GREENHOUSE GAS EMISSIONS – E3

Eco-efficiency resources for the food processing industry

Some common terms explained

There are a lot of phrases and concepts in relation to greenhouse gas emissions, climate change and emissions trading, many of which are similar and difficult to understand. This fact sheet provides a brief description of some of the common terms and concepts and how they relate to the food industry.

Greenhouse gases (GHG) are those gases that trap heat in the atmosphere, similar to the way a greenhouse works.

The three most common gases for the food sector are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Most greenhouse gas emissions from food processing industries stem from energy use and waste streams. Reduction in energy use through efficiencies is the easiest way companies can reduce their production of greenhouse gases. Refer to the Energy efficiency overview (E1), Utility efficiency overview (U1) and Resource recovery from wastewater (W8) fact sheets for suggestions on how to implement energy efficiencies in food factories.

Carbon dioxide equivalents (CO_2-e)

The measurement of greenhouse gases is generally expressed as carbon dioxide equivalents (CO_2-e) to allow easy interpretation.

Each greenhouse gas is given a carbon dioxide rating, or Global Warming Potential (GWP) relating to the amount of carbon dioxide required to have the same impact on the environment. For example, methane's rating is 21, so one tonne of methane is equivalent to 21 tonnes of carbon dioxide. This allows assessments to be undertaken based on CO_2-e allowing comparisons between assessments. Table 1 outlines the GWP of some common greenhouse gases.

Table 1: Global Warming Potential[1]

Gas	Chemical formula	Global Warming Potential
Carbon dioxide	CO_2	1
Methane	CH_4	21
Nitrous oxide	N_2O	310
Hydrofluorocarbons	HFCs	140 – 11,700
Sulphur hexafluoride	SF_6	23,900
Hydrofluoroethers	HFEs	100-500
Perfluorocarbons	PFCs	6,500-9,200

[1] Australian Department of Climate Change, January 2008, National Greenhouse Accounts (NGA) Factors, www.greenhouse.gov.au/workbook/pubs/workbook-feb2008.pdf

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Carbon footprint

Carbon footprint refers to the amount of CO_2-e produced by an individual, organisation or product.

Greenhouse gas emissions can be divided into three separate categories based on the amount of control a company has over their release.

- Scope 1 – direct emissions from combustion of fuels or production of gases such as fuel use in the forklift, burning gas on-site in a boiler or production of methane through anaerobic wastewater treatment.
- Scope 2 – indirect emissions generally from the use of electricity generated off-site.
- Scope 3 – indirect emissions from goods and services such as emissions from disposal of the product or emissions during the production of raw materials.

A full carbon footprint takes into consideration all greenhouse gas emissions from every aspect of production and consumption, commonly termed cradle-to-grave. Figure 1 below outlines the sources of emissions for a food product.

The carbon footprint process for a food product

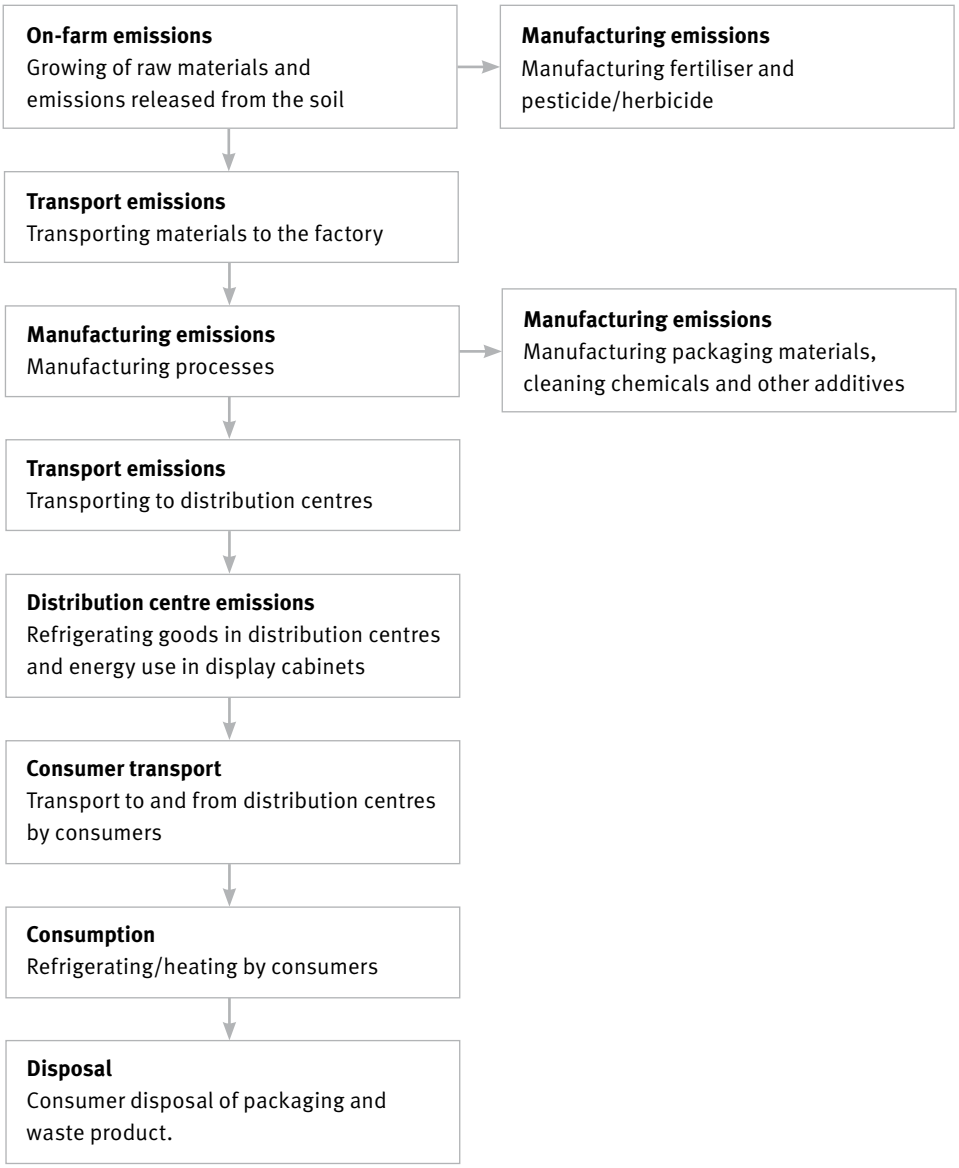


Figure 1: Flow diagram of the carbon footprint process for a food product.

There are generally two reasons to undertake a footprint exercise:

1. to evaluate the risk, manage the footprint and reduce emissions over time
2. to report the footprint to a third party.[2]

For a full carbon footprint of a product, the food processor will have to work with companies both up and down the supply chain. However, the following is a process for food processors to develop a basic footprint for the aspects of production under their control to manage their footprint and reduce emissions over time.

Basic carbon footprint methodology

Define the methodology
Either a company wide methodology or preferably an internationally recognised methodology such as the Greenhouse Gas Protocol www.ghgprotocol.org or the International Standard ISO 14064.1 Greenhouse Gases: Specification, with guidance at the organisational level for quantification and reporting of greenhouse gas emissions and removal.

Define the scope and boundary
For example, a single product or the whole factory, direct or indirect emissions or both and define the unit of measure, e.g. the product or the unit of production.

Determine the period of assessment
For example, a representative period such as a financial year, month, season.

Determine energy used during the assessment period
For that period, determine the amount of energy used on site in terms of electricity, gas, fuel for transport and other fuel.

Determine emissions from wastewater treatment process
In particular emissions from anaerobic digestion – refer to *Energy recovery (E5)* fact sheet for more information. Ignore wastewater discharged directly to sewer.

Convert energy to CO_2-e
Use a GHG calculator such as that provided in the ecoBiz Baseline Assessment or the conversion factors provided in the National Greenhouse and Energy Report (Measurement) Technical Guidelines.

Quantify production
Determine the amount of product produced during the period of assessment, for example, tonnes of product or number of items.

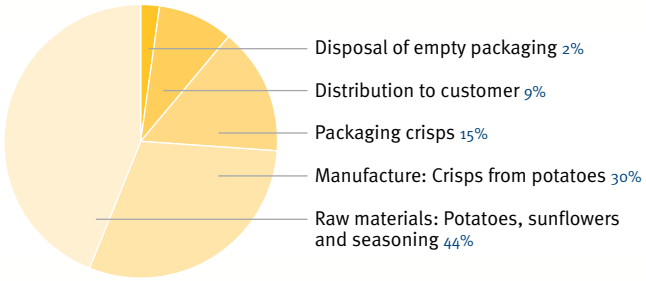
Determine CO_2-e per unit of measure
Divide the total CO_2-e by the unit of measure, e.g. unit of production or product, to get an averaged CO_2-e/unit of measure.

This process allows manufacturers to understand the different types of energy use in a factory in a comparable form and allows an assessment of the activities on site which result in most of the emissions. This process can be useful in comparing energy use and GHG emissions from year to year.

[2] Carbon Trust, 2007, Carbon Footprinting: An introduction for organisations, www.carbontrust.co.uk

THE CARBON FOOTPRINT OF POTATO CRISPS

A carbon footprint undertaken by Walkers Crisps in the United Kingdom found the following distribution of carbon emissions from the whole life of a packet of crisps from growing, through processing, to consumption and disposal.[3]



Whilst the majority of the carbon was emitted during the growing of the raw ingredients a large proportion of the carbon was due to the processing of the crisps and in particular, frying the crisps. It was found that because potato farmers were paid by weight, they provided their potatoes in a humidified environment increasing the water content of the potatoes. This increased the amount of energy required to fry the crisps contributing to increased carbon emissions.[4]

For more information:

There are many resources available to assist companies in determining their carbon footprint. However, many calculators apply to households and are not easily adapted to industrial uses. The Australian Greenhouse Challenge provides a carbon emissions tool to determine the carbon footprint from all your activities. www.greenhouse.gov.au/challenge/members/emissions.html

The Australian Department of Climate Change has produced the National Greenhouse and Energy Report (Measurement) Technical Guidelines which provide conversion factors, www.climatechange.gov.au/reporting/

Greenhouse Gas Protocol, www.ghgprotocol.org

The United Kingdom's Carbon Trust is a useful resource for more information, www.carbontrust.co.uk

Carbon neutral

Even the most efficient food manufacturer will generate emissions through energy consumption. Carbon neutral is the term applied when the balance of carbon emissions is zero. That is, for all emissions produced there are just as many emissions reduced.

In order to become carbon neutral:

- establish the boundary for the product or service that is to become carbon neutral
- list the activities involved within the boundary and the amount of CO_2-e generated through the process
- determine if any of the CO_2-e can be avoided through changes in process
- determine if any of the CO_2-e can be reduced through efficiencies
- determine if any of the CO_2-e can be reduced through changes in energy source, e.g. fossil fuel-based electricity to renewable energy
- offset remaining CO_2-e that cannot be removed from production (see below).

For more information visit:
www.davidsuzuki.org/Climate_Change/What_You_Can_Do/carbon_neutral_business.asp

[3] Walkers Snack Foods, 2007, Walkers Carbon Footprint, www.walkerscarbonfootprint.co.uk/walkers_carbon_footprint.html

[4] Murray, S., Oct 12, 2007, Financial Times, FT REPORT – SUSTAINABLE BUSINESS 2007: Food chain is complex, search.ft.com/ftArticle?queryText= per cent22Sarah+Murray per cent22+FT+Report&aje=false&id=071012000042&ct=0

Carbon offset

Carbon offsets is a means for companies or individuals to reduce their net carbon emissions by investing in an off-site activity that has a lower level of carbon emissions. In Australia there are several types of activities that are considered carbon offsetting: renewable energy, energy efficiency and forestry or bio-sequestration, or converting GHG equivalents, e.g. biogas capture and reuse.[5]

The production of renewable energy such as wind, solar, hydro, geothermal or biomass displaces fossil fuel usage and results in a net reduction in CO_2-e generation. Companies can invest in renewable energy as a means of offsetting CO_2-e production. Investment in renewable energy as an offset choice reduces the reliance on fossil fuels providing long-term benefits as well as immediate offset.

Energy efficiency achieves offset by investing in projects that provide a net reduction in emissions, such as a process or factory upgrade. This method provides financial support for energy efficiency projects which might not be otherwise affordable and can promote awareness of energy efficiency and provide long-term benefits of reduced energy usage. However, the difficulty in measuring pre and post emissions make this method less straightforward than the other two options.[6]

Tree planting or bio-sequestration is possibly the most widespread and well known offset, with plants absorbing carbon as they grow. Offset companies who revegetate and rehabilitate degenerated areas and that plant a diverse range of local native plants, as opposed to mono-cultures, provide the additional benefits of improving biodiversity of an area. This provides a long-term sustainable offset.

Bio-sequestration takes 70 years for the full emissions reduction to occur and if trees are not maintained properly and die then the carbon absorption does not happen. If fire or premature harvesting happen, the benefit from full offset will not be gained, so it is important to check the credentials of offset providers.

Did you know?

It takes approximately six trees to offset one tonne of carbon dioxide emissions as long as they are grown over a 70 year lifespan. The majority of the absorption occurs within the first 30 years.[7]

There is no internationally accepted standard for carbon offsetting. The two main standards in Australia are Greenhouse Friendly and NSW Greenhouse Gas Abatement Scheme. Registration with these schemes will ensure offset companies are Approved Abatement Providers.

For more information on Carbon Offsets and companies who provide offsets refer to Global Sustainability at RMIT University 2007 Report - Carbon Offset Providers in Australia 2007 at www.carbonoffsetguide.com.au

GreenPower

GreenPower is a national scheme that certifies the sources of renewable energy purchased by the distribution company and allows customers to compare products. Companies offering GreenPower must generate or purchase that amount of electricity from green sources such as wind, solar, geothermal, biomass and hydro power. Companies can purchase a portion (from 10 to 100 per cent) of electricity as GreenPower.

For more information visit: GreenPower, www.greenpower.gov.au

Greenhouse Friendly

Greenhouse Friendly assists companies to certify their products or services as carbon neutral and to certify carbon abatement programs using approved methodology and trained certifiers. For more information refer to *Energy efficiency programs (E2)* fact sheet.

[5] Global Sustainability at RMIT University, May 2007, Carbon Offset Providers in Australia 2007, www.global.rmit.edu.au/CarbonOffsets2007.pdf
[6] Global Sustainability, May 2007, Carbon Offset Providers.
[7] Carbon Neutral, December 2007, Turn Emissions into Trees, www.carbonneutral.com.au

Renewable Energy Certificates (RECs)

RECs are an electronic form of renewable energy currency under the mandatory renewable energy target (MRETs) to increase the uptake of renewable energy in Australia. Owners or operators of registered renewable energy power stations (including photovoltaic cell owners) apply for energy credits for the energy they produce. These credits can then be traded with other companies to assist companies in meeting their renewable energy targets. These RECs will play a part in carbon pollution education schemes.

For more information on RECs and MRETs visit the Australian Office of Renewable Energy Regulator at www.orer.gov.au

Carbon Pollution Reduction Scheme

The Australian Government has committed to introducing a Carbon Pollution Reduction Scheme (CPRS) (emissions trading scheme) by 2010 with the design of the scheme. The CPRS will take the form of a 'cap and trade' scheme similar to those in Europe and in parts of the US.

The overall objective of a 'cap and trade' scheme is to achieve a fixed level of emissions generation as set by the governing body and market driven efficiency. Government, in consultation with industry, determines the level of emissions that can be released and calculates the tonnes of carbon available that are then called 'carbon credits'. These carbon credits are allocated or auctioned to producers and form the limit of emissions that the company or other entity is legally allowed to emit. All companies captured by the scheme are required to provide a carbon assessment to determine the quantity of emissions they produce.

Companies must purchase carbon credits if they emit more than their allocation or can sell carbon credits if they produce fewer emissions.

The objective of the CPRS is that the market will set the price for carbon credits and drive the price and payback on efficiency initiatives. For example, initiatives that are currently uneconomical may become viable if the alternative is to purchase carbon credits. Generally CPRS will result in higher energy costs for companies regardless of whether they are directly captured under the scheme or not.

The most effective action to be taken at this time is to understand energy use in the factory and minimise the amount of energy used. An energy efficient factory will be in a strong position to participate in the CPRS when it arises.

IMPACT OF CPRS ON THE FOOD INDUSTRY

The impact of the CPRS on the food industry is currently unclear. It is probable that at least the larger energy users will be included in the CPRS. However, it is likely that these companies will already be participating in a Greenhouse Challenge Plus, EEO or other initiatives and will have a good understanding of their energy use.

It is likely that energy costs will increase and it may provide opportunities for companies who produce energy from their processes or wastewater (refer to *Energy recovery (E5)* and *Resource recovery from wastewater (W8)* fact sheets) to tap into this resource or to sell this energy to other participating companies.

This series of fact sheets provides examples and suggestions to the modern food processor on how to achieve both economic and environmental benefits from eco-efficiency. Visit the project website www.ecoefficiency.com.au for more ideas and case studies.

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This series of eco-efficiency fact sheets will demonstrate the importance of water in a modern food factory and suggest areas where savings can be made. The project website www.eco-efficiency.com.au has more ideas and case studies on water savings across the food industry.

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