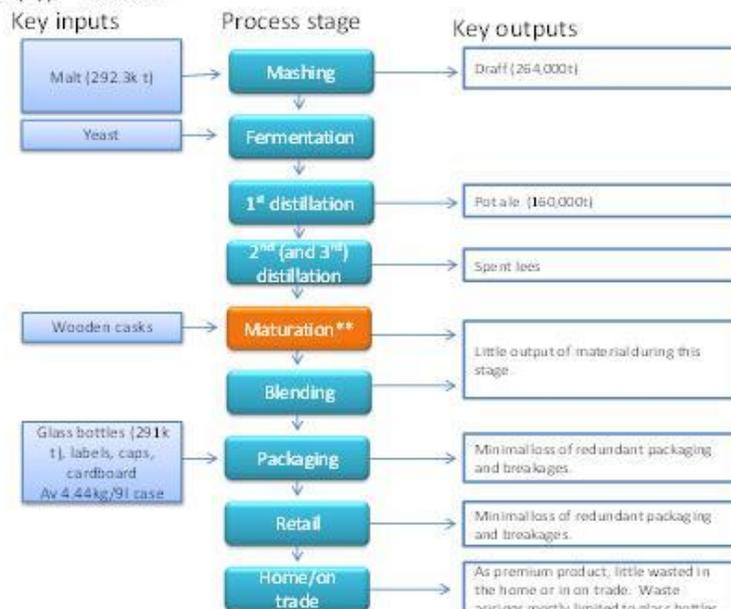
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Grain whisk(e)y - water



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Malt whisk(e)y – material



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