



# SMART EATING

## Food & Climate Change



## Educator's Guide



CITY OF CAPE TOWN | ISIXEKO SASEKAPA | STAD KAAPSTAD

---

THIS CITY WORKS FOR YOU



## Contents

1. Purpose .....	2
2. Project Methodology .....	2
3. Background .....	7
4. Food Production and Climate Change .....	9
5. Environmental impacts related to food production .....	11
6. Transporting Our Food .....	18
7. Waste Management .....	18
8. Is healthy food also climate-friendly (and vice versa)? .....	20
9. Cooking and storing our food.....	22
10. Eco procurement .....	23
11. Drinking water .....	24
12. Curriculum Links .....	25
13. Summary .....	27
14. References.....	29
15. Useful Websites.....	32



## 1. Purpose

This educator's guide has been developed as support documentation for educators who wish to participate in the Smart Eating Project about food and climate change. The Toolkit was developed for the City of Cape Town by the *icologie* team (Grace Stead, Andy le May and Jenny Josefsson). The toolkit includes this educator's guide, a learners' booklet and tuck shop audit sheet. There is also a PowerPoint presentation available.

The booklet provides an overview of the project methodology for the project, as well as reference material to assist the educator. It is important that the project is not a stand-alone action within the classroom, but becomes an integral part of the curriculum in a practical way. This educator's guide aims to make it easier for the educator to achieve this. The educators guide provides an overview of the main concerns relating to food and climate change, as well as linkages of how this can be interpreted within schools. The audit sheet provides a simple scoring system for assessing items in the tuck shop.

## 2. Project Methodology

The project aims to raise awareness around the links between food and climate change through doing a workshop with learners and then getting them to do an audit of the tuck shop and / or canteen. They then consider their findings and make recommendations around changes that can be implemented at the school. It is best if these can then be presented to the school and considered for implementation. Some schools might also have feeding schemes that could be considered.


The **objectives** of the Smart Eating project are to:

- Place Smart Eating Project in context of City's Energy & Climate Change Strategy, SMART Living Campaign and YES Programme.
- Establish buy-in from educators and learners to do the tuck shop audit.
- Present benefits and outcomes of the Smart Eating
- Present, negotiate and agree on implementation plan.
- Discuss and negotiate logistical arrangements.
- Clarify expectations, outcomes and deliverables.

During the Food and Climate Change audit process the learners should be encouraged to consider a variety of requirements:

1. Identify the **direct and indirect impacts** of the food items currently in the Tuck Shop. Learners should be encouraged to research the background of each of the products to identify the impacts at all stages of the production process.
2. Identify **alternative products** that can be chosen that have a lesser impact on the environment and thus climate change.



- 
3. Learners are to inform their peers as to their findings and provide **motivations** with compelling reasons as to why there should need to be a shift in behaviour and what products should be replaced to ensure a reduced negative impact.
  4. Develop a procedure to **measure new products** and keep the current information up-to-date.
  5. It could also be useful to do a survey of where the learners get their lunch from, and what they usually eat. This type of baseline data would indicate where the focus on the Smart Eating project should lie, as well as any future measures.

To provide guidance to the learners the following needs to be considered by the educators:

1. Ensure that **learners work in groups** – this is essential to gain the relevant information and also encourages teamwork.
2. The **scope of the audit** needs to be defined so that it can be compared to other schools (benchmarking) or compared to other audits to be done in the future. For the purpose of this project we are auditing the Tuck Shop facilities, although some schools might want to consider including their food gardens if appropriate.
3. Learners need to understand that there are different methodologies that they can use for the **data collection** depending on the situation. For the purpose of this audit we have provided some simple-to-use audit sheets to allow data to be gathered in a timely and easy fashion. This approach will not cover all eventualities but will be expeditious and give a comprehensive benchmark.
4. The Audit sheets have been developed for use in the schools, but can be **adapted to the local situation** at the school.

Learner should set **time frames** for specific actions so that the audit team can provide feedback and any problems can be addressed early in the process.

The project needs to be **communicated** within the school. Ensure that the relevant staff members at the school and specifically the tuck shop are informed about the process.

Once the **data** has been collected it needs to be collated and analysed to ensure that the right conclusions are reached. These conclusions will then be used to make recommendations for implementation through a retrofit plan that will be presented to the school.

## Support material

The toolkit includes a booklet for learners as well as a powerpoint presentation that can be used by teachers and an audit sheet for doing the audit.

Learners need to consider the various food types available at the school tuck shop and score them on the audit sheet according to the different impact areas such as production, transport, packaging etc. This will then give them a simple analysis of how different food types impact on climate change in different ways.



Below is an outline of the different food types and impact areas, as well as an example of how to fill in the tuck shop audit sheet. You need to consider all the different items individually to determine where they come from and what their impact is. The aim is to get an accurate score per item and which will assist learners to choose products with the lowest score as they should have the lowest impact on the environment and climate change.

## FOOD TYPE

- Describe the type of food to be audited, e.g. chocolate bar, chips, fizzy drink, ice-lolly, apple, carrot, meat pie.
- If unsure, break it down and take an average e.g. hamburger consists of a bread bun, patty, tomato, cheese, etc. Add the score up and divide by the number of items to determine an average.
- If there is a mixture of items, then always use the "worse case"

## PRODUCTION

Organic / Free range (1) Agriculture without pesticides, artificial fertilisers, genetic modification and sewage waste, as well as livestock that is reared free range (If **organic seasonal** fruit or vegetables is used, then score 0)

Conventional (3) Standard farming techniques (If **seasonal** fruit or vegetables are used, then score 2)

## PACKAGING

No packaging (0) No packaging associated with product, e.g. carrots from food garden

Recycled (1) Packaging that is already being recycled at the school e.g. tin cans, glass bottles, cardboard, plastic bottles with a poly logo such as PET

Recyclable (2) Packaging that can be recycled at the school in the future e.g. tin cans, glass bottles, cardboard, plastic bottles with a poly logo such as PET

Non-recyclable (3) Packaging that cannot be recycled e.g. cling wrap / tin foil / chips bags / polystyrene / tetra pack (juice carton box with foil, cardboard and plastic composite)

## TRANSPORT

Home / school (0) Made / grown at home or school

Local / Regional (1) Cape Town or Western Cape Region

National (2) Anywhere within South Africa, incl. Lesotho and Swaziland

Imported (4) Imported from any other country, 3 point if from within Southern African region



## STORAGE

Open Air (0)  
Fridge (2)

Any open air or pantry storage, e.g. chips, fruit, sweets  
Products that need to be kept in a fridge, e.g. cold drinks, milk, cheese. If refrigerated only after opening then score only 1 point.  
Products that need to be kept in a freezer, e.g. ice cream, frozen foods


## PREPARATION

Raw (0)  
Cooked (1)  
Deep fried (2)  
Processed (4)

Any products that are consumed without any cooking e.g. fruit, uncooked  
Any products that need to be cooked or re-heated locally before consumption e.g. home made lasagne  
Any products that are deep fried on-site e.g. "slap" chips  
A set of procedures used to produce a product, most commonly in the food and chemical industries. Any products that have been processed in a factory, e.g. chocolates, bread, meat pies, chips gets a 3 score and if it additionally needs to be re-heated prior to consumption then it gets a 4 score.

The following items have been included into the example below:


- Chocolate bar made under license in Durban, with some imported ingredients
- Packet of chips imported from USA
- Fizzy drink made in Johannesburg with an imported formula

SMART EATING: FOOD AND CLIMATE CHANGE AUDIT SHEET																			
DATE:							TEAM:							 CITY OF DURBAN (0000000000) 0000 00000000 THIS CITY WORKS FOR YOU					
VENUE:							NAMES:												
FOOD TYPE	PRODUCTION		PACKAGING				TRANSPORT				STORAGE			PREPARATION			TOTAL	COMMENTS	
Describe the type of food to be audited	Organic	Conventional	None	Recycled	Recyclable	Non-recyclable	Home / School	Local / Regional	National	Imported	Open air	Fridge	Freezer	Raw	Cooked	Deep fried	Processed	Total number of points per food item – less is more	Any comments that might influence scoring
POINTS	0/1	2/3	0	1	2	3	0	1	2	3/4	0	1/2	3	0	1	2	3/4		
Chocolate bar		3				3				3	0						3	12	Made in Durban, some imported bits
Chips		3				3				4	0						3	13	Imported from Europe
Fizzy Drink		3			2				2			1					3	11	Made in JHB, some elements imported
Ice Lolly		3				3				4			3				3	16	Imported from Italy
Apple	1			1				1			0			0				3	Organic, Ceres, out of season
Carrot	0		0				0				0			0				0	Organic, Food garden, in season
Meat Pie		3				3		1				2					4	13	Made Locally
<b>TOTAL</b>																			<b>TOTAL</b>



- Ice lolly made in Italy
- Organic apples grown in Ceres, out of season
- Carrots from the school food garden, grown organic and in season
- Meat pie made in Atlantis

An item such as a hamburger can either be calculated as a whole, or as individual items with an average as outlined below. See the description for the details of the individual items used to prepare the hamburger.

SMART EATING: FOOD AND CLIMATE CHANGE AUDIT SHEET																			
DATE:							TEAM:							 <small>CITY OF CAPE TOWN - LOCAL GOVERNMENT - 1996</small> <small>THIS CITY WORKS FOR YOU</small>					
VENUE:							NAMES:												
FOOD TYPE	PRODUCTION		PACKAGING				TRANSPORT				STORAGE			PREPARATION				TOTAL	COMMENTS
	Organic	Conventional	None	Recycled	Recyclable	Non-recyclable	Home / School	Local / Regional	National	Imported	Open air	Fridge	Freezer	Raw	Cooked	Deep fried	Processed		
POINTS	0/1	2/3	0	1	2	3	0	1	2	3/4	0	1/2	3	0	1	2	3/4	Total number of points per food item – less is more	Any comments that might influence scoring
Burger		2				3			2				3		1				
Bread		2				3			2				3		1			11	Local, Frozen, Plastic bags
Onions		3				3		1			0				1			8	Local, plastic bags, out of season
Tomatoes	0					3		1			2		0					6	Regional, plastic, organic, in season
Burger		2				3			3				3		1			12	Frozen, processed
Ketchup		2				3			3		1						3	12	Plastic sachets
Cheese		2				3		1			2						3	11	
																		60	Total
																		10	Average
<b>TOTAL</b>																			<b>TOTAL</b>

The hamburger comprises of the following items:

- Bread made locally, but delivered frozen in plastic bags.
- Onions grown locally, but delivered in plastic bags
- Tomatoes grown in Ceres (regional) and delivered in plastic bags
- Burger delivered frozen, with some processing involved
- Tomato sauce which is processed in a factory in a plastic bottle
- Cheese which is processed, with plastic wrapping and need to be refrigerated

The educators can have a workshop with the learners where the powerpoint presentation can be used to provide background information and work through the examples given above. It is structured in such a way that the learners first get information about why it is important, and are then encouraged to work out a project plan for implementing the tuck shop audit and giving feedback to the school. The presentation has a variety of examples and visuals to assist with getting the message across.





### 3. Background


The scientific evidence confirming that climate change is already taking place is abundant. It states that most of the global warming observed during the past 50 years has anthropogenic (human) causes. Climate change projections for Southern Africa indicate, amongst other things, increased variability in rainfall, more frequently occurring extreme climatic events and increases in temperature. In Cape Town a significant number of disasters have already been associated with climatic conditions such as flooding and storm surges etc (Mukheibir & Ziervogel, 2007). In the light of this it is urgent to address both the causes and effects of climate change and its projected impacts, as negligence in doing so may have unwanted, if not disastrous, consequences.

Over the past five to ten years research around human food consumption and its linkages to climate change have been given much attention, and it is now widely recognised that the processes surrounding food consumption (including production, harvesting, transports, storing, preparation, waste et cetera) significantly contributes to emissions of greenhouse gases and subsequently to global warming (*see for example* Carlsson-Kanyama, 2003; Garnett, undated *and* Steinfeld et al., 2006). Food production and processing requires, amongst other things, energy. Energy is used for planting and harvesting crops, feeding livestock, slaughtering animals, storing, transporting and preparation of food, as well as for a number of other inputs. Although there are several ways to produce energy, the use of fossil fuels, like oil, gas and coal, is currently the source of 70% of the energy used worldwide. Fossil fuels have major negative impacts on our planet, and one of the most serious consequences of fossil fuel use is global warming (Food Facts, Sierra Club *and* Energy consumption and its environmental impact, Sierra Club).

By using fossil fuels to produce energy, so-called greenhouse gases (GHGs) are emitted into the atmosphere. The most common GHGs are carbon dioxide (CO<sub>2</sub>), methane, nitrous oxide and refrigerant gases. The name 'greenhouse gases' derives from their ability to contain the sun's rays in the atmosphere, which then causes an overall warming of the Earth; hence we get the same effect as in a greenhouse (or a car parked in the sun on a hot summers day). It is however important to understand that greenhouse gases occur naturally in the atmosphere and that the warming is essential for the existence of all life on the planet. The use of fossil fuel has however increased the amount of GHGs, and as a result more sunrays are contained in the atmosphere, and the planet experiences an increased overall warming effect.

This phenomenon causes changes in the Earth's climate, and some of these climatic changes are projected to have negative impacts on both human and non-human life (Energy consumption & its environmental impact, Sierra Club *and* Steinfeld et al., 2006). In the light of debates around whether climate change and global warming is taking place or not, it should be noted that Intergovernmental Panel on Climate Change (IPCC) (2007) states that "Warming of the climate system is unequivocal..." and that most of the





observed increases in global temperatures since the mid 20<sup>th</sup>-century are very likely due to anthropogenic increases in GHG emissions (IPCC, 2007).

In order to mitigate the impacts of climate change a multitude of strategies can be adopted to reduce anthropogenic GHG emissions, however even if all GHG production would cease with immediate effect, a 1°C temperature can still be expected (IPCC, 2007). This overall increase in global temperatures will inevitably have impacts on the planet's system across all levels, thus adaptation to the projected impacts of climate change is crucial. It is necessary that any implementation measures must be based on local specific research on anticipated climatic events and climate change induced impacts.

According to Mukehibir & Ziervogel (2007) the following climatic changes are projected for Cape Town:

- Increases in average temperatures and an overall drying effect
- Issues of poor air quality (more brown haze and smog) due to decreases in weather circulation
- Increases in hot and dry berg winds which could increase fire risks
- Increases in the frequency of extreme climatic events
- Permanent and non-permanent inundation

The impacts on peoples' lives and livelihoods will be diverse and multiple, and in many cases difficult to anticipate. There is nevertheless some consensus that the demand for energy and fresh water will increase. Hotter and dryer climate is expected to cause a growing demand for e.g. cooling of houses and water for drinking and sanitation, and flooding will increase pressure on drainage systems and wastewater treatment works. All of these processes require energy and water, and so it is likely that people in Cape Town will face increased water and energy shortages (Mukheibir & Ziervogel, 2007).

There are a number of ways for decision-makers and the public to adapt to and mitigate the impacts of climate change. By assessing, adapting and altering the current food production/consumption patterns, arguably one of the largest contributors to GHG emissions, these can be made more resource- and energy-efficient and thus reduce the food industry's demand for energy and water.

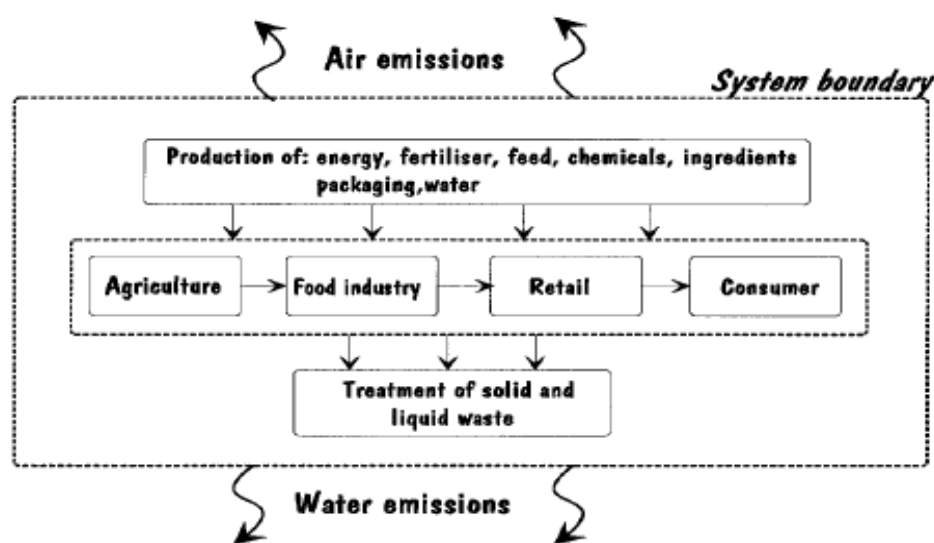
The linkages between global warming, climate change and food have for the past five years gained in recognition, and current research has established that in many cases an individual's food consumption generates more GHG emissions than the individual's transportation (use of cars, planes, buses, trains, boats etc.). An often quoted example is that a person who changes from a meat-based diet to a vegetarian diet will reduce his or her CO<sub>2</sub> emissions with 1,5 tons per year, and by changing to a hybrid car, he or she will reduce CO<sub>2</sub> emissions with 1 ton per year (Eshel & Martin, 2005). The need to change food production and consumption to successfully mitigate the impacts of climate change, and to conserve the planet's scarce fresh water resources, is becoming alarmingly evident.



The first step would be to properly research and understand the relationship between food and climate change, and further to identify appropriate options for mitigation and adaptation. This document provides an overview of these relationships and current available mitigation/adaptation options and examples placed in the context of South Africa and Cape Town where possible and appropriate.

It is crucial to recognise that in order to grasp the climatic impacts of current food consumption patterns, all stages of the food's life cycle and its related GHG emissions must be considered. Garnett (undated) suggests the following categorisation:

- Agriculture (production)
- Manufacturing (production)
- Refrigeration
- Transport
- Packaging
- Retail
- Home
- Waste



**Picture 1. Example of food Life Cycle Analysis diagram (Garnett, undated).**

Picture 1 one shows a simplified overview of different stages in a food life cycle and how each component generates an output, and the final outputs being waste and/or air emissions. Needless to say, food, as well as any product, cannot be viewed as being separate from the systems that enable its production and consumption.

Although figures around how much energy that is used for food production varies, it can be said with great certainty food is a major energy consumer. Estimates show that 15-20 percent of the world's total energy consumption falls directly under the banner of food production, and some figures are even higher (Ekocentrum, undated).

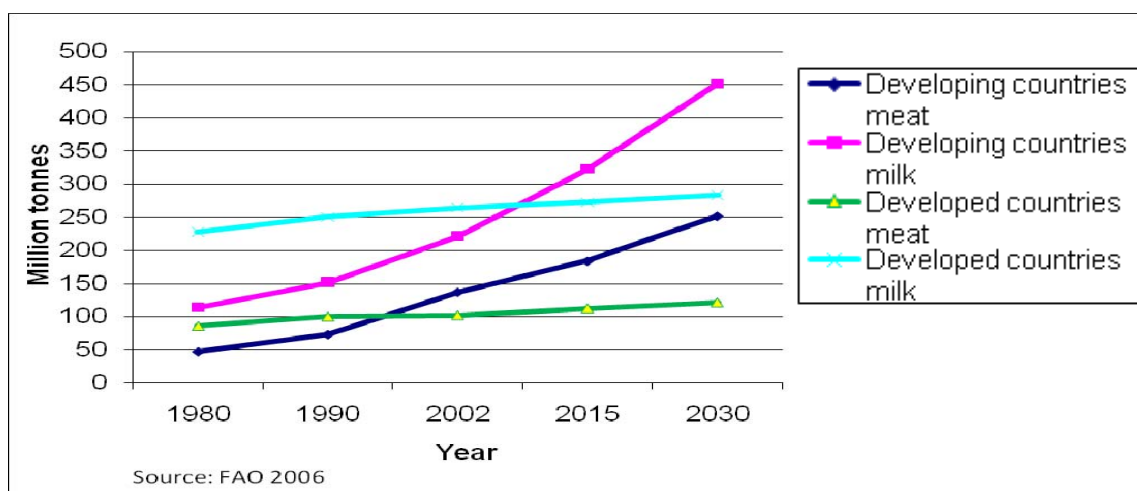
## 4. Food Production and Climate Change

In the European Union (EU) almost 31% of the GHG emissions can be related to food and worldwide numbers are estimated to be between 17-32 %. There are however uncertainties and variability between countries, as well as between calculation methods and data source reliability (EIPRO, 2006). In the Food and Agriculture Organisation's (FAO) report



commonly known as “Livestock’s Long Shadow” (Steinfeld *et al.*, 2006) global livestock production is estimated to cause 18% of the world’s total GHG emissions. In the EU meat and fish products cause 15% of the total of all GHG emissions and 50% of all food related GHG emissions.

For Africa and South Africa such research was at the time of writing unavailable, but as a country with high meat production (1084 000 tons of beef and 500 000 tons of poultry annually, (see for example [http://www.fao.org/es/ess/yearbook/vol\\_1\\_1/pdf/b02.pdf](http://www.fao.org/es/ess/yearbook/vol_1_1/pdf/b02.pdf)) and consumption, even though unevenly distributed over the population, the livestock sector’s GHG emissions are likely to be significant. For the developing world in general, meat and dairy demand is growing rapidly, but per capita the demand is still lower than in the developed world.




**Picture 2. Expected growth in the demand for meat and milk in developing and developed countries (Steinfeld *et al.*, 2006).**

Picture 2 shows the expected increase in demand for meat and dairy in the developed and developing world respectively. As there is no decrease expected, this poses a question to what the impact will be on global warming and subsequently on climatic changes, considering the environmental impacts associated to meat and dairy production. It should however be noted that all food production has a carbon footprint, and even though meat and dairy in general has a bigger footprint and more negative environmental impacts than non-animal based food, there are exceptions to this rule, and some of these will be highlighted in the following chapters.

An EU study from 2006 investigating the environmental impacts of consumer products classified the following four groups as ‘high impact’ in terms of the studied environmental impacts:

- Cars
- Food
- Heating
- House building





These products account for 70-80% of the total life-cycle's environmental impacts of products, and the studied impacts were abiotic depletion, acidification, eco-toxicity, global warming, eutrophication, human toxicity, ozone layer depletion and photochemical oxidation. Food, drinks, tobacco and narcotics causes 20-30 % of the environmental impacts of the total consumption of the products studied, and meat products have the greatest environmental impacts, followed by dairy products. With regards to eutrophication this group is responsible for 50 % of this type of impact (EIPRO, 2006).

## 5. Environmental impacts related to food production

The manner in which food is produced is already impacting our everyday lives negatively in a number of ways, which are also anticipated to worsen in the future (Energy consumption & its environmental impact, Sierra Club). Some impacts are direct, e.g. eutrophication of rivers and wetlands due to run-off from agricultural areas that use large quantities of fertilisers. Eutrophication disrupts and alters the ecosystem, and habitats may become uninhabitable for the living organisms in that space. It can further make lakes, rivers and coastal areas dangerous for recreational use for people, as toxic algae blooming is directly linked to eutrophication.

Indirect negative environmental impacts of food production would for example be long-term and slow changes in larger systems, for example climatic systems, that also correspond with other contributing factors (e.g. multiple uses of fossil fuel). It can therefore be complicated to distinguish **what impacts on what** and **how**, and furthermore to **what extent**. The Sierra Club (Energy consumption & its environmental impact, Sierra Club) has listed some overarching as well as interlinked factors that signify the current landscape of food production:

- Food production has large-scale, multiple and vast environmental impacts;
- Agribusiness farms employ chemical-intensive systems, which contribute to the pollution of soils, air and water;
- Long-distance transportation of food from centralised producers is ineffective use of resources and energy (derived from fossil fuel), and further contributes to soil, air and water pollution;
- Uncontrolled grazing and deforestation as a result of current agricultural practices, are two of the largest contributing factors to biodiversity and habitat loss, as well as so-called 'wilderness' areas;
- Factory farms are increasing in numbers, and thereby pollution is increasing as well (as this type of food production is chemical- and water intense) together with the suffering of animals (animals in factory farms live under appalling conditions), and
- Food production is increasingly dominated by a few large-scale producers: This creates a biased market with little or no competition. This in turn undermines small-scale producers and long-term resilience of the planet's food security.



## *The environmental impacts of livestock production*

The list below provides an overview of the most frequent and well-researched environmental impacts that result from livestock production and meat and dairy consumption. Figures are largely based on global averages, meaning that there are variations on national, local and individual levels.


- Livestock production is responsible for 10 percent of the human induced GHG emissions, this is larger than the emissions from the transport sector;
- 37 percent of the methane is emitted from this sector;
- 65 percent of the nitrous oxide emissions;
- 9 percent of the CO<sub>2</sub>;
- 65 percent of the ammonia emission origin from the livestock sector, which contribute to pollution, acidification and ozone depletion;
- Meat and dairy products are under-priced in their relation to their real environmental costs;
- Industrial animal production causes widespread pollution from animal manure and the use for fertiliser;
- At least 50 percent of the world's pork and 70 percent of the world's poultry meat and eggs are produced in industrial systems;
- Over 90 percent of the world's soya beans and 60 percent of the maize and barley are grown for livestock feed;
- Choices about diet can affect an individual's carbon footprint as significantly as choices of transport;
- The IPCC has proposed a reduction in livestock-related GHG emission by 20 percent, and
- Intensification of the agricultural industry is likely to worsen the environmental impacts and animal welfare conditions (Steinfeld et al., 2006).

The last 50 years has seen soaring demand for animal protein, in 1950 an estimated 44 million tons of meat was produced and in 2007 this had increased to 275 million tons (Brown, 2001).

- 56 billion animals are raised and slaughtered each year;
- Factory 67 percent, poultry, 50 percent, egg 42 percent, and
- World beef production up 2.3 percent per year, pork 2.0 percent per year, poultry 4.8 percent per year, and aquaculture 11 percent per year (World Watch, 2008).

Industrial systems today generate 74 percent of the world's poultry products, 50 percent of all pork, 43 percent of beef, and 68 percent of eggs. While developed countries dominate this production, it is within the developing nations where livestock producers are rapidly expanding and intensifying their production systems (Brown, 2001).





Food conversion ratios have however changed over time and these examples show us that production has shifted to better conversion ratios, i.e. production is more efficient:

- 1968 - 17:1 Beef, 11:1 Lamb, 6.6:1 Pork, 3:1 Chicken, and
- 2001 – Factory farming feed lots 7:1 Cattle, 4:1 Pork, 2:1 Chicken, Fish < 2:1 (Chemical industry, 1968).

However, large amounts of land are still used for grazing and cattle feed production:

- 36 percent of world grain harvest consumed by livestock, poultry and aquaculture and 65 percent of this is used in the USA;
- In 2000, 80 percent of the beef and lamb produced on rangelands is being grazed at or already are beyond grazing capacity (Brown, 2001), and
- 33 percent of global arable land is used for producing feed (Steinfeld et al., 2006).

## Livestock production and water usage

The statistics available for water use for livestock production is somewhat ambiguous. There is little consistency to what is included in calculations for water use related to livestock productions: Many surveys quote only drinking water, while others include the total life cycle's water usage, including feed production. Some sources claim that meat uses three times the water of plant protein; others state it is 100 times more. If we take a very conservative position between the two camps, say 10 times what industry says, then we end up with around 2.1 million gallons to raise 1 1250 pound steer. That's around 10 millions litres to raise 1 beef cow. This is enough water to float a navy destroyer.

Looking at the bigger picture, and comparing the differences in water use for a vegetable versus meat-based diet, the following figures are suggested by Robbins (undated):


- A vegan diet uses approximately 1365 litres per day
- A meat diet uses approximately 20 475 litres per day
- A vegan diet saves 6 825 000 litres per year per person

It is also worth mentioning that irrigation of feed crops for cattle accounts for nearly 8% of global human water use (World Watch, 2008).

## A diverse range of problems

There are a number of problems associated with livestock production (and meat and dairy consumption), both with regards to negative environmental impacts and social problems. The first problem addressed here are the vast inequalities and human rights issues linked to meat production, and in developing countries in particular. In poverty-stricken countries the use of land for grazing and to produce cattle feed becomes highly problematic as the part of the population that are in need of nutritious food often cannot afford the locally





produced meat. Meat is often exported to the developed countries, but leaving the negative environmental impacts in the country of production. Land and crops that could be used to feed people are instead used for livestock production (like soya beans), and in countries where land is unequally distributed and people are limited in their livelihoods options, this becomes a human rights issue. In for example Guatemala, 75% of children under five are malnourished, and every year 10.5 tonnes of meat, fed on corn and beans, is being produced for export to the USA. At present Guatemala is facing a shortage of low priced corn and beans, which for many poor people serve as the staple food ([www.rawfoodexplained.com](http://www.rawfoodexplained.com)). Worldwide and estimated 1.1 billion people are undernourished and underweight (Brown, 2001).

The second problem is the water shortage that many parts of the world are facing. Again this is essentially a bigger problem in developing countries than in developed countries. The residential, industrial and agricultural sectors require large quantities of water, and as irrigation is a major water consumer, several of the world's rivers now run dry or have their water-flow significantly reduced before reaching the sea. The Yellow River in China exemplifies this:


- This river had flowed uninterrupted for thousands of years;
- 1972 it ran dry and failed to reach sea for 15 days;
- 1973 to 1985 it ran dry intermittently;
- since 1985 it run dry for part of each year, and
- during 1997 it did not connect to sea for 226 days (Brown, 2001).

This is largely due to the growing and intensified agricultural industry in China, but obviously the construction of the Three Gorges Dam has played a role as well.

Thirdly, clearing of land for livestock production (cattle feed production and grazing) is the main cause of deforestation and desertification. Forests are currently shrinking by more than nine million hectares per year. 25 percent of the world's population is currently affected by desertification. From a climate change perspective this is crucial to consider, as forests store at least 20 times as much carbon per hectare compared to land used for crops or grazing. In Latin America nearly 70 percent of former forests have been cleared for grazing of cattle, and recent research state that cattle rearing is the major source of land and water degradation worldwide (Steinfeld et al., 2006). In 2007, at least 60 percent of all meat production took place in developing countries (World Watch, 2008). Consequences of deforestation and desertification are e.g. erosion, dust storms, loss of carbon sinks, loss of livelihoods options and risks to food security, and for poor people in particular.

According to the FAO, more than 75 percent of the world's fisheries are now overexploited, fully exploited, significantly depleted or recovering from over exploitation. A study by a team of leading fishery scientists, published in 2006 in the journal *Science*, concluded that the world's fisheries are in collapse and if current trends continue they will be beyond repair by 2048 (Word Press 2008). A study from 2008 shows 415 eutrophic (overly nutrient-rich) and





hypoxic coastal systems worldwide, whereof 169 are labeled 'red' (documented hypoxic areas), 233 'yellow' (areas of concern), and 13 systems as 'green' (in recovery) (<http://news.nationalgeographic.com/news/bigphotos/14793409.html>).

Correlations between livestock production and human (and animal) health issues are gaining recognition, and the World Bank Stated that "extraordinary proximate concentration of people and livestock poses probably one of the most serious environmental and public health challenges for the coming decades". According to World Watch (2008) this is due to a number of factors resulting from current livestock production practices:

- Avian flu, Pig Fever, Nipah Virus;
- Crowded and filthy conditions;
- Antibiotics resistance, and
- Anti-depressants (given to the livestock).

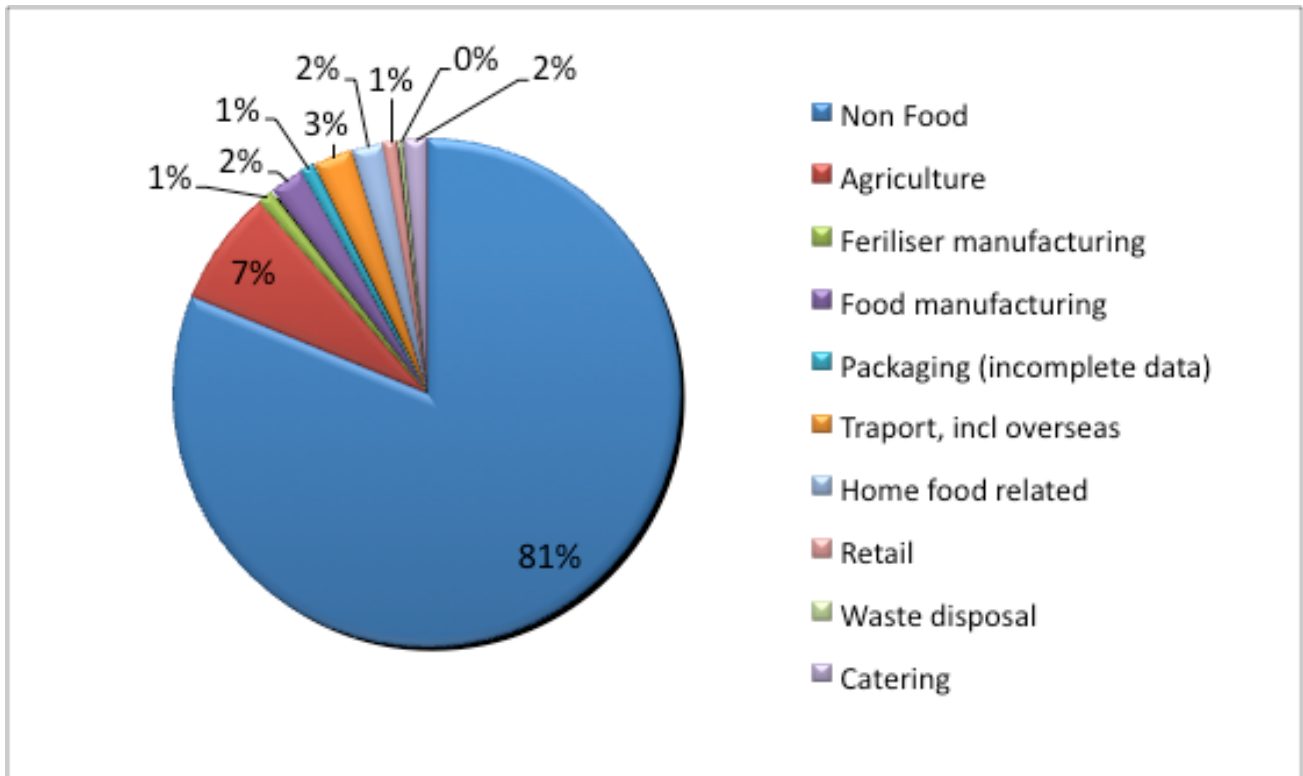
During the past decades, the United States has increased its meat production while consolidating livestock production into fewer, larger farms. The result has been rapid growth in poorly treated animal waste lagoons, the spread of resistance among infectious bacteria due to the use of antimicrobials for livestock disease prevention, animal welfare procedures that severely restrict natural animal behaviours, and a rural population incapable of competing with wealthy food industry corporations.

The sixth problem identified here is emissions of greenhouse gases, directly and indirectly related to livestock production:

- Carbon dioxide (CO<sub>2</sub>) is perhaps the most known greenhouse gas and account for 18 percent greenhouse gas emissions induced by the livestock sector;
- Methane is a greenhouse gas with a 21 times more warming potential than CO<sub>2</sub>, and livestock accounts for 37 percent of all human induced Methane emissions;
- Nitrous Oxide is 296 times more potent at a global warming gas than CO<sub>2</sub>. Livestock production accounts for 65 percent of human induced NO<sub>2</sub> emissions, and
- Ammonia, which is largely produced by ruminants, contributes to e.g. acid rain and livestock accounts for 64 percent of human induced Ammonia (Steinfeld et al., 2006).

According to the UN "The environmental costs per unit of livestock production must be cut by one half, just to avoid the level of damage worsening beyond its present level" (Steinfeld et al, 2006). Unlike other economic sectors, where most GHG emissions are generated by the use of fossil fuels, GHG emissions from the livestock sector mainly come from natural and unavoidable bodily functions of the animals (feeding, digestion and excretion).





Picture 3. GHG emissions related to food production and consumption (Garnett, T, undated.)


Of the total GHG emissions generated by the livestock sector, 34 percent comes from deforestation for land for grazing and feed production, 30,4 percent comes from manure, enteric emissions account for 25,3 of the GHG emissions, fertilisers for 6,2 and 'other' constitute 4,1 percent (Steinfeld et al., 2006).

Environmental degradation in the form of pollution and so-called 'dead zones' is another problem directly linked to the livestock sector, and Brown (2001) calls it a "self-reinforcing cycle of environmental degradation":

- Marine ecosystems are being destroyed by rivers drying up due to irrigation systems;
- Livestock produces 20 times more excrement than the entire US human population; fisheries in the North Sea are collapsing;
- Dust storms in China due to vegetation-loss and erosion are increasing in intensity and frequency;
- Rainforests are being depleted due to land-clearing and fires;
- There is an expanding dead zone in the Gulf of Mexico;
- Water tables are dropping in India, and
- Crop yields are dropping in Africa (due to biodiversity losses, over-grazing, over-exploitation of arable land which leads to nutrient losses in the soil etc.).

Aquatic and marine dead zones are often caused by an increase in chemical nutrients in the water, known as eutrophication, and chemical fertiliser is considered the prime cause of dead zones around the world. The Pacific's coast of the United States between





California and Washington has a 1120 square mile (2900 km<sup>2</sup>) dead zone partially caused by stronger winds that many associate with global warming. This dead zone has recurred between June and September every year since 2002

([http://en.wikipedia.org/wiki/Dead\\_zone\(ecology\)#cite\\_noteoregondeadzone-2](http://en.wikipedia.org/wiki/Dead_zone(ecology)#cite_noteoregondeadzone-2)).

Considering that half of the world's workforce is dependent on croplands, fisheries, rangelands, and forests for their jobs and livelihoods, environmental degradation and the occurrence of dead zones poses a serious threat to the sustainability of many peoples' livelihoods (Steinfeld et al, 2006).

## Projections for the future

The world's population will increase by 80 million per year 2000 - 2020 and by 2050 it is estimated to reach 9,3 billion people (U.S Census Bureau). The following countries (examples) are expected to see significant population growths:

- India +563 million;
- China +187 million;
- Pakistan +200 million (144 to 344);
- Egypt nearly double (68 to 114);
- Sudan will go from 31 million to 64 million;
- Ethiopia's population will triple, from 63 million to 186 million, and
- In Iran and Mexico the population will increase by half (Brown, 2001).

It is also worth mentioning the correlation between population growth, urban-rural immigration, urbanisation and the environment, as in 2008 the world's population became mostly urban, and 3.5 billion people are now residing on 3 percent of the land surface. This has led to, and will continue to cause, growing slums, increased poor air quality, and perhaps even decreases in human fertility due to health problems induced by hazardous living environments. In addition to this, GHG emissions are expected to increase as a result of increased urbanisation if projections are correct. As already pointed out, the demand for meat and dairy products will increase as well, and global meat and dairy production is expected to double by 2050 (Steinfeld et al., 2006).

It should be noted that climate change will impact upon food production and food security as well. This is anticipated to impact upon peoples' livelihoods, and in particular on those that are already vulnerable. Water shortages, temperature changes, inundation (permanent and non-permanent), and increased intensity and frequency of extreme events will inevitably affect crop yields, the use of certain crops, the food's lasting quality and so on. Expected alterations in animal systems, for example occurrence and/migration of certain insect species etc., could also impact upon the agricultural sector (IISD, 2003).



## 6. Transporting Our Food

Transportation of food from supermarket to household accounts for nearly half of the GHG emissions induced by transporting food for human consumption. The remaining half is for transporting food from farms and factories to the stores, and other transport related to food production. A 'rule of thumb' is that the closer the food is produced to the consumer, the less GHGs are emitted into the atmosphere (Ekocentrum, undated). Global transport of food is however increasing, and it is not longer only taking place in the developed world, but it is increasing in the developing world as well. A well-known example is that cod caught off Norway is shipped to China to be processed into fillets (due to e.g. cheaper labour), and then shipped back to Norway to be sold (Rosenthal, 2008).


Food miles, which tells us how far the food has travelled from field to plate, was one of the first concepts behind the relationship of food and climate change. It is however only one component of the whole life cycle of food, but considering seemingly unreasonable demands (from a climate change perspective), such as always having year-round access to exotic fruits in the stores, food miles is a valuable and fairly tangible tool to measure our food's relationship to climate change. For example, half of the vegetables and 95 percent of the food eaten in the UK are produced in other countries, and one third of goods transported by truck consist of agricultural products. Also, 20 percent of the UK's food transport comes from when the consumers transport the food from the store to the household (Food Matters – Food Miles, 2009).

There is currently an assessment being undertaken, initiated by South African fruit and wine farmers – the Biodiversity and Wine Initiative (BWI) - to determine the environmental costs of their products, including measuring the carbon footprint of the industry. South Africa is one of the biggest fruit and wine exporters in the world, and this research is conducted due to increases in consumer demand for eco-labelling and similar initiatives. It is also stated that with the expected climatic changes, the fruit and wine industry must adapt its production if the industry is to survive, as droughts, floods and increased fuel prices may have significant effects on its production methods. With regards to the airfreighted products, it is clear that an important sector of South Africa's exported products is highly dependant on fossil fuel and is a large contributor to global warming (Nieuwoudt, 2008).

## 7. Waste Management

The wastage of food occurs during all steps in the food's life cycle, from production, harvesting, processing, to trade and consumption. Food is one of the most resource- and energy-consuming product groups, hence prevention of food wastage could be an important tool to reduce environmental impacts, GHG emissions and resource depletion (Schneider, 2008). It is estimated that almost ten percent of the food put on the plate is thrown away, and that throughout the entire food lifecycle almost 25 percent is wasted. This is not only generating solid waste; but it is also a waste of energy as all the energy used





for producing, transporting and storing that wasted 25 percent of the food is wasted too (Ekocentrum, undated). Besides waste of actual food and energy, water and packaging are large waste groups also related to this sector. Water follows the same principle as energy; the water used to produce the food is wasted if the food is wasted.

- Most food that is wasted goes to landfills where it produces methane gas, which is a powerful GHG;
- In the EU landfills and the agricultural sector are the two largest contributors to methane gas emissions;
- One third of the more than 9000 tonnes of solid waste dumped in the landfills of Hong Kong each day are food leftovers, and this amount has more than doubled within the last five years;
- In the UK 6,7 million tonnes of food is wasted each year, which is around one third of the food purchased;
- Most of the food thrown away is actually perfectly edible, and
- The food industry generates 10-20 percent of the waste by weight (including packaging) which is 3-8 percent of business turnover (The food we waste, 2008, DEFRA, 2006 and Schneider, 2008)

The principal sources of wasting food are:

- Poor quality production;
- Trimmings (bread crusts, tomato ends etc.);
- Machinery performance problems;
- Packaging;
- Good product disposal, e.g. out of life, and
- Market imposed changes (sudden demand loss, climatic variability etc.) (The food we waste, 2008, DEFRA, 2006 and Schneider, 2008).

Packaging of food is another food-related source of waste. The global food packaging industry is estimated to be worth £100 billion a year, and it has an annual growth of 10-15 percent. Packaging costs make out 10-50 percent of the store-price of food, but the cost for waste disposal is not included. In the UK, 3.2 million tonnes of the annual 26 millions tonnes of household waste comes from food packaging. 11 percent of the UK household waste is plastic, and 40 percent of that is plastic bottles (Food Packaging - [www.thesite.org](http://www.thesite.org)). Increased wealth and higher living standards tend to promote a lifestyle that generates more waste, and packaging in particular. The growing urbanisation also contributes to increased usage of food packaging as distances between people and the place of production are increasing, and transports require packaging for protection and storage of the food. The projected increase in the demand for convenience food, as a result of economic growth and increased wealth, will also create more food-related waste due to the use of packaging (Food Packaging - [www.thesite.org](http://www.thesite.org)).



## 8. Is healthy food also climate-friendly (and vice versa)?

“The simplest way to improve your health is to make the switch from processed food to whole [unprocessed] foods” (Dobec, 2009).

A positive side-effect of eating food that has a low carbon footprint and use little energy for production, is that it is often healthier than food with high energy consumption. So-called junk food often has a very big carbon footprint, and it has negative impacts on human health as well. One third of the total energy used for food production goes to snacks, sweets and beverages. Another ‘rule of thumb’ is that the less processed the food is, the smaller is its carbon footprint. Unprocessed food is also in general higher in nutritional value than processed food. In many cases the unprocessed food is also cheaper, for example fruits and vegetables that are unprocessed are often substantially cheaper than canned or frozen produce (Ekocentrum, undated). Generally speaking a significant reduction in meat and dairy consumption (which are often processed) would improve public health in terms of expected reductions in cancer, obesity and certain heart conditions (Steinfeld et al., 2006).

Industrial processing of food is claimed to destroy the nutrients in food and make the food more difficult to digest. It is further dependant on products that have well-know harmful impacts on our health, such as sugar, white flour, hydrogenated oils, additives, colourants and synthetic vitamins (Fallon, 2002). The long-terms impacts of industrially processed food on human health have not yet been properly researched, but concern is growing around for example aspartame, monosodium glutamate (MSG) and hydrogenated oils. Laboratory tests on rats feeding only on certain types of highly processed food (like for example breakfast cereal) have shown worrying results such as increases in diabetes, liver and kidney dysfunction and nerve and spine degeneration.


Fruit juice is often perceived as a healthy and vitamin-rich beverage, and rightly so if the juice is fresh and not industrially processed. Fruits are often heavily treated with pesticides (unless they are organic), and in industrial juice processing the entire fruit, including its skin, is pressed in order to get as much juice out of it as possible. This means that the chemical remnants from the pesticides on the skin go into the juice as well.

With regards to MSG, it has been related to cancer, obesity, seizures, headaches and a variety of neurological diseases. It should however be noted, that MSG and its health impacts have been heavily debated for years, and research proven its harmlessness has also been presented (Fallon, 2002).

The following list shows some of the negative health impacts associated with industrially processed food:

- Obesity: According to the WHO, increases in child obesity are directly related to processed food. When grains are processed, the nutrient parts of the grain (proteins,





vitamin E and B, fat and fibres) are often removed, and only starch remains. Overconsumption of starch will eventually be stored in the body as fat.

- Diabetes: Processing of for example breakfast cereals have created a product which is 100 percent starch, i.e. 100 percent glucose. Too high levels of glucose can cause tissue-damage and are directly linked to diabetes. When perishable fats are removed through processing the food loses a lot of its flavour, and sugar and sugar derivatives are then added to improve the taste. Overconsumption of sugar contributes to Type 2 diabetes and obesity, both illnesses that are increasing among children. Sugar is essentially what is labelled on the packaging as: cane sugar, beet sugar, corn syrup, corn sweeteners, fructose, glucose, honey, maple syrup, malt, molasses, rice syrup, fruit juice concentrate, date sugar, xylitol, sucrose and so on.
- Heart disease: Processed food is often extremely high in salt and trans fatty acids, both of which can cause strokes and a number of heart diseases if over consumed.
- Cancer: Processed foods, and refined carbohydrates in particular, are likely to increase the risk of pancreatic, prostate and breast cancer. Acrylamide is a carcinogenic substance which is created when certain food, like for example potatoes and bread are heated at high temperatures, such as baking and deep-frying. In potato chips levels of acrylamide have proven to be significantly elevated, and some researchers claim that this substance causes thousands of cases of cancer each year in the U.S.A. alone.
- Food additives: There are over 3000 different chemical that can and are being added to processed food. These are colourants, stabilisers, preservatives, sweeteners, thickeners, flavourants, emulsifiers, softeners etc. and the impacts additives have on the human and the environmental health are not yet established (All the Health Risks of Processed Food, 2005 *and* Dobec, 2009).

It can sometimes be difficult to distinguish unprocessed food from processed food, and not all processing is harmful. Technically speaking, when food is cooked it is being processed, but it is rather the industrial processing that is harmful, and not the processing taking place in our homes (Fallon, 2002 *and* Dobec, 2009). Dobec (2009) describes unprocessed foods as “food in its most natural state”, and further says that as a guideline, food without labels and packaging are usually unprocessed food. Unprocessed foods, or whole foods, are richer in nutrients than processed foods, being that it is ‘whole’, and no parts of it has been removed through processing. Our bodies have evolved and adapted slowly over a long period of time to the food we eat today, and sudden changes (such as adding various artificial additives) can have harmful effects on our health, and some say that this is most certainly the case. Overeating can for example be related to consumption of processed food, as due to its nutrient-deficiency we still feel hungry after having a meal (Dobec, 2009).

An interesting exception to the rule of healthy food also being climate-friendly is that rice, (which is an essentially healthy food source, and also constitutes the staple food in many poor countries) uses large quantities of energy during its production stage and also releases



methane gas. A kilo of rice uses 15 MJ for its production, and compared with e.g. potatoes (3.1 MJ) the difference is rather significant (Carlsson-Kanyama, 1998).

In terms of performance related to diets, it has long been evident that nutritious food is very important for academic and physical performance. For school-children in particular saturated fat, salt and 'empty calorie food' can have a negative impact on their school performance. When children's test results have been compared against what type of food they eat, it has been shown that children having a nutrient- and vitamin-rich diet perform better in school than children with poor diets (Heller, 2008).

## 9. Cooking and storing our food

Preparation of food (cooking) accounts for 2-18 percent of the total energy consumption associated with food. The two major energy users are the oven and the microwave, where for example boiling potatoes requires 4,6 MJ and oven-baking potatoes 29 MJ (Ekocentrum, undated). Deep-frying of food is however the type of food preparation that requires the most energy and it also depletes most of the nutrients from the food. Three percent of the energy used in a household is used for preparing and storing food, and this inevitably impacts upon the electricity bill as well as the climate (Energy-efficient Cooking, 2008).

The following tips can reduce the energy consumption related to preparation of food (on a household level):

- Use a lid for the pot when cooking;
- Match the size of the pot with the size of the burner;
- Purchase the smallest sized cooking appliance possible for the cooking needs as this will save fuel and energy;
- A so-called Hot Box can further make cooking more energy-efficient;
- If a paraffin stove is being used it should be kept clean as it then is more efficient and the smoke is less poisonous;
- Place kitchen towel on top of the lid to prevent heat from 'escaping' if not cooking on an open flame;
- Make use of the remaining heat from the oven and the burner after turning it off;
- Use the microwave sparsely, it is best use for heating of leftovers, defrosting and cooking small quantities;
- Use the oven sparsely when you use it, and make sure to cook several things simultaneously, as it is the heating that is the major energy user. Leaving the oven on for one hour uses the same amount of energy as the heating does;
- Simmering the food instead of boiling causes less steam, which reduces the need for ventilation and also uses less energy because it contains heat and water better,
- Use a kettle to boil water. A kettle uses 50 percent less electricity than heating water in a pot on the stove;
- Only boil as much water as you need;



- Soak beans, samp and lentils overnight as this saves time, money and energy as the food need less boiling, and
- Cook large amounts of food seldom instead of cooking small portions often (Energy-efficient Cooking, 2008 *and* Smart Living Handbook, 2009).

When buying a new fridge or freezer, the energy-efficient options will save both money and energy, and hence reduce the carbon footprint of the fridge/freezer itself. A full freezer or fridge also uses less energy than a freezer that is empty or half-full, so by cooking large quantities, letting the leftovers cool off, and then freezing the food less energy is used both for the oven/stove and for the freezer/fridge. Bottles of water could also be stored in the fridge, as this will retain the cold. For the domestic refrigerator it is better to let the food cool properly before placing it in the fridge – so-called ‘free cooling’. By letting the food cool down from 80° C to 30° C before refrigerating it, up to 75 percent of the energy used to cool the food is saved. It is also important to leave a space at the back of the fridge to allow for air circulation around the condenser coils (Energy-efficient Cooking, 2008 *and* Smart Living Handbook, 2009)

In the industrial food and drink sector, refrigeration is one of the largest energy consumers for the producer:

- Liquid milk processing use 25 percent of their electricity used for refrigeration;
- Breweries use 35 percent;
- Confectionary use 40 percent;
- Chilled ready meals use 50 percent;
- Frozen food use 60 percent, and
- Cold storage use 85 percent of the totally electricity used (Improving Refrigeration System Efficiency, 2007).

## 10. Eco procurement

Sustainable, green or **eco procurement** is when the procurement of goods or services takes environmental and social aspects into account. It needs to consider the best value for money (price, quality, availability, functionality); environmental aspects over the entire life cycle of products; and social aspects (issues such as poverty eradication, labour conditions and human rights). In short, it is shopping with a conscience.

Eco procurement is a rapidly growing concept, and it is used as a tool to gain shares on an increasingly environmentally aware market. Unfortunately so-called ‘greenwash’ is quite common, which means that a business, a good or a service is not as ‘green’ (environmentally-friendly) as it claims to be. Eco procurement therefore requires research and insight into the goods and services purchased, and it needs to be a well-planned and interactive process.



## 11. Drinking water

Water was briefly discussed in chapter 3.1.1 and as pointed out then, links between water, climate change, food production and livestock production are particularly complicated and difficult to quantify. Some things are however more crucial than others. Due to climatic variability resulting from global warming, it is projected that many countries, like for example South Africa, is likely to expect extended dry periods with hotter temperatures, and that water shortages will become more frequent (Mukheibir & Ziervogel, 2007).

Energy (electricity) is also projected to become scarcer (and more expensive), which will inevitably impact upon people's livelihoods. It would then be of interest to reduce the production of water-intensive food production as a means to proactively adapt and mitigate impacts of climate change. The same argument could be used for direct water consumption, where low-energy and minimum water usage should be promoted.

Statistics show that the differences between bottled water and tap water in terms of energy use and CO<sub>2</sub> emissions are vast:

- One litre of bottled water uses 26 litres of water and one kilo of fossil fuel (0,5 kilo CO<sub>2</sub>) to produce;
- Most empty water bottles go to landfills where they take up to 450 years to decompose;
- Bottled water is up to 1000 – 10 000 times more expensive than tap water (depending on country of origin, brand etc.);
- Bottled water generates 1000 times more CO<sub>2</sub> to produce than tap water;
- In the UK the bottled water is estimated to increase by 30 percent 2007-2012;
- Bottled water in South Africa is expected to reach 568 million litres by 2010;
- 568 million litres of water requires 190 7880 litres of oil to produce,
- In 2006 consumption of bottled water generated 98 000 tonnes of CO<sub>2</sub> in South Africa, and
- The same amount of CO<sub>2</sub> is equivalent with the annual energy consumption of 142 000 low-income households (Battle of the Bottles, 2008 *and* 1 liter Bottled Water uses 26 Liters Water + 1 Kg Fossil Fuel + 1 Pound CO<sub>2</sub>).



## 12. Curriculum Links

Environment and sustainable development are curriculum concerns in primary and high school, which means that learner participation in this tuck shop audit can help achieve learning outcomes. These outcomes can be assessed as part of the work plan. If educators plan well, then this audit process can fit into their learning programmes and subject frameworks. It need not be extra-curricular or extra work. Here are a few examples of the curriculum links, although there are many more. The Smart Eating project is best used if linked into the curriculum for the whole term. This way it can be applied across different subjects which would contribute to the understanding of the cross-cutting issues involved in food and its environmental impacts.

**Grade:** 10 (and Grade 11)

**Subject:** Life Orientation

**Learning:** Citizenship Education: Participate in a group project to address a contemporary social and environmental issue.

**Grade:** 10 (and Grade 11)

**Subject:** First Additional Language

**Learning:** Listening and speaking: Planning and research skills for oral presentations: research a topic, referring to a range of supplied, relevant sources; organise material by choosing main ideas & details or examples for support; use appropriate vocabulary, conventions and formats; prepare introductions and conclusions; incorporate appropriate audio-visual aids.

**Grade:** 10 (and Grade 11)

**Subject:** Home Language

**Learning:** Listening and Speaking: Learn about and share ideas and concepts, defend a position, make an unprepared response; participate in group discussions by expressing own ideas and opinions and listening to and respecting those of others, while engaging with issues such as inclusivity and power relations, and environmental, socio-cultural and human rights issues; participate in panel discussions, debate, forums and formal meetings following correct procedures.

**Grade:** 11 (and Grades 10 and 12)

**Subject:** Life Sciences

**Learning:** Plan and conduct an investigation; analyse findings and communicate them. Apply Life Sciences knowledge to everyday life. Investigate human influences on the environment. Manage natural resources. Investigate a local environmental issue; problem solving; decision making.

**Grade:** 11 (and Grades 10 and 12)

**Subject:** Mathematical Literacy

**Learning:** Investigate a problem on issues such as those related to social, environmental and political factors; choose methods to summarise and display data in statistical charts and graphs.

**Grade:** 11 (and Grades 10 and 12)

**Subject:** Physical Sciences



**Learning:** Investigate and report findings. Sustainable use of energy, saving energy in the home. Controversies around the use of nuclear energy. Dependence on fossil fuels, their environmental impact and dwindling supply.

**Grade:** 11 (and Grades 10 and 12)

**Subject:** Geography

**Learning:** Plan and structure a project/enquiry at a more advanced level; use and manipulate data and information. Report findings / take a substantiated position. Propose solutions / strategies to manage local / global problems: Energy use and management. Water as a critical resource. Global warming; poverty, inequalities, conflict, urbanisation; hazards and environmental management of hydrological systems (e.g. rivers). The concepts development and sustainability, strategies to address development problems, application in local context.

**Grades:** 7, 8 and 9

**Subject:** Life Orientation

**Learning:** Health Promotion – Evaluate actions to address an environmental health problem. Human rights. Volunteer organisations (Grade 7). Plan an action in which laws, policies are applied to address an environmental health issue. Democratic processes to address a local problem (Grade 8). Develop and implement an environmental health programme. Participate in a national health or safety programme (Grade 9).

**Grade:** 9 (and grades 7-8)

**Subject:** Mathematics

**Learning:** Data handling – Pose questions relating to human rights, social, economic, environmental and political issues in South Africa. Collect data. Draw graphs. Critically read and interpret data with awareness of sources of error and draw conclusions and make predictions about social, environmental and political issues.

**Grade:** 9

**Subject:** Technology

**Learning:** The impact of technological developments on the quality of people's lives and on the environment; strategies for reducing undesirable effects.

**Grade:** 9 (and grades 7-8)

**Subject:** Home Language

**Learning:** Speaking – Communicate ideas, facts and opinions on challenging topics accurately and coherently, demonstrate a range of complex interaction skills by participating actively in group discussions, interviews, surveys, debates, and while so doing: tackle important issues e.g. social and ethical issues related to the environment and human rights; motivate own point of view using evidence, negotiate difference to arrive at a common point of view or compromise.

**Grade:** 9

**Subject:** First Additional Language

**Learning:** Speaking – Give a short formal talk or presentation, using some statistics and visual effects (e.g. a poster); using challenging topics (e.g. human rights and environmental issues).



**Grade:** 9

**LA:** Social Sciences

**Learning:** Development issues, approaches to development, concept of sustainability, use of appropriate technology. Sustainable use of resources, principles of Agenda 21, the need for everybody to be actively involved in addressing environmental problems. Social and environmental conflicts in SA, the role of factors shaping access to resources such as housing, jobs. Relevant case studies. History – Apartheid and how it affected people’s lives.

## 13. Summary


Current food consumption patterns in developing countries exceeds the level of sustainability by at least a factor of 4, and it is questionable that sustainability could be achieved in this sector if current trends in food demand (and consumer behaviour) persists (Carlsson-Kanyama, 1998).

A number of solutions and options (large- and small-scale) are available for reducing the GHG emissions and environmental degradation related to food production, and these are:

- Biogas plants;
- Improved diets (vegetable-based rather than meat-based diets);
- Tax full water cost;
- Food prices to be more consistent with the actual costs of environmental degradation etc,
- Carbon footprint labelling of food;
- Land of origin labelled on food;
- Polluter pays principle (PPP);
- Consumer awareness, consumer demand and behavioural changes;
- Policy and regulations regarding subsidies of food products to adapt to GHG emissions and climate change;
- Policy and regulations to promote organic farming;
- Improved and more energy-efficient irrigation systems, and
- Planning and policy to discourage large concentrations of populations near cities (this would however require incentives for rural development instead).

Compassion in World Farming suggests that the EU and other developed countries must reduce meat and dairy consumption by one third over the next decade, and by 50 percent by 2050. On an individual basis this would mean that a person who eats meat daily would only eat meat five days a week, or reducing the amount of daily meat and dairy consumption. It is also suggested that farmers would reduce stock-density and move from intensive to extensive methods, and raise animal welfare standards, focus on organic and free-range production, while protecting their livelihoods. Localisation of livestock production and consumption would also support rural development, and a reduction in the demand for animal feed would increase farmland biodiversity and prevent further loss of biodiverse areas due to deforestation and desertification (Steinfeld et al, 2006).





There further ethical and livelihoods considerations related to food production, as well as food import/export/ Carbon footprint calculations and food miles do not account for the working conditions of people employed in food production. Nor do they consider social and economical impacts of changes in consumer demand/behaviour. The concept of food miles presents the food that has travelled the shortest distance from field to plate as being more preferable than food that has travelled long distance, as this food often has a bigger carbon footprint. Food miles as a concept is however subject to certain ethical concerns regarding to poverty alleviation and development, as in some cases export of food from developing countries to developed countries has important social and economic benefits for the developing country and its population (McGregor & Vorley, 2006).

In Africa for example, it is estimated that 1million livelihoods are supported by the UK's consumption of imported fresh fruit and vegetables. So the question is, where does the responsibility lie for the GHG emissions and the environmental degradation that food production and export/import contribute to? Further, where does the responsibility lie for the livelihoods of people producing this food, people that likely have many times lower carbon footprints per capita than the people buying this food? Not to forget though, that the impacts of human induced climate change will hit the developing world harder than the developed world.



## 14. References

All the Health Risks of Processed Food. In Just a Few, Quick and Convenient Bites. (2005)  
<http://www.sixwise.com/newsletters/05/10/19/all-the-health-risks-of-processed-foods---in-just-a-few-quick-convenient-bites.htm> 2009-06-23

Brown, L.R. (2001). Eco-Economy: Building an Economy for the Earth.  
[http://www.earthpolicy.org/Books/Eco/EEch7\\_ss5.htm](http://www.earthpolicy.org/Books/Eco/EEch7_ss5.htm)

Carlsson-Kanyama, A (1998). Climate change and dietary choices - how can emissions of greenhouse gases from food consumption be reduced? *Food Policy*, vol. 23, no.3/4, pp.277-293.

Carlsson-Kanyama, A et al. (2003). Food and life cycle energy inputs: consequences of diet and ways to increase efficiency. *Ecological Economics* no. 44, pp. 293-307.

Chemical Industry (1968) June 6 issue.

Cousins, G (undated). Conscious eating.

Dead Zones

[http://en.wikipedia.org/wiki/Dead\\_zone\(ecology\)#cite\\_note-oregondeadzone-2](http://en.wikipedia.org/wiki/Dead_zone(ecology)#cite_note-oregondeadzone-2)

Dobec, S. (2009) Whole Foods – Whole Health. Comparing Unprocessed and Processed Foods. [http://nutrition.suite101.com/article.cfm/whole\\_foods\\_whole\\_health](http://nutrition.suite101.com/article.cfm/whole_foods_whole_health) 2009-06-23

EIPRO (2006). *Environmental impact of products: Analysis of the life cycle environmental impacts related to the total final consumption of the EU25*. European Science and Technology Observatory and Institute for Prospective Technological studies, full report, May 2006. <http://ec.europa.eu/environment/ipp/identifying.htm> 2009-05-07

Energy Consumption & Its Environmental Impact. Sustainable Consumption , Sierra Club.  
[http://www.sierraclub.org/sustainable\\_consumption/factsheets/energy\\_factsheet.asp](http://www.sierraclub.org/sustainable_consumption/factsheets/energy_factsheet.asp)  
2009-05-07

Eshel, G & Martin, P. (2006). Diet, Energy and Global Warming. *Earth Interactions*, vol. 10, pp. 1-17.

Food Facts: the environmental impact of agriculture and food production  
[http://www.sierraclub.org/sustainable\\_consumption/food\\_factsheet.asp](http://www.sierraclub.org/sustainable_consumption/food_factsheet.asp) 2009-05-07

Energy-efficient Cooking.

<http://www.bbc.co.uk/bloom/actions/cookingtips.shtml> 2009-06-23



Food Matters – Food Miles.

[www.bbc.co.uk/food/food\\_matters/foodmiles.shtml](http://www.bbc.co.uk/food/food_matters/foodmiles.shtml) 2009-06-22

Food Packaging - [www.thesite.org](http://www.thesite.org)

<http://www.thesite.org/healthandwellbeing/fitnessanddiet/food/foodpackaging> 2009-06-23

Garnett, T (undated) Food and Climate Change, The World on a Plate. Food Climate Research Network.

Heller, L (2008). Fruit and veg linked to kids' school performance - study.

<<http://www.nutraingredients.com/Research/Fruit-and-veg-linked-to-kids-school-performance-study>> 2009-07-13

IISD (2003). Livelihoods and Climate Change. Combining disaster risk reduction, natural resource management and climate change adaptation in a new approach to the reduction of vulnerability and poverty. A Conceptual Framework Paper Prepared by the Task Force on Climate Change, Vulnerable Communities and Adaptation.

[http://www.iisd.org/pdf/2003/natres\\_livelihoods\\_cc.pdf](http://www.iisd.org/pdf/2003/natres_livelihoods_cc.pdf) 2009-06-12

Improving Refrigeration System Efficiency (2007). Guidance Based on Visits to 30 Food and Drink Factories. [http://www.ior.org.uk/ior/\\_images/pdf/general/](http://www.ior.org.uk/ior/_images/pdf/general/REIG5%20Site%20Guidance%20Topics%20-%20Final%20Jul-07.pdf)

[REIG5%20Site%20Guidance%20Topics%20-%20Final%20Jul-07.pdf](http://www.ior.org.uk/ior/_images/pdf/general/REIG5%20Site%20Guidance%20Topics%20-%20Final%20Jul-07.pdf) 2009-06-25

IPCC (2007). Intergovernmental Panel on Climate Change Fourth Assessment Report: *Climate Change 2007: The Physical Science Basis. Summary for Policymakers*, IPCC, February 2007 <http://www.ipcc.ch/SPM2feb07.pdf> 2009-05-17

Ekocentrum (undated). *Mat, miljö och energikonsumtion*. Faktasammanställning på uppdrag av Miljöförvaltningen, Stockholm av Ekocentrum, Informationscentrum för Ekologiska Produkter.

[www.ekocentrum.info/files/Energiberakning.pdf](http://www.ekocentrum.info/files/Energiberakning.pdf) 2009-05-07

Fallon, S. (2002). Dirty Secrets of the Food Processing Industry. Presentation given at The Consumer Health Conference, Canada March 2002.

McGregor, J & Vorley, B. (2006). Fair miles"? The concept of "food miles" through a sustainable development lens, International Institute for Environment and Development.

<http://www.iied.org/pubs/display.php?o=11064IIED&n=12&l=25&s=SDO> 2009-05-07

Mukehibir, P. & Ziervogel, G. (2007). Developing a Municipal Action Plan (MAP) for climate change: City Of Cape Town. *Environment & Urbanization*, vol. 19, no. 1, pp. 143-158.



Nieuwoudt, S. (2008). Measuring the Carbon Footprint of Fruit and Wine.  
<http://ipsnews.net/news.asp?idnews=43628> 2009-06-22

Production of meat and share in the world.  
[http://www.fao.org/es/ess/yearbook/vol\\_1\\_1/pdf/b02.pdf](http://www.fao.org/es/ess/yearbook/vol_1_1/pdf/b02.pdf) 2009-06-25

Robbins, J. (undated). Diet for a new America.

Rosenthal, E. (2008). Environmental Cost of Shipping Groceries Around the World. New York Times, April 26, 2008.

Smart Living Handbook (2009) (3<sup>rd</sup> ed.). Smart Living Handbook. Making sustainable development a reality in Cape Town homes. City of Cape Town, 2007.

Steinfeld et al. (2006). *Livestock's Long Shadow. Environmental Issues and Options*. Food and Agriculture Organization of the United Nations, Rome 2006.  
<http://www.all-creatures.org/articles/env-livestockslongshadow.pdf> 2009-05-07

1 liter Bottled Water uses 26 Liters Water + 1 Kg Fossil Fuel + 1 Pound CO<sub>2</sub>  
[http://www.digitaljournal.com/article/108604/1\\_liter\\_Bottled\\_Water\\_uses\\_26\\_Liters\\_Water\\_1\\_Kg\\_Fossil\\_Fuel\\_1\\_Pound\\_CO2](http://www.digitaljournal.com/article/108604/1_liter_Bottled_Water_uses_26_Liters_Water_1_Kg_Fossil_Fuel_1_Pound_CO2) 2009-05-08

Water: Battle of the bottles  
<http://www.caterersearch.com/Articles/2008/08/14/322791/water-battle-of-the-bottles.html> 2009-05-08

World Watch (2008). Meat Production Continues to Rise, B. Haliwell.  
<http://www.worldwatch.org/node/5443> 2009-06-12

World Watch (2005). Towards happier emails in a globalized world.  
<http://www.worldwatch.org/node/1826> 2009-06-12

World watch (2008). Report Calls for Better Animal Waste Treatment.  
<http://www.worldwatch.org/node/5726> 2009-06-12

www.Rawfoodexplained.com  
<http://www.rawfoodexplained.com/why-we-should-not-eat-meat/booklet-review-meat-and-the-vegetarian-concept-part-ii.html> 2009-06-12

2008 National Cattlemen's Beef Association, Fact sheet  
<http://news.nationalgeographic.com/news/bigphotos/14793409.html>



## 15. Useful Websites

- Abalimi Bezekhaya: food gardening  
[www.abalimi.org.za](http://www.abalimi.org.za)
- Carbon Footprint Calculator: carbon calculator  
[www.platbos.co.za/carbon\\_calculator.html](http://www.platbos.co.za/carbon_calculator.html)
- Enviropaedia: resource directory  
[www.enviropaedia.com](http://www.enviropaedia.com)
- Foodbank South Africa: food redistribution (Feed back)  
[www.foodbank.org.za](http://www.foodbank.org.za)
- Full Cycle - composting  
[www.fullcycle.co.za](http://www.fullcycle.co.za)
- Greater Good SA  
[www.ggsa.co.za](http://www.ggsa.co.za)
- Green Map Cape Town: local directory  
[www.capetowngreenmap.co.za](http://www.capetowngreenmap.co.za)
- Greenspace: local directory  
[www.greenspace.co.za](http://www.greenspace.co.za)
- Harvest of Hope : organic food boxes delivered to your school  
[www.harvestofhope.org.za](http://www.harvestofhope.org.za)
- IPCC: Intergovernmental Panel on Climate Change  
[www.ipcc.ch](http://www.ipcc.ch)
- SASSI: Sustainable Seafood Initiative  
[www.wwfsassi.co.za/home.asp?m=1](http://www.wwfsassi.co.za/home.asp?m=1)
- Schools of Environmental Education and Development  
[www.seed.co.za](http://www.seed.co.za)
- Smart Living Handbook: resource book  
[www.capetown.gov.za/environment](http://www.capetown.gov.za/environment)
- South African Weather Service  
[www.weathersa.co.za/References/Climchange.jsp](http://www.weathersa.co.za/References/Climchange.jsp)
- The Southern Energy Network  
[www.climateaction.net](http://www.climateaction.net)
- The Story of Stuff  
[www.storyofstuff.com](http://www.storyofstuff.com)
- Urban Sprout: local directory and blog  
[www.urbansprout.co.za](http://www.urbansprout.co.za)
- WARMTH : War against malnutrition, tuberculosis and hunger  
[www.warmth.org.za](http://www.warmth.org.za)





## A Few Products

Camphill Farm: natural and organic products

[www.camphill.org.za](http://www.camphill.org.za)

Elgin Organics: organic fruit and fruit juice

[www.elginorganics.com](http://www.elginorganics.com)

Ethical Co-op: online organic shop

[www.ethical.org.za](http://www.ethical.org.za)

Faithful to nature: online organic shop

[www.faithfultonature.co.za](http://www.faithfultonature.co.za)

Greenhome: biodegradable and compostable food packing

[www.greenhome.co.za](http://www.greenhome.co.za)

Good for the ground: biodegradable and compostable films bags

[www.goodfortheground.com](http://www.goodfortheground.com)

Health Connection Wholefoods

[www.health-connection.co.za](http://www.health-connection.co.za)

Komatifoods

[www.komatifoods.co.za](http://www.komatifoods.co.za)

Neighbourgoods Market

[www.neighbourgoodsmarket.co.za](http://www.neighbourgoodsmarket.co.za)

Organic Living: organic shop

[www.organicliving.co.za](http://www.organicliving.co.za)

Stellar Winery: organic wine

[www.stellarorganics.com](http://www.stellarorganics.com)

Superfoods

[www.superfoods.co.za](http://www.superfoods.co.za)

Tierhoek Organic: organic jam, jellies and dried fruit

[www.tierhoekorganic.com](http://www.tierhoekorganic.com)

Wellness Warehouse

[www.wellnesswarehouse.com](http://www.wellnesswarehouse.com)

Compiled by *icologie* for the Environmental Resource Management Department

City of Cape Town

June 2010

