



RESOURCE EFFICIENCY FACTSHEET

# Food & Beverage Manufacturing Sector



## The food and beverages sector

The Food and Beverages sector is one that, from an Irish perspective, is not only nationally significant in terms of employment and environmental impact but it can also be subdivided into sectors that can also be considered nationally significant in themselves (e.g. dairy processing, meat processing, bakeries, brewing and distilling, soft drinks, fruit and vegetable processing etc.).

The products of this sector are fast moving consumer goods (FMCG) that are consumed daily, have typically a short shelf-life and are a significant source of packaging waste. In 2016 the food and beverages sector spent c.€12bn on raw materials and produced over 12 million tonnes of products with a sales value of over €24bn (source: CSO Prodcom).

The Irish government has set targets to greatly increase the output from the sector through the 'Food Wise 2025' (covering 2015-2025), 10-year rolling national plan. The plan includes a commitment to increasing the value of agri-food exports by 85% to €19 billion and the creation of an additional 23,000 direct jobs in the agri-food sector all along the supply chain from primary production to high value-added product development.

Unlike the earlier plan, Food Harvest 2020, where there were sectoral targets (e.g. milk output to increase by 50%) there is no specific detail in the FoodWise 2025 plan as to how the growth projections, above, are to be achieved. It is also worth noting that these growth projections do not specify quantity increases, rather they refer to financial and employment increases only.

## Potential resource efficiency initiatives in the sector

### Policy

Food waste is a significant problem throughout the supply chain; in agriculture, food production, transport, storage, distribution, in the consumption phase and final disposal. The 2011 EU Communication on Resource Efficiency, suggests that "By 2020, incentives to healthier and more sustainable food production and consumption will be widespread and will have driven a 20% reduction in the food chain's resource inputs. Disposal of edible food waste should have been halved in the EU." Ireland is a signatory to the Food Waste Charter<sup>1</sup>. The Charter adopts the United Nations Sustainable Development Goal that we will halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses by the year 2030.

Fig 1. shows where in the food chain that the waste is generated. As can be seen, the main sector for waste is households, at 53%.

*"AROUND 88 MILLION TONNES OF FOOD WASTE IS GENERATED IN THE EU AND OVER ONE MILLION TONNES IN IRELAND ANNUALLY"*

## Food waste resources in EU

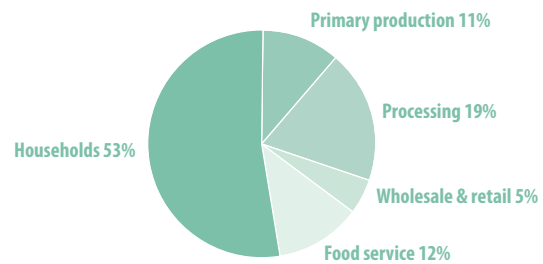


Fig.1 - EU food waste by sector in 2012; includes food and inedible parts associated with food (source: Fusions EU Project, Estimates of Food waste in the EU).<sup>2</sup>

Both France<sup>3</sup> and Italy<sup>4</sup> have introduced national plans on food waste and laws for food donation/distribution. To mitigate the impact of increased primary production in Irish agriculture the FoodWise 2025 plan promotes the concept of sustainable intensification, coordinated through a partnership of Irish Government Agencies (Sustainable Food Systems Ireland). Sustainable intensification is designed to increase productivity while using natural resources in a sustainable manner. Ireland has a grass-based livestock production system that is reportedly more environmentally sustainable (the lowest GHG emissions in the EU for dairy animals and the fifth lowest for beef) compared to alternative intensive feed systems although recently Irish agriculture has been reported as the least climate efficient in Europe<sup>5</sup> (the highest greenhouse gas emissions per euro of output).



<sup>1</sup> <http://foodwasteforum.ie/wp-content/uploads/2017/03/Food-Waste-Charter-V008.pdf>

<sup>2</sup> <https://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf>

<sup>3</sup> [http://ec.europa.eu/environment/eir/pdf/report\\_fr\\_en.pdf](http://ec.europa.eu/environment/eir/pdf/report_fr_en.pdf)

<sup>4</sup> [http://ec.europa.eu/environment/eir/pdf/report\\_it\\_en.pdf](http://ec.europa.eu/environment/eir/pdf/report_it_en.pdf)

<sup>5</sup> [http://www.europarl.europa.eu/RegData/etudes/STUD/2017/585905/IPOL\\_STU\(2017\)585905\\_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2017/585905/IPOL_STU(2017)585905_EN.pdf)

<sup>6</sup> <http://webarchive.nationalarchives.gov.uk/20130125041707/http://www.defra.gov.uk/statistics/files/defra-stats-foodfarm-food-productivity-methodology-120126.pdf>

## Relevant Indicators

Meaningful indicators are required to demonstrate resource efficiency improvements in a company or sector. Indicators are normalised to production to take account of seasonality in the food and beverage sector and increases or decreases in throughput of materials. Benchmark data are available from sources including Teagasc, Enterprise Ireland and the EU (BAT Reference Guide for the Food, Drink and Milk Sector). Sectoral data are available from CSO. Of particular relevance to food processing is the percentage of food wasted. The use of material flow analysis is a tool that can be used to determine potential inefficiencies in existing systems, in terms of tonnes of raw materials and products. An economic indicator, total Factor Productivity (TFP) can be used to measure the effective use of inputs in a sector by comparing them with the volume of outputs. TFP compares inputs: purchases, labour costs and capital expenditure with outputs (turnover) in economic rather than material quantity terms. Total Factor Productivity of the Food Chain has previously been reported on in the UK. Examples of other resource efficiency indicators are included in the following sections.

## Materials

In the food and beverages industry, one of the biggest operating costs is the purchase of raw materials and packaging.

### Recommendations for reducing materials consumption include:

- Redesign product, production process and packaging process to minimise materials usage (e.g. reduce the amount of the materials used in the final product – “Lightweighting”).
- Avoid one-trip packaging. Dawn Meats introduced reusable returnable packaging. There was a reduction of 166t (or 10%) of cardboard usage.

## CASE STUDIES

Green Isle redesigned the packaging for Goodfellas pizza boxes which resulted in savings of 460 t.p.a. of cardboard. Additionally, 100% recycled board is now used; a shrink wrap saving of 73 t.p.a. (or 290 tCO<sub>2</sub>). Some other examples from Irish manufacturers include Tayto re-designing their cardboard boxes and Irish Distillers reducing the weight of spirits bottles by 30%. Bachelors redesigned their peas and pulses cans which resulted in a weight reduction per can with associated steel savings of 20 tonnes per annum.

## Waste

There are several initiatives in place in Ireland to help reduce food waste. Under the EPA's BeGreen banner programmes like Stop Food Waste and Local Authority Prevention Network (LAPN) (Food and Events) focus mainly on the domestic sector, although there are some business-related activities. Crosscare, Foodcloud, and the Bia Food Initiative are social enterprises, working with surplus food, from manufacturers as well as the wholesale and retail sectors.

Sector-specific initiatives such as BIM's Green Seafood Business Programme and Bord Bia's Origin Green programme deal with food processing. One example of waste recovery is the Glanbia Ingredients Ireland (GII) membrane treatment plant, which separates waste white-water into water of drinking water quality standard while at the same time removing solids that can then be used as an organic certified fertiliser. Errigal Seafood is focusing on initiatives aimed at reducing overall waste through further meat recovery as well as funding research into the use of all by-products from manufacturing, such as shellfish shells, to explore their use as organic fertiliser and road grit.

## Energy

A typical range for energy consumption in plants processing milk is 0.5-1.2 MJ/kg of milk intake. Typical figures for the energy consumption per tonne of fish intake are 65-87 kWh for filleting, 150-190 kWh for canning and c.32 kWh for fish meal and oil production, plus 32 litres of fuel oil. Typical ranges for energy consumption in meat processing operations are 1200-4800 MJ per tonne of hot standard carcass weight.

### Measures that can be employed to reduce energy consumption in the sector are:

- Heat Recovery (from air compressors, refrigeration plant and boiler stacks). A seafood processing company based in the West of Ireland installed a heat exchanger on the hot gas discharge pipe of their refrigeration system. The exchanger recovers waste heat from the gas and uses it to generate hot water.

This project reduced their hot water bill by 70% and also resulted in significant electricity savings by reducing the load on the refrigeration system.

- Process Optimisation (reconfiguration of existing processes) including the use of pinch-point analysis.
- Boiler condensate return.
- Hot Water pre-heating using Solar Thermal Energy or Heat Pumps.
- Combined Heat and Power, for steam hot water and electricity generation.
- Tri-generation (CHP with additional cooling).
- Use of free or alternative cooling. Diageo in St. James Gate, Dublin achieved saving of 1 GWh per annum (2% of the site's electrical load) reducing the mechanical refrigeration load by using incoming mains water to reduce the requirement for mechanical cooling.

### CASE STUDY

Shellfish Ireland use significant amounts of diesel fuel to generate steam in their cooking process. Through work with BIM's Green Seafood Business Programme the theoretical quantity of fuel was calculated and compared with actual consumption. This showed an overuse of fuel per kg of cooked product. Through better optimisation and upgrading of their steam injection process, Shellfish Ireland reduced their diesel consumption by 10%. The concept of theoretical yield involves calculating the maximum product output from the input of materials, energy and water. This approach of using theoretical yield calculation could be used in other sectors.

### Water

The food-processing and drinks industries are large water users. Water is used as an ingredient, in process cleaning (clean-in-place and clean-out-of-place), in the conveying of raw materials, and as the main agent used in sanitising plant and equipment. Large scale use of water can result in significant volumes of wastewater as well as associated contaminants. Rates of water consumption can vary considerably depending on the scale of the plant, the age and type of processing, the level of automation, and cleaning practices. Typical figures for fresh water consumption in meat processing are 2–15m<sup>3</sup> per tonne of live carcass weight. Typical figures for fresh water consumption per tonne of fish intake are 5–11m<sup>3</sup> for fish filleting, 15m<sup>3</sup> for canning and 0.5m<sup>3</sup> for fish meal and oil production. Fish meal and oil production also consumes about 20m<sup>3</sup> of seawater per tonne of fish intake.

### CASE STUDY

Seafood processor, Sofrimar, installed online hourly water metering and identified that large amounts of water were being used for cleaning. The company installed a new system which improved nozzles, centralised their chemical dosing and reduced flow rates from 100 litres per minute to 30-40 litres per minute. This reduced Sofrimar's water use by 30%.

### Resource efficiency initiatives include:

- Recovery of rinse solutions for reuse as a first flush/rinse (commonly practised in the dairy processing sector in automated clean-in-place systems).
- Recover evaporator condensate. Connacht Gold recovered 20,000m<sup>3</sup> of hot water from evaporator condensate (a saving of €21,000).
- Condensate return systems for reuse as boiler feed water is considered best practice.
- Use of high-pressure low-volume hoses for cleaning
- Use of spray-balls in vessels optimises cleaning volumes
- Flow restrictors or aerators in taps to reduce flow volumes

### Clean Technologies

Clean Technologies are manufacturing processes or product technologies that reduce pollution or waste, energy use, or material use in comparison to the technologies that they replace.

### Some technologies for consideration in minimising resources include:

- Crushed ice to clean pipelines of product in place of aqueous rinse.
- Membranes to concentrate liquid products (e.g. milk, whey protein, casein etc.) prior to pervaporation and spray-drying.
- Advanced membranes and diffused air systems used in wastewater treatment aeration systems for more efficient oxygen transfer (kgO<sub>2</sub>/kWh).
- Material recovery for reuse (closed loop/zero emissions)
- Improved sensors for better process control (e.g. steam mass flow meters to avoid boilers cycling).
- Ambient temperature sterile solution for knife cleaning in meat processing instead of high temperature continual overflow baths.

## Further Information

Origin Green, Bord Bia sustainability programme for the Food and Drink Sector <http://www.origingreen.ie/>

EPA Green Business List of Funding Opportunities to Green Your Business:

<http://greenbusiness.ie/wp-content/uploads/2015/05/Funding-List-2.pdf>

BIM Green Seafood Business Programme:

<http://www.bim.ie/green-seafood/>

EPA Green Business Programme, resources include case studies and sectoral guides:

<http://greenbusiness.ie/>

The new EU BAT reference guidance for the food, drink and milk sector (first draft Jan 2017)

[http://eippcb.jrc.ec.europa.eu/reference/BREF/FDM/FDM\\_31-01-2017-D1\\_b\\_w.pdf](http://eippcb.jrc.ec.europa.eu/reference/BREF/FDM/FDM_31-01-2017-D1_b_w.pdf)

The EPA's Stop Food Waste programme; assists businesses in reducing food waste:

<http://www.stopfoodwaste.ie/food-in-business/>

The EPA's Local Authority Prevention Network programme on food waste prevention:

<http://localprevention.ie/projects/food-waste/>

Cleaner Production Assessment in Meat Processing:

<http://www.uneptie.org/shared/publications/pdf/2482-CPmeat.pdf>

Cleaner Production Assessment in Fish Processing:

<http://www.unep.fr/shared/publications/pdf/2481-CPfish.pdf>

Cleaner Production Assessment in Dairy Processing:

<http://www.unep.fr/shared/publications/pdf/2480-CpDairy.pdf>

Resource Efficiency in Priority Irish Business Sectors

### Authors

Clean Technology Centre, Cork Institute of Technology.

Melbourn Building

53 Melbourn Avenue

Bishopstown

Cork

Ireland

Tel: 353 21 4344864

Email: [ctc@ctc-cork.ie](mailto:ctc@ctc-cork.ie)

Website: [www.ctc-cork.ie](http://www.ctc-cork.ie)

This factsheet is one of seven that accompanies the main report of the EPA research project: Efficiency in Priority Irish Business Sectors (2014-RE-DS-1). Other factsheets are available on the following sectors: Construction, Pharmaceutical and Chemical, Retail, Manufacture of Non-Metallic Mineral Products, Accommodation and Food Service. There is also an overall factsheet. The main report is available at [www.epa.ie](http://www.epa.ie).

