



FOOD TECHNOLOGY FACT SHEET

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Carbon Strategy for the Food Industry

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Introduction

Carbon strategy is a term that refers to a systematic plan of action for managing carbon consumption and emissions related to food manufacturing and distribution activities. The impetus for carbon management strategy is rooted in several driving forces (Holcomb, 2010; Park, 2010):

1. Global climate change issues
2. Stakeholder and investor demands
3. Environmentally and socially conscious consumers
4. Government regulations and policies
5. Return on investment

Interpretation and agreement with the first three driving forces varies widely, but the last two are universally accepted. The need for carbon management in the food industry is not a fad (Capper et al. 2010) and is soundly based on satisfying these driving forces.

The purpose of this fact sheet is to introduce the reader to the major concepts of carbon strategy in the food industry and list some proactive steps to develop an effective carbon management plan.

Three important terms are at the center of carbon consumption and emission issues for food processors:

- Green house gas (GHG)
- Carbon footprint
- Life cycle assessment (LCA)

Green house gasses (GHGs) absorb infrared radiation in the atmosphere. GHGs common in food processing activities are listed in Table 1. Most of the GHGs emitted from food processing plants are a result of the use of electricity, natural gas, coal, diesel, gasoline or other energy sources. For example, the combustion of natural gas results in the emission of carbon dioxide according to the following chemical formula:



According to the U.S. Department of Energy (DOE, 2010), of the energy-related carbon emissions from the food industry, 40 percent result from use of electricity, 37 percent

from natural gas and 17 percent from coal. Other sources of GHGs in food processing include emissions from waste water treatment plants, refrigeration systems, composting operations and land application of water (sprinklers).

The carbon footprint of a food manufacturing facility is a measure of the equivalent carbon dioxide emissions associated with ongoing activities. Calculation of the footprint can be plant-wide or focused on a particular service or product. Emis-

Table 1. List of green house gases (GHGs) that are common in the food processing industry, adjusted for heat retention characteristics relative to carbon dioxide (Blasing, 2000).

GHG	Relative global warming potential
Carbon dioxide (CO ₂)	1
Methane (CH ₄)	25
Nitrous Oxide (N ₂ O)	298
HCFC-22	1,810
CFC-11	4,750
CFC-12	10,900



A systematic plan of action, or strategy, is required to address carbon management in today's food processing environment. Limited attention or disregard of carbon management may eventually reap destructive business results ranging from reduced sales to regulatory actions.

Proactive Steps

Suggestions for proactive measures to incorporate a carbon management strategy into a food industry business are listed below. Application should include a Pareto approach throughout strategy development and implementation to help identify the opportunities with the greatest return on investment. Business-wide continuous improvement processes also should include carbon management goals.

1. Inventory GHG emissions to establish a baseline footprint
 - Overall facility
 - Individual products
2. Consider GHG emissions in core business strategy
 - Product development (low or zero carbon products)
 - Advertising and marketing
 - Capital expenses
 - Planning
 - Product development and design
3. Assess internal opportunities to reduce GHG emissions
 - Capital improvements
 - o High efficiency equipment
 - o Waste heat recovery
 - o Insulation
 - Alternative energy sources
 - Logistics improvements
 - Packaging reduction and recycling
 - Lean, six-sigma approach
4. Establish third party emission reduction
 - Sourcing locations
 - Source measurement and evaluation
 - Transportation modes
5. Validate and verify results
6. Disseminate results
 - Stakeholders and investors
 - Consumers
 - Regulatory agencies

Conclusion

A carbon-constrained economy is a reality that businesses around the world must prepare for in earnest. Companies should focus on a developing a carbon management strategy that will prepare them to comply with upcoming regulation (Concessi, 2010) and increase competitiveness. This fact sheet outlines proactive steps to establish a carbon management strategy and provides a list of basic resources. If you would like guidance in the development of your carbon management strategy, please call the Robert M. Kerr Food & Agricultural Products Center at 405-744-6071 or e-mail fapc@okstate.edu to request assistance.

sions are classified in three categories: scope 1, 2, and 3. The categories are defined as (World Resources Institute, 2004):

- Scope 1: Direct emissions – sources owned or controlled by the food processor (e.g., boiler, heater, cooker, vehicle fleet, waste water treatment). NOTE: GHGs not covered in the Kyoto Protocol (CFCs, NO_x, etc.) are not included in scope 1.
- Scope 2: Electricity indirect emissions – those created by the use of purchased electricity.
- Scope 3: Other indirect emissions – those emissions that occur as a result of food processing activities but from sources not owned or controlled by the manufacturer (e.g., ingredients, freight, equipment manufacture, solid waste disposal, contractor, employee business travel). NOTE: Scope 3 is an optional reporting category.

Life cycle assessment (LCA) is a calculation of the cumulative effects of a food product or service on GHG emissions including acquisition of ingredients, production, product use and waste disposal. An LCA is used to study environmental impact and is commonly called a “cradle-to-grave” analysis. Primary components of an LCA are (Dantes, 2010): (1) environmental loads related to energy, raw materials, emissions and waste; (2) environmental impacts of loads; and (3) assessment of options to reduce impacts.

Importance of Carbon Strategy

Given the driving forces behind carbon management, the importance of developing and implementing a basic strategy is threefold (Wordsworth et al. 2004):

1. Increasing competitiveness
2. Enhancing reputation
3. Regulatory compliance

Resources

Online Carbon Calculators

Results will vary significantly depending on the assumptions and methods used by each calculator. Most of the calculators do not provide information regarding their assumptions, conversion factors and calculation methods. Furthermore, many of the tools are designed for personal or household use only. Padgett et al. (2007) and Roche and Campanella (2010) have published comparisons of some carbon calculators.

<http://www.squidoo.com/carboncalcs> (This website has a list of 75 carbon calculators.)

<http://www.epa.gov/RDEE/energy-resources/calculator.html>

<http://www.log-net.com/sustainability/?gclid=CLmdgJie-KACFYk55wodTjahwQ>

http://www.nativeenergy.com/pages/nativeenergy_s_business_calculator/488.php#begin

<http://www.lcacalculator.com/>

<http://coolclimate.berkeley.edu/>

<http://www.eatlowcarbon.org/>

<http://www.carbonfootprint.com/calculator.aspx>

<http://www.carbonify.com/carbon-calculator.htm>

<http://www.clearwater.org/carbon.html>

http://www.conservation.org/act/live_green/carboncalc/Pages/default.aspx

<http://www.nature.org/initiatives/climatechange/calculator/>

<http://www.stopglobalwarming.org/carboncalculator.asp>

Standards, Codes and Related Publications

New standards and codes are continuously developing for carbon management practices. The International Standards Organization (ISO) is particularly active in the forefront of this area. A search for new and updated standards should be conducted on a routine basis.

British Standards Institution (www.bsigroup.com/en)

- BSI PAS 2050 Assessing the life cycle greenhouse gas emissions of goods and services
- BSI BS ISO 14064 Greenhouse gases parts 1, 2 and 3
- BIS ISO 14065 Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition

Carbon Trust publications (www.carbontrust.co.uk)

- Code of good practice for product greenhouse gas emissions and reduction claims (CTC745)
- Product carbon footprinting: The new business opportunity pack (CTC744)
- Carbon footprinting – The next step to reducing your emissions (CTV043)

Greenhouse Gas Protocol Initiative publications (www.ghgprotocol.org)

- A corporate accounting and reporting standard
- GHG protocol for project accounting

- Guidance for quantifying GHG reductions from grid-connected electricity projects
 - Land use, land-use change and forestry guidance for GHG project accounting
 - Designing a custom GHG calculation tool
 - Measuring to manage: A guide to designing GHG accounting and reporting programs
 - Designing a U.S. greenhouse gas emissions registry
- International Standards Organization (www.iso.org)*
- TC 207/SC5 Life cycle assessment – Standards 14040 through 14049
 - TC 207/SC7 Greenhouse gas management and related activities – Standards 14064 through 14069
- Voluntary carbon standard 2007.1 (www.v-c-s.org)*

Glossary of Terms

The following list of terms (arranged alphabetically) are commonly used when discussing carbon management strategy.

Cap and trade: Also called emissions trading, the “cap” is a legal limit on the quantity of greenhouse gases that a region can emit each year and “trade” means that companies may swap among themselves the permission – or permits – to emit greenhouse gases.

Carbon calculators: The calculator used to measure the carbon footprint of a product/activity/person. Predefined conversion factors like LCA and EIOLCA are used to calculate the footprint.

Carbon footprint: Carbon footprint is a term used to describe the green house gas (GHG) emissions of an organization, product or a person and is measured in terms of carbon dioxide equivalents.



"Carbon issues aren't going away, and nobody can say for sure how the economy will be impacted. There are too many unknowns at this time: the public value of carbon savings, the costs of carbon offsets and the impacts on both producers and consumers."

— Rodney Holcomb, FAPC Agricultural Economist

Carbon permits: Also known as the emission permit, it is the fixed amount of GHG that may be released into atmosphere.

Carbon strategy: Systematic plan of action for managing carbon consumption and emissions.

Carbon tax: Policy instrument that sets a per-unit charge on emissions. Typically the system involves a tax on fuels that emit carbon dioxide when burned and on other greenhouse gas emission.

Clean technology: A technology which reduces the use of natural resources and promotes use of renewable sources.

Environmental footprint: Environmental impact any company or entity makes as it performs any activity. A footprint is determined by how well raw materials or byproducts are (or aren't) absorbed by the surrounding environment.

Food miles: The distance travelled by a food product from the farm to the store where it is purchased.

Global warming potential: Potential of a given quantity of chemical to cause global warming over a specific time period compared to the same mass of CO₂.

Green house gas: Gases in an atmosphere that absorb and emit radiation within the thermal infrared range. Examples: Carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O).

Life cycle assessment (LCA): A calculation of the cumulative effects of a food product or service on GHG emissions including acquisition of ingredients, production, product use and waste disposal. An LCA is used to study environmental impact and is commonly called a "cradle-to-grave" analysis.

Locally sourced materials: Materials obtained from a defined radius around a project site, helping to support the local economy and reducing transportation costs and energy.

Low carbon economy (LCE): An economy which has a minimal output of GHG into the atmosphere.

Non-renewable resource: Use of material and energy sources that leads to depletion of the earth's reserves that cannot be renewed in human-relevant periods of time. This includes coal, gas, oil and many mineral resources, like copper.

Offsetting: To counterbalance, counteract or compensate for. Carbon offsetting is the act of mitigating greenhouse gas emissions through emissions trading.

Polluter Pays Principle (PPP): Requires that the costs of pollution be borne by those who cause it.

Renewable resource: A resource that can be used continuously without being depleted (because it regenerates itself within a useful amount of time).

Sustainable: Anything that is capable of being continued without causing long-term effects on the environment.

Whole-of-life cost: Total cost of ownership over the life of an asset.

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