FOOD WASTE

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RESEARCH TOPIC

INTRODUCTION

925 million people went hungry in the world in 2010. However the world produces 2720 kilo calories per person per day – more than enough food for everyone. The problem does not lie with food supply, but with its distribution. Bearing this in mind, it is shocking to consider that one-third of all food produced for human consumption is not even eaten.

Food waste at the Biopower plant, Pratteln

Food waste versus waste of food

Food waste and wasted food are two different concepts. Food waste concerns disposed food: what foods do we throw away, and what happens to it? Waste of food involves a more subjective social dimension: the attitudes and reasoning behind the decision to let perfectly edible food go to waste.

Apart from a global study[1] done by the Food and Agriculture Organisation in 2010, there are virtually no differentiated statistics on food waste. It is impossible to find out exactly how much food goes into waste in Metro-Basel.

Hence in this study we begin by investigating and documenting what happens to the food we throw away, as this – real processes and movement of material – is the most visible trail that can be found in the city, although as we find out, it is not very visible after all.

After that, we come to the question of why all that food waste is created. What are the human attitudes and systemic behaviours that lead us to waste so much food when we know we should not? Does the way we treat our food waste affect the way we think about it?

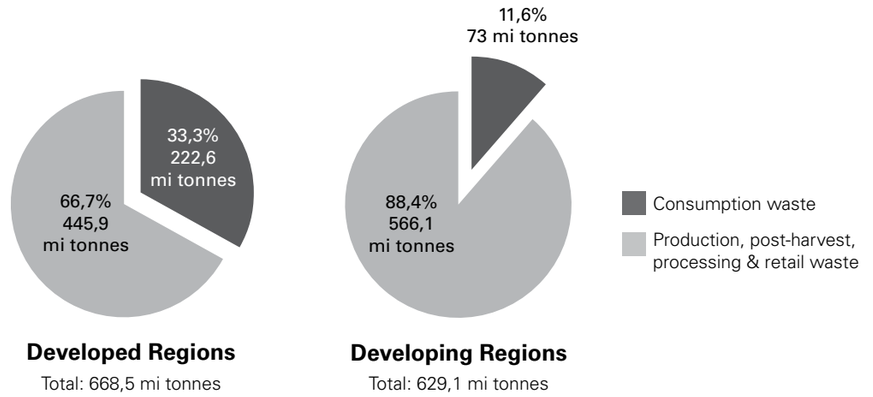
[1] "Global Food Losses and Food Waste: Extent, Causes and Prevention", Food and Agriculture Organisation, 2010.

Global Food Waste

1/3 or **1,3 billion tonnes**

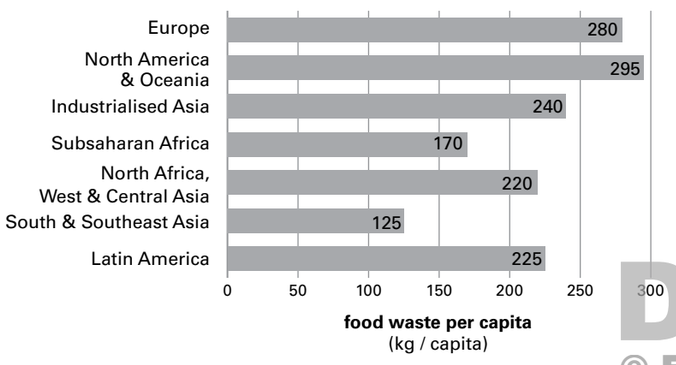
of food produced for human consumption is lost or wasted

1/3 of all food wasted in developed regions is wasted at the consumption level. In developing regions only 1/10 is wasted at consumption.



Developed Regions
Total: 668,5 mi tonnes

Developing Regions
Total: 629,1 mi tonnes



Developed and developing regions waste about the same amount of food in absolute numbers. However developed regions waste almost 50% more food per capita than developing regions.

Agriculture Production

Mechanical damage and/or spillage during harvest operation.
Crops sorted out post-harvest. Fruits and vegetables that do not fit criteria for retailers and consumers are eliminated.

Agricultural Waste in Europe

Post-Harvest Handling and Storage

Spillage and degradation during handling, storage and transportation between farm and distribution

Post-Harvest Waste in Europe

Processing and Packaging

Spillage and breakage during industrial or domestic processing.
Crops sorted out if not suitable to process. Inedible parts removed.
Process interruptions and accidental spillage.

Processing and Packaging Waste in Europe

Food Losses

Food losses are defined by the FAO as "the decrease in edible food mass throughout the part of the supply chain that specifically leads to edible food for human consumption". They occur at the production, post-harvest and processing stages in food production.
However although FAO considers these only as "losses" and not "waste", part of food is wasted when regulations come into play, for example eliminating perfectly edible food that do not conform to mainstream standards of visual appearance.

Supermarket Retail

Losses and waste in market system, e.g. overstocking and trimming.

Supermarket Retail Waste in Europe

Consumption

Losses and waste during consumption at household level

Consumption Waste in Europe

Food Waste

Food waste is related to the behaviour of retailers and consumers and their attitude and values towards food. FAO considers food wasted when it does not specifically go to purpose of feeding human beings.
While this is indeed often the case, food sometimes goes to other purposes, such as feeding animals or made into compost that provides nutrients for plant growth. As such is it considered to be waste as well?

HISTORY

The development of efficient waste management techniques in Basel hinged upon two key events: the cholera epidemic of 1848 and the high population growth in the second half of the 19th century. These two events and their associated unhygienic conditions were no longer tolerable. Consequently a cantonal waste collection system was introduced, which regularly collected waste and deposited it in a landfill.

"Glöggliwagen", domestic refuse collection in the 1920's, Basel Staatsarchiv Basel-Stadt, Bildersammlung

Historical Gallery

One of the first waste management techniques was dumping waste in the Rhein, using a special boat with a floor that could be opened. Waste could be transported to the middle of the river and dropped there. This guaranteed that the river current would carry it away and it would not be washed back onto the nearby river banks.

1887 Hygiene situation of the Birsig in 1887. Simply tipping rubbish onto the street or into the passing Birsig in the backyard was normal. The facades of buildings increasingly resemebled retaining walls for piles of rubbish.

Source: Unknown

1920's The first "rubbish trucks" were open carriages pulled by horses. They were named "Gleggliwagen" because of the bells that were hung on the horses.

Source: Industriewerke Basel

1931 The OCHSNER system is introduced in Basel. Households were equipped with standardised containers tailored to fit the transport wagons, and the fire doors of furnaces fit exactly to transport vessels. After the Second World War, the firm Ochsner and its licensed products became known throughout Europe. For the first time, Europe had a standardised rubbish container – the Patent Ochsner.

source: Patent Ochsner AG

source: Museum Baselland, Liestal

1942 The Liestal Sommerhalde Landfill, household waste was dumped in the woods near a housing complex. Every community was responsible for the disposal of their own waste, and this situation was often the result.

source: IWB

1943 Establishment of the KVA I (Kehrichtverbrennungsanlage) in Basel, as storage of waste is not the same as disposal of waste. Fears of disease, bans on export of waste to the countryside and the political turmoil of the time were significant factors in forcing the city to adopt incineration, despite concerns about the cost of building the facility.

source: IWB

1960 Garbage truck on a landfill near the city of Basel. As the city did not have enough space to maintain its own landfill, much of the waste was transported to landfills in Alsace or in the greater Basel area.

source: IWB

1965 A Saurer rubbish truck – the third generation after the Patent Ochsner to work in Basel. The trucks had a system that enabled them to be locked and tipped, as well as hinged lid pails. Ochsner buckets were used in some households until the introduction of the Bebbi-sack in 1991.

1868 Persistent shortages and increasing demands on waste disposal ultimately led to the construction of KVA II, next to KVA I.

source: IWB

1975 Demonstration agianst the establishment of a new regional landfill near Aesch, Baselland. County officials argued that there were no alternatives to bringing waste to the countriside.

Schweizer Fernsehen, Blickpunkt Region - 14.03.1975

1983 Regional Landfill Elbisgraben, near Liestal, is established. Waste from the communities of the districts of Liestal, Sissach and Waldenburg was disposed here for the next 20 years.

Source: Staatsarchiv Baselland

1993 Introduction of the "Bebbi-Sagg" in Basel city.

source: IWB

1998 Commissioning of KVA III. Combustion of some household waste from District Lörrach begins in 1999.

source: Google Earth, 2011

1999 Incineration plant Sausheim opens its doors near Mulhouse. From 2005 onwards, all household waste in the Metro-Basel region is incinerated, either at KVA Basel or at Sausheim.

2006 Commissioning of the first Biopower plant in Northwest Switzerland in Pratteln.

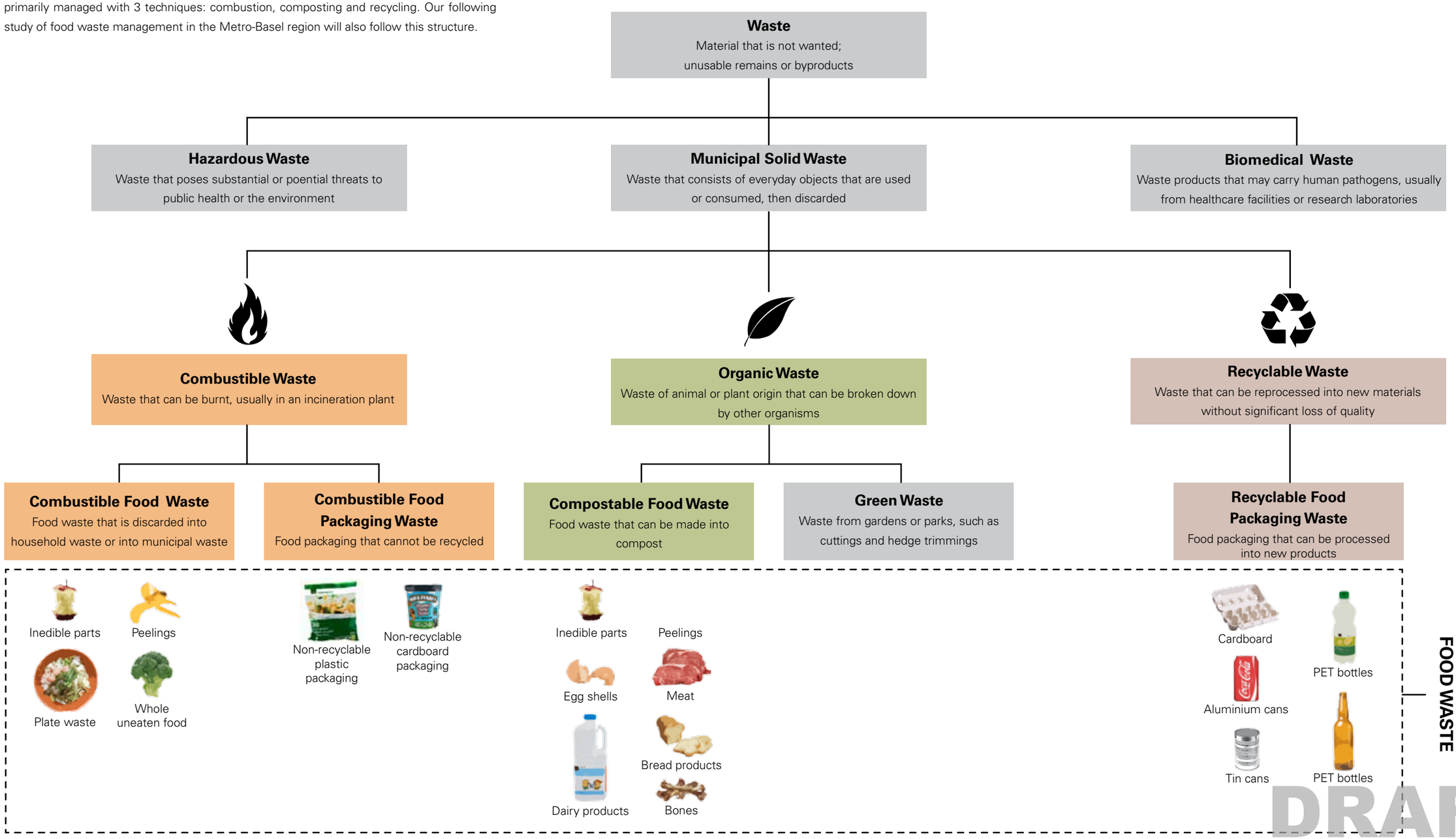
FOOD WASTE MANAGEMENT

As there are almost no statistics available for food waste in the Metro-Basel region, the problem of tracing food waste was approached from the perspective of food waste management. Again, there is no specialised procedure for treating food waste, but embedded within the existing waste management methods of incineration, recycling and composting.

Waste bunker at the incineration plant, Basel

Classification of food waste and management techniques

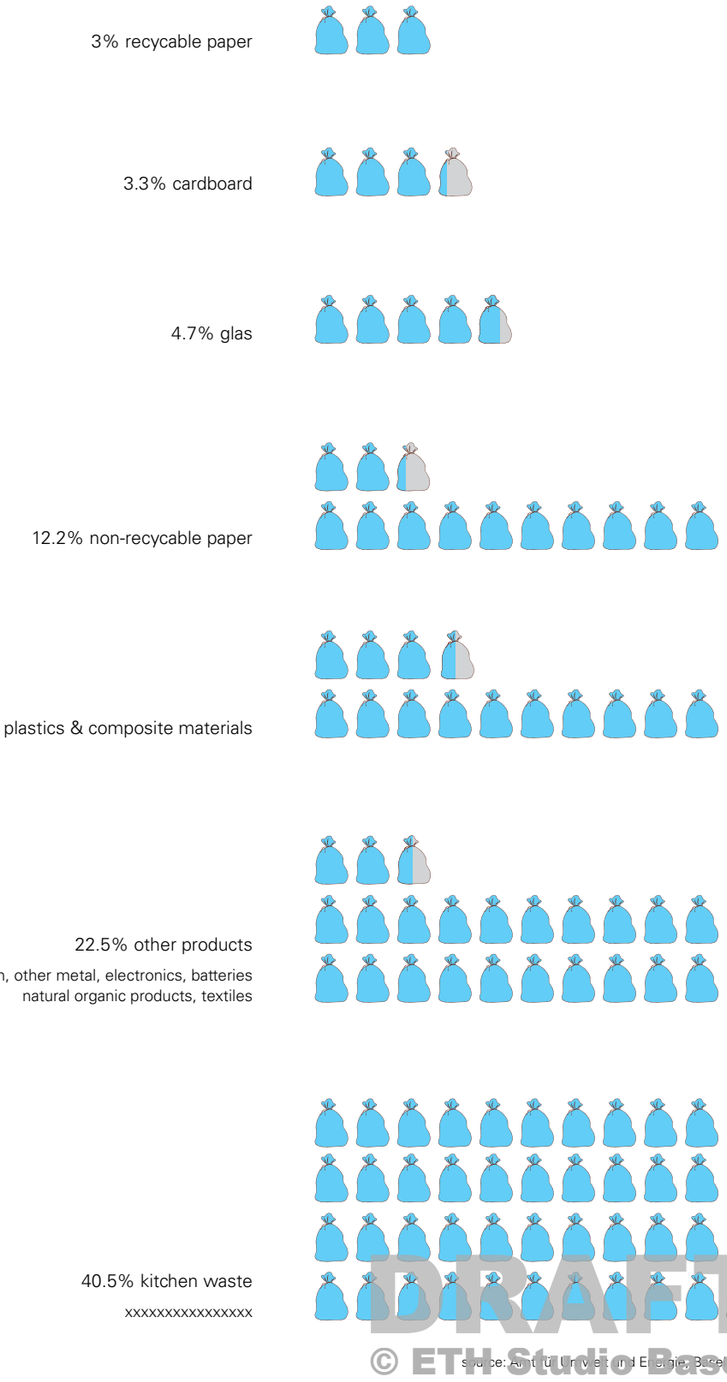
In investigating the food waste of Metro-Basel, we are interested both in waste derived directly from food, as well as the abundant food-related waste of packaging. These types of waste are primarily managed with 3 techniques: combustion, composting and recycling. Our following study of food waste management in the Metro-Basel region will also follow this structure.



Bebbi Sagg on the sidewalk waiting to be collected

Content in a “Bebbi Sagg”

The Bebbi-Sagg was introduced in 1993. Previously, most of waste from the house goes into combustible household waste, with very little in recycling. With the introduction of the Bebbi-Sagg, recycling and combustible houshold waste amounts became almost equal. However much of material that can be composted still remains in the Bebbi-Sagg to be incinerated.



COMBUSTIBLE FOOD WASTE

Combustible food waste is disposed of by burning, usually in incineration plants. With very efficient incineration plants, such as the KVA Basel, enough energy can be recovered from the waste to offset the cost of the operation, such that it becomes a very cost-efficient process. Consequently incineration has replaced landfilling as the most prevalent method of waste management.

Combustion Chamber, KVA Basel

BASEL-STADT (2005)
Household combustible waste: 31‘616 tonnes
168 kg / person / year

BASEL-LANDSCHAFT (2010)
Household combustible waste and bulky waste: 47‘192 tonnes
172 kg / person / year

DISTRICT LÖRRACH (2008)
Household waste: 38‘000 tonnes
170 kg / person / year

HAUT-RHIN (2009)
Household waste: 281 kg/person/year[1]

(1) Higher number may also be due to different methods of accounting for „household waste“

Overview of Combustible Waste Management

Combustible food waste is usually collected regularly with other combustible household waste, then transported to the incineration plant. Private firms usually have contracts with companies such as Lottner AG to collect their combustible waste. After incineration, leftover by-products of burning are sent to landfills.

However the incineration process produces toxic by-products that have to be treated and securely disposed of in landfills. **These “toxic landscapes” are often hidden from view. Additionally when food waste is incinerated, nutrients within are not returned to the environment in any form but lost to burning.**

Waste seperation
Combustible waste is separated in households and collected in specialised bags or containers.

Collection
Waste is collected regularly according to a weekly schedule.

Transport
Waste is transported by garbage trucks or by rail.

Underground landfill
Electric filter dust transported to underground landfill in Heilbronn.

Electric filter dust
2,88% of waste

Slag, fly ash
17,2% of waste

Landfill
Slag and fly ash transported to landfills in Liestal, Liesberg, Scheinberg and Retzwiller.

Incineration plant
Waste is incinerated in incinerator plants such as the KVA Basel and Sausheim incineration plant.

Heat
52,2% of energy produced

Steam
12,1% of energy produced

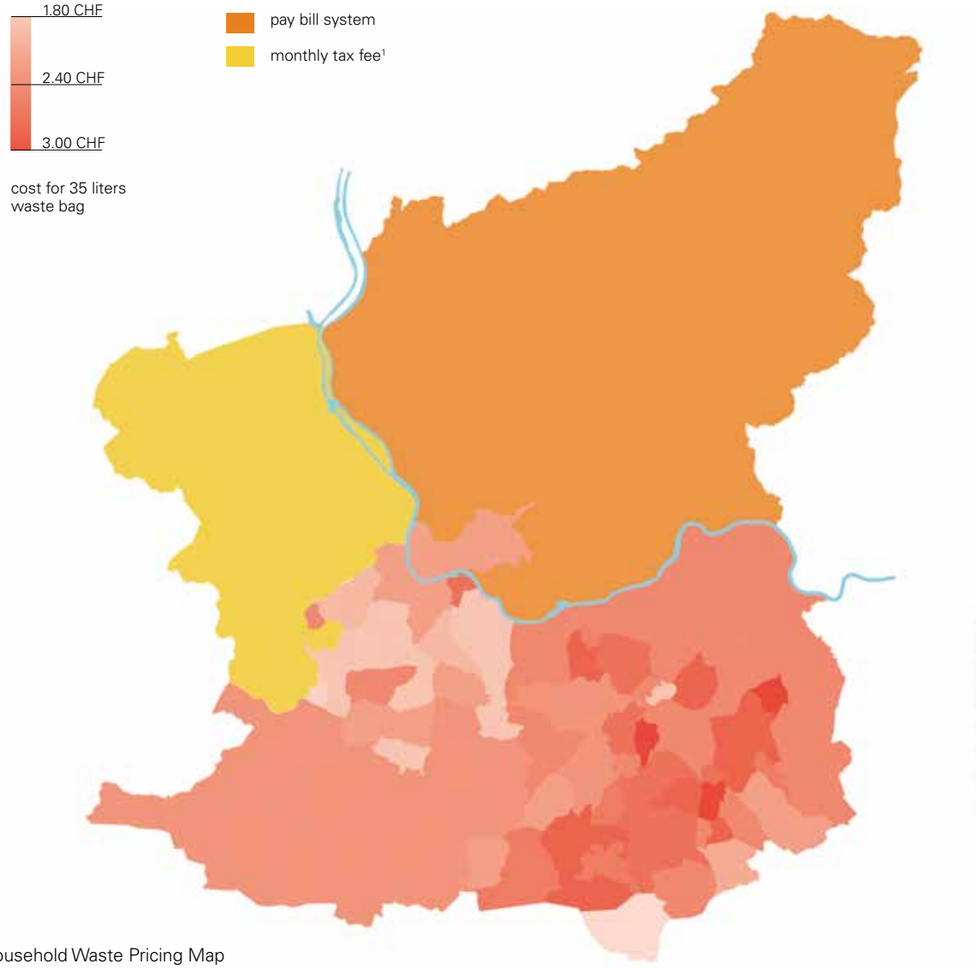
Electricity
4,2% of energy produced

District heating network
Heat generated in the form of hot water is given to the district heating network

Steam
Steam generated from combustion is given to surrounding industries

Electricity
Electricity not used for own operations is channeled into the city‘s grid

* All percentages from KVA Basel



Household Waste Pricing Map

Pricing of Household Waste

The pricing of household waste collection reveals the political borders of the Metro-Basel region. In Switzerland, cost of collection is mostly a fixed cost determined by each community, paid through special rubbish bags or labels. In Germany, in addition to a fixed cost of 2,60 Euros for every empty of a 60 litre rubbish container, an annual cost ranging from 26 to 103 Euros is imposed, depending on household size. In France, collection costs are paid monthly in a 58 Euro tax that also includes water and wastewater costs.

(1) tax includes fee for water & waste water

GAF
35 Liters: 2.50 CHF

KELSAG
35 Liters: 2.40 CHF

“Bebbi Sagg”
35 Liters: 2.30 CHF

Pratteln
35 Liters: 2.20 CHF

Arlesheim
35 Liters: 1.80 CHF

Bottmingen
35 Liters: 2.00 CHF

Binningen
35 Liters: 2.00 CHF

Arisdorf
35 Liters: 2.70 CHF

Münchenstein
35 Liters: 2.10 CHF

Oberwil
35 Liters: 2.00 CHF

Reinach
35 Liters: 2.00 CHF

Biel-Benken
35 Liters: 2.00 CHF

Giebenach
35 Liters: 2.55 CHF

Muttenz
35 Liters: 2.00 CHF

Füllinsdorf
35 Liters: 2.80 CHF

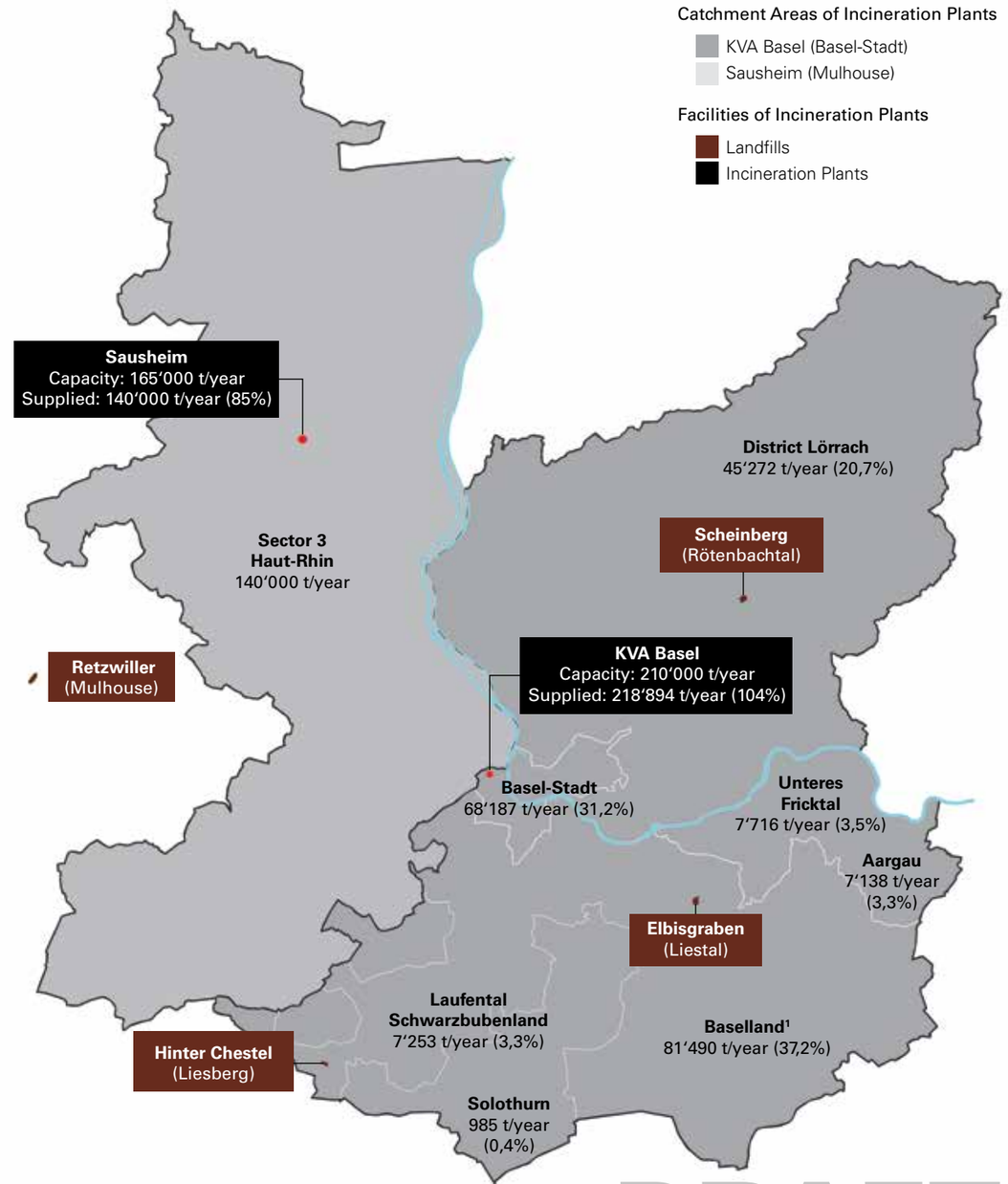
KVA Basel source: IWB

Incineration at KVA Basel

The KVA (Kehrichtverbrennungsanlage) Basel is one of the two incineration plants servicing the Metro-Basel region. It is responsible for the incineration of combustible waste from Basel-Stadt, Basel-Landschaft and District Lörrach, as well as Laufental Schwarzbubenland, Solothurn, Unteres Fricktal and Aargau.

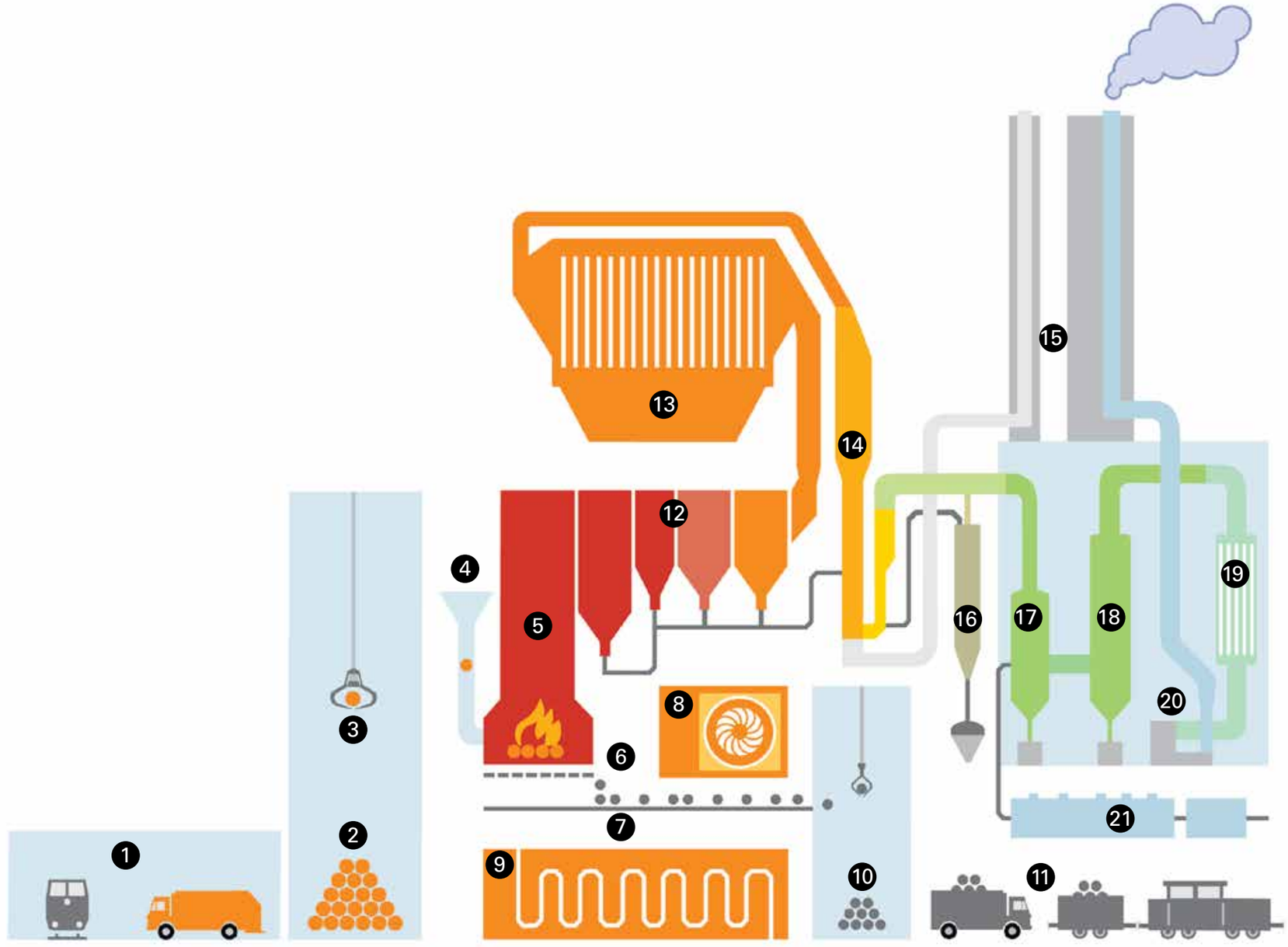
The combustible waste of Sector 3 of Haut-Rhin, including Pays de Saint-Louis, is sent to Sausheim Incineration Plant in Mulhouse.

Energy from the combustion process is recovered as electricity, steam and hot water, some of which is distributed to the city. Toxic by-products left over from combustion are deposited in landfills in Liestal, Liesberg, Scheinberg, Heilbronn (underground landfill) and Retzwille.



(1) without Laufental

Section of KVA Basel



(1) delivery by truck and train
(2) waste bunker
(3) crane to mix waste
(4) hopper
(5) combustion chamber
(6) grate
(7) slag belt
(8) turbine
(9) steam / hot water production
(10) slag bunker
(11) slag removal by truck and train
(12) steam boiler
(13) electrostatic precipitator (filter)
(14) $DeNO_x$- Catalyst
(15) Chimney / standby chimney
(16) fly ash silo
(17) acid scrubber
(18) alkaline scrubber
(19) fine dust separator
(20) induced draft fan
(21) wastewater treatment plant

(1) delivery by truck and train

(2) waste bunker

(3) crane to mix waste

(5) combustion chamber

(9) steam production

9) hot water production

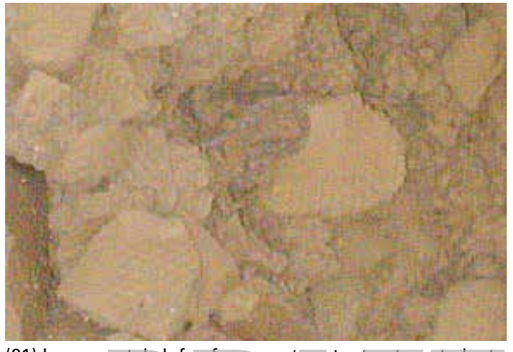
(10) slag bunker

((11) slag removal by train

(13) electrostatic precipitator (filter)

(13) electric filter dust

(15) chimney / standby chimney



(21) heavy metal slufge from wastewater treatment plant

Daily 514 t. of waste are delivered by truck

Daily 86 t. of waste are delivered by train

Input of waste to KVA Basel

A total of 219’000 tonnes of waste is sent to KVA Basel for incineration annually. Waste is transported daily via truck and train. A discount of 20 CHF per tonne is given to waste delivered by train, which generates less carbon emissions than truck delivery.

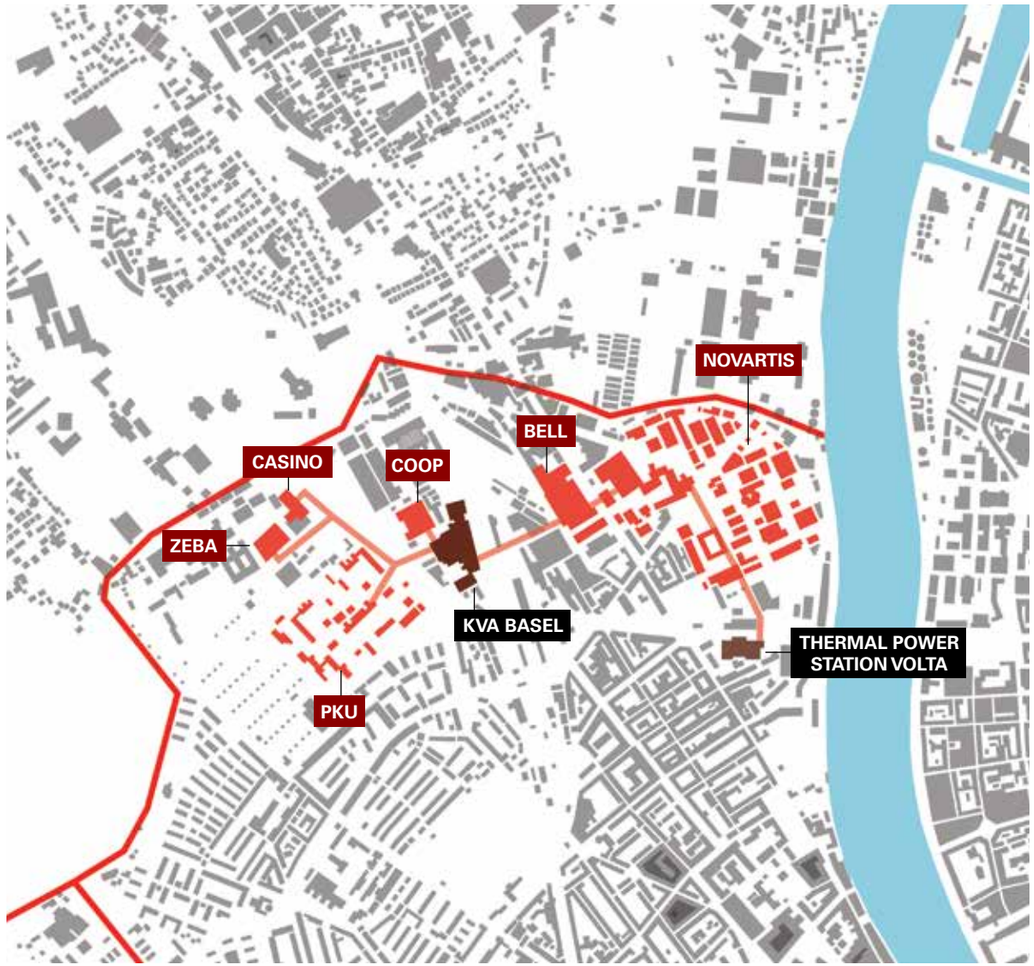
The waterplant Birsfelden, produces nearly the same amount of energy as the KVA Basel. However the energy output of the KVA is smaller

Energy Output

KVA Basel is one of the most efficient incineration plants in Europe. Consequently it is able to recover 68.9% of the energy it uses in combustion.

Out of 58’709 MWh of electricity it produces per year, 28’820 MWh is used for its own operations, leaving a net surplus of 28’889 MWh.

Output		
ELECTRICITY	4.2%	28’889 MWh/year
HEAT via hot water	52.5%	365’580 MWh/year
STEAM	12.1%	84’396 MWh/year
LOST/UNUSED	31.1%	216’601 MWh/year

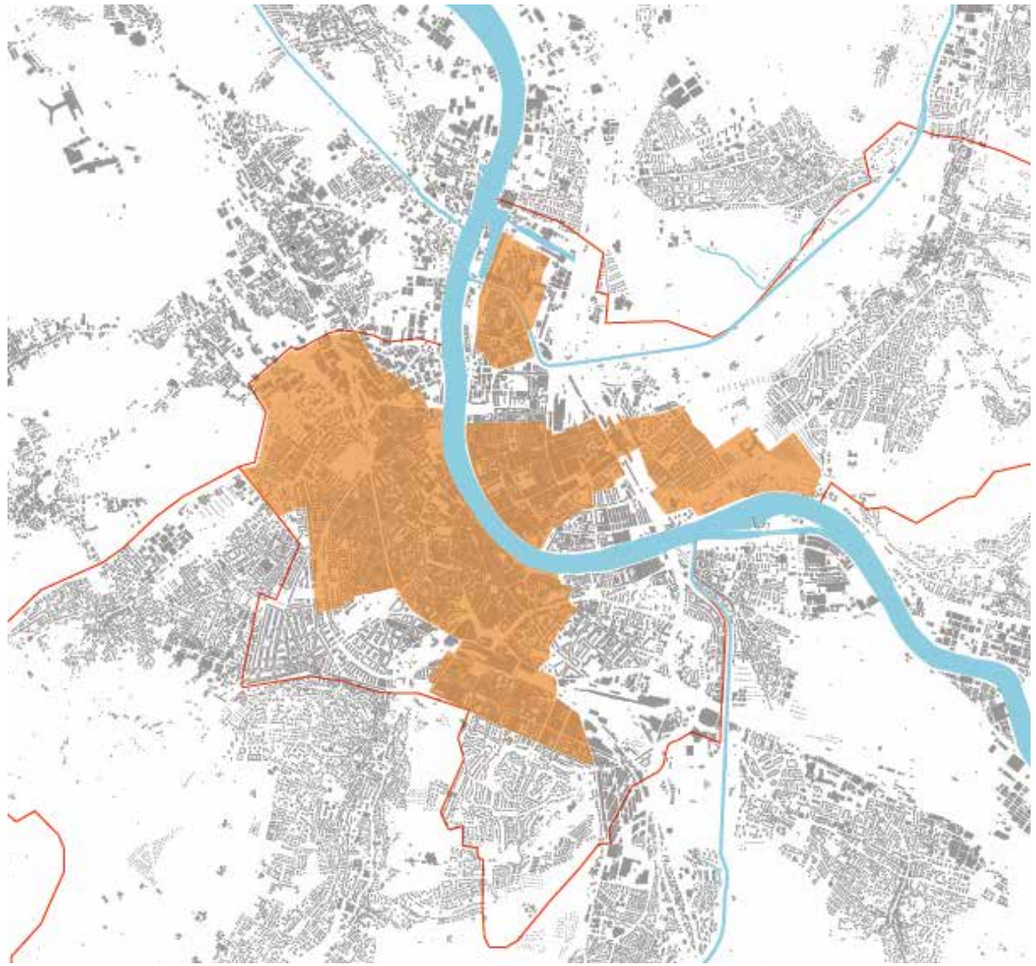


facilities that provide steam
facilities that receive steam

Steam distribution Network

Steam produced by KVA Basel: 84’396 MWh

Steam at 400°C at 40 bars of pressure is produced during the combustion process. The steam is passed over a turbine to produce electricity. After this, the steam still has 13 bars of pressure and is supplied directly to industrial customers.



areas that receive hot water from KVA Basel

Hot Water Distribution Network

Hot water produced by KVA Basel: 365’580 MWh

Heat produced during the combustion process is recovered as 170°C hot water and distributed through the district heating network. The Basel-Stadt district heating network is 200 km long, and the largest across Switzerland and supplies 45’000 homes, 250 industrial and commercial enterprises, 200 buildings and 13 public hospitals. KVA Basel supplies around 45% of the required heating.

Toxic slag from the incineration process

source: IWB, Basel

Disposal of Toxic By-Products

Incineration of waste creates toxic by-products that have to be processed and then disposed of, to avoid danger to public health and polluting the environment.

Slag and Bottom ash

17,2% of total incinerated waste by weight

Residues from the incineration process. Contains heavy metals, dioxins, and other pollutants. Often too toxic to be reused.

Electric filter dust

2,88% of total incinerated waste by weight

Dust particles that are removed from flue gas during purification.

(1) Underground landfill, Heilbronn

Old salt mine that receives 6056 tonnes of electric filter dust from KVA per year. These by-products can cause serious pollution if they come into contact with groundwater.

(2) Landfill, Scheinberg

Located in the Rötenbachtal in the district of Lörrach. Receives 13’000 tonnes of slag and fly ash from KVA Basel per year.

(3) Landfill Elbisgraben

Located in Liestal in Basel-Land. Receives 19’400 tonnes of slag and fly ash from KVA Basel per year.

(4) Landfill “Hintere Chestel”, Liesberg

Located in Liesberg in Basel-Land. Receives 21’000 tonnes of slag and fly ash from KVA Basel per year.

20 [km]

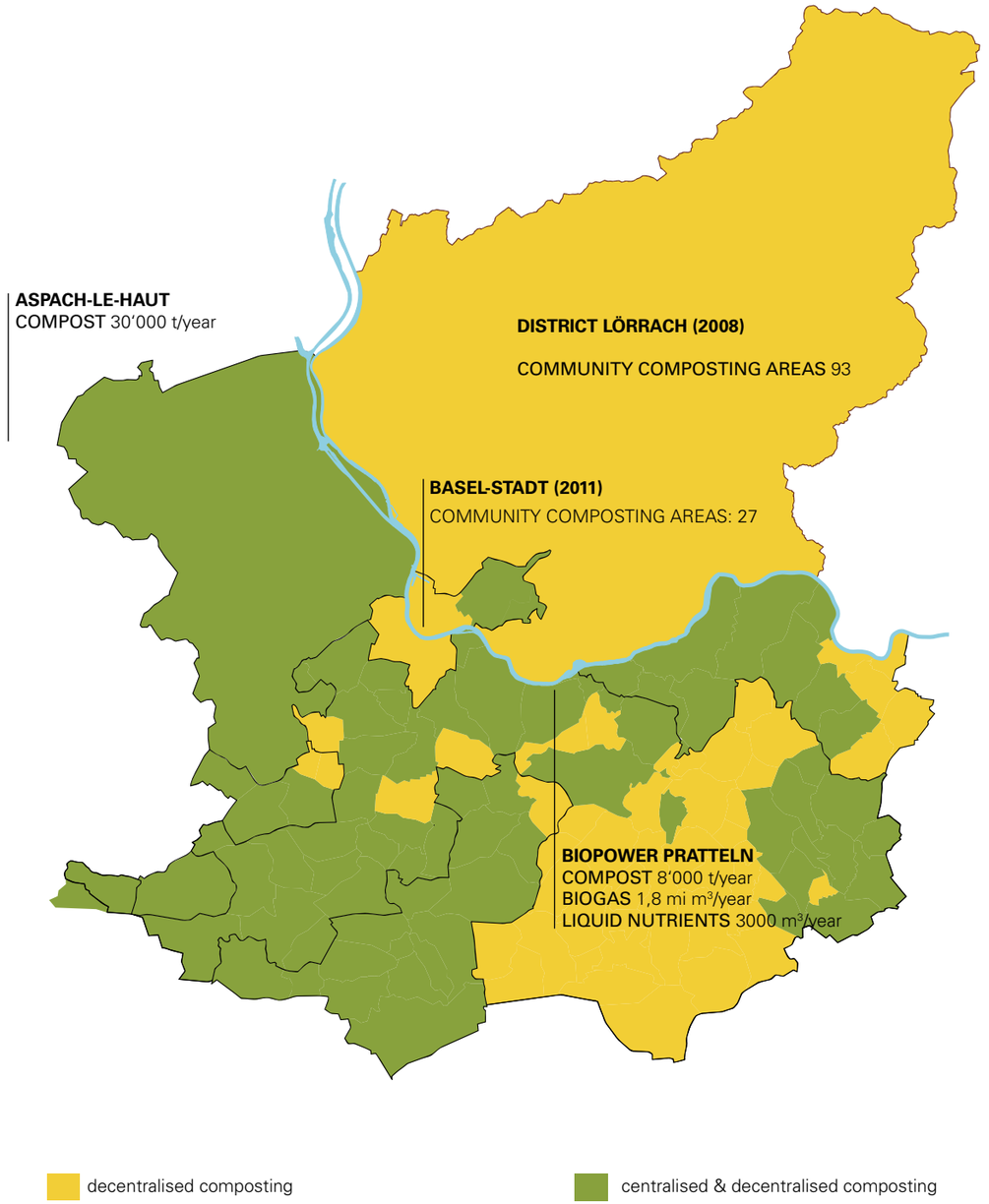
COMPOSTABLE WASTE MANAGEMENT

The composting of food waste is a practice that dates back to the Roman Empire since Pliny the Elder (AD 23-79) – a natural method for returning the nutrients still held within the food to the earth. Its use decreased with the advent of industrialisation and the growing prevalence of landfilling and incineration.

Compostable Food Waste

With concerns about landfill space and the pollutants given off during the incineration process, as well as growing interest in organic farming and sustainable development, the popularity of composting as a method of managing organic waste is increasing. However, in the city, there is the problem of not having space to compost and not having the space to use the compost. **Lack of space, lack of time and ignorance about composting are the main obstacles in promoting composting.**

In addition to decentralised composting (individually and in groups), large-scale composting and fermentation facilities have been developed. These facilities can accept types of organic waste that may not be compostable on a small scale. **However there are concerns that the compost from these facilities is of a lower quality than from decentralised composting. The large amount of salt present in food waste accepted at large-scale facilities is detrimental to plant growth.**



(1) Only community composting areas

Overview of Compostable Waste Management

Composting is usually done at the decentralised and centralised levels. In decentralised composting, composters separate compostable waste at home, then compost individually or as a group on a small scale. Only certain materials can be used. In centralised composting, facilities like Biopower Pratteln collect a wider range of material and compost or ferment them on a large scale to produce compost and biogas.

Peelings | Inedible parts | Meat | Egg shells | Dairy products | Bread products | Bones

Decentralised composting
Decentralised composters are supposrted by advisory boards from the government.

Personal composting
Compost in own home or garden

Group composting
Compost as a group or community in a single location

Quality of compost can be quite high if done properly

Compost available at low prices or for free to members.

Personal gardens
Composters responsible for utilising own compost.

Quality of compost lower due to inclusion of food waste with high salt content

Landscape and city gardens
Compost from large-scale composting is sent to city garden facilities

Centralised composting

Bioklappe
Food waste deposited for a fee in specialised containers

Large-scale composting / fermentation
Organic waste is processed into compost and biogas

Natural gas network
Biogas is mixed into the existing natural gas network

Composting process takes 6-12 months per harvest.

Composting Process

(1) Reduction Phase

Build up „army“ of microorganisms, including bacteria and fungi.
Rapid decrease of colourful mixed organic waste.
Creation of heat: 40°C - 60°C

(2) Conversion Phase

Degradation of organic waste into humus with microorganisms and small animals.
Compost is lukewarm.

(3) Construction Phase

Further degradation into valuable humus under the action of microorganisms and small animals.
Action of composting organisms results in an intimate mix of organic and mineral components into typical compost particles.

Twigs and branches in the lowest part of compost ensure supply of air and prevent waterlogging.

Personal Composting

Personal composting is most commonly practiced, and as such the total number of personal composters is unknown. First-time personal composters can seek counselling from Compost Advice (Kompostberatung), which will provide advice and help at no cost, although most composters will be required to purchase the equipment themselves. Chaff (Häcksel) is provided for freee to mix the food waste with.

Cost of Composting: 60 - 170 CHF

Lid: 10 CHF - 120 CHF

Silo: 40 CHF

Fork: 10 CHF

Time Needed per Harvest: 29 hours per year

INITIAL
Installation
20-30 minutes

DAILY
Chopping of food and mixing with chaff
2-3 minutes

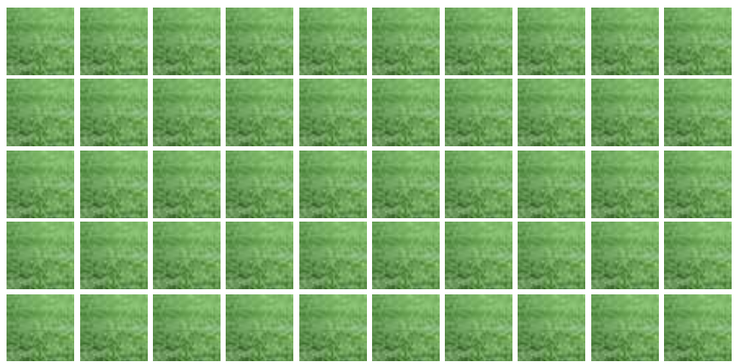
WEEKLY
Turning and mixing
10 minutes

ANNUAL
Harvest
60-90 minutes

Space Needed
1.5 m²

= 1 m²

Harvested Compost: 500 litres (4-person family house)
Fertilises 50 m² of grass



Group Composting

Group composting is suitable for households where there is no space for personal composting. However individuals in Basel-Stadt are counselled to first attempt personal composting, due to the lack of capacity in the group composting areas.

BASEL-STADT: District composting areas (Quartierkompostplätze)

27 district composting areas and 15 family gardens were set up by individuals with the assistance of Compost Advice (Kompostberatung). These areas are centrally located within neighbourhoods and can serve 30 to 50 households. Members can either bring their compostable waste for free if they help in the composting process, or for a small fee if they do not. The harvested compost is given to members free or at a very small price.
Unfortunately their locations cannot be disclosed due to lack of capacity and potential for abuse (bringing waste here for free instead of paying for the Bebbi-sagg).

DISTRICT LÖRRACH: Community composting (Gemeinschaftkompostierung)

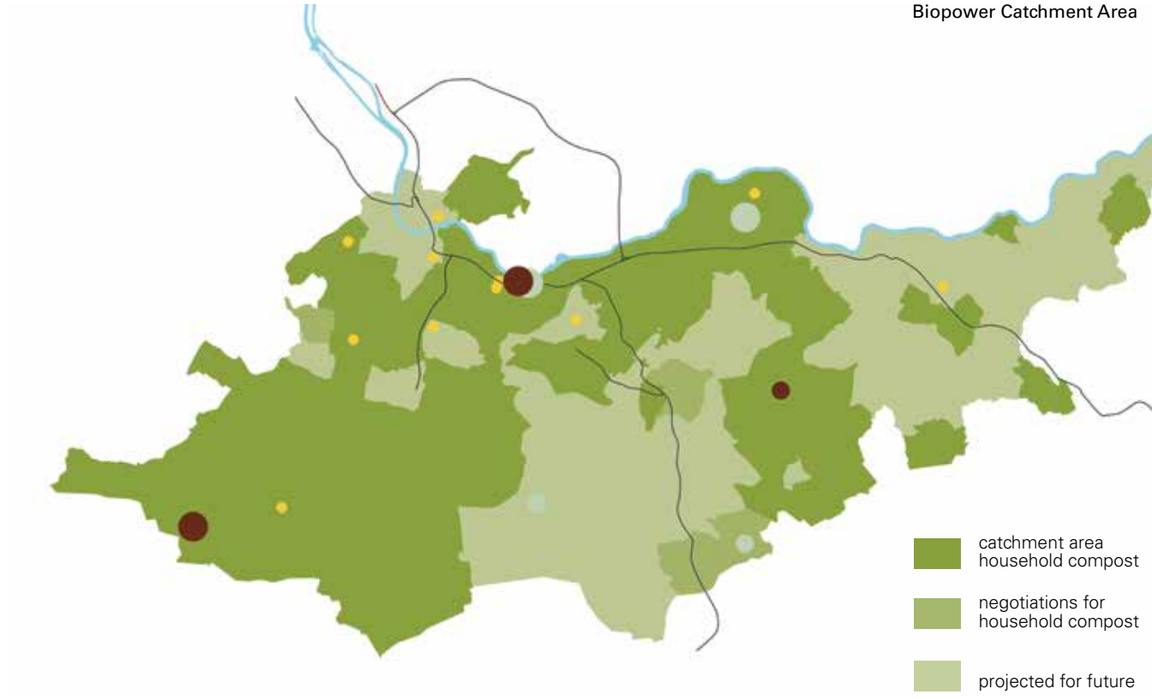
93 locations for community composting were set up in 2008, with the largest serving up to 40 households. 150 litres of compost is harvested per year per household.

Large-scale centralised composting facility at Biopower Pratteln

Composting and Fermentation at Biopower Pratteln

Biopower Pratteln is one among several Biopower plants in Switzerland. It serves 24 communities in Basel-Land, which deposit their organic waste into special containers (Bioklappe) for a small fee. The organic waste is brought to the facility, which composts and ferments it on a large scale to produce compost and biogas. The compost is used in the countryside areas and in the city gardens. The biogas is purified to natural gas standards and added to the existing natural gas network, which also provides gas for vehicles.

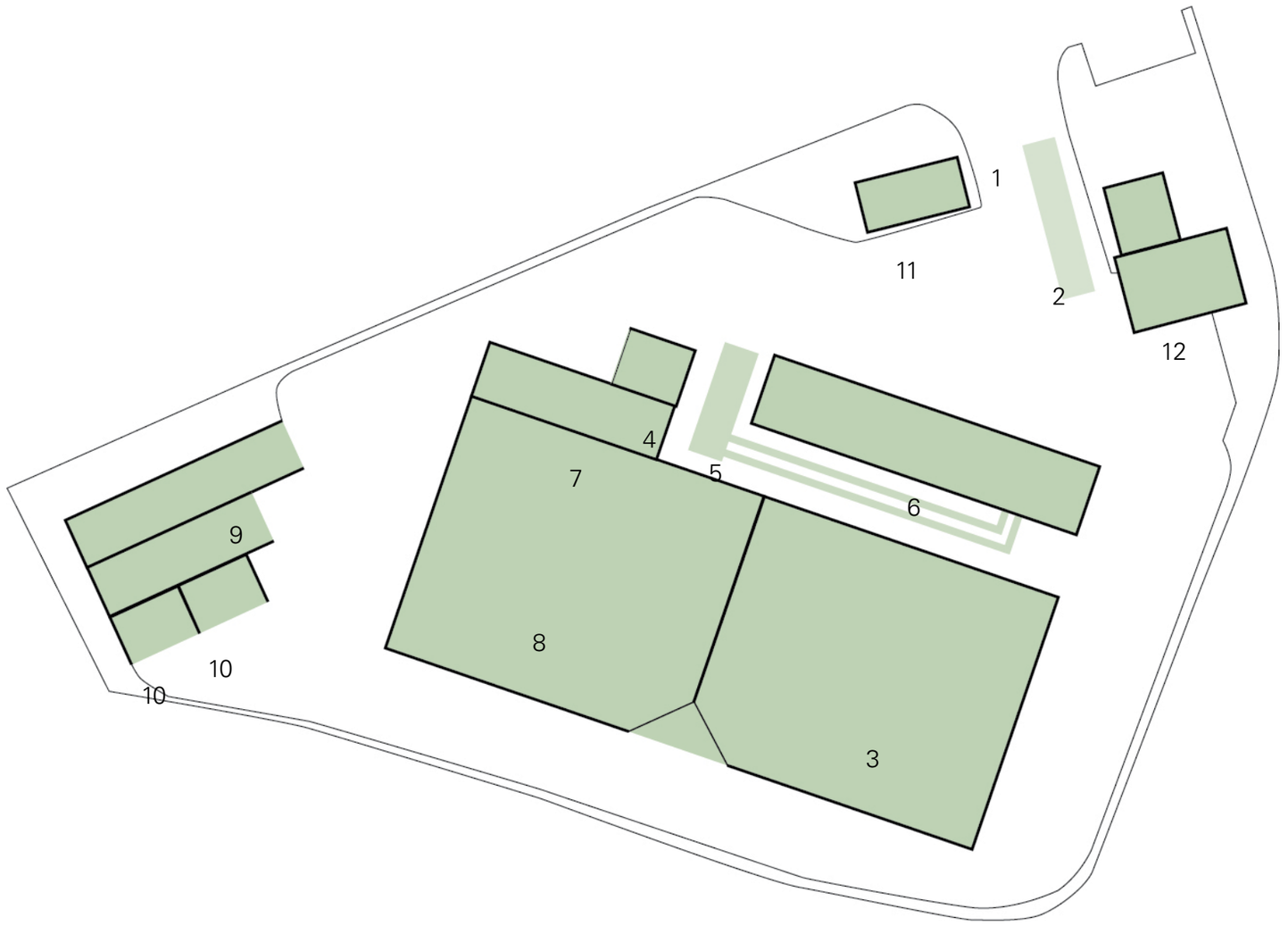
Basel-Stadt chose not to use the Biopower facilities as the cost of transporting the organic waste to Pratteln and composting it there is higher than incinerating it at KVA Basel, due to KVA Basel's high efficiency



active Biopower plant
- 5'000 - 10'000 t. of compost per
- > 10'000 t. of compost per year

projected Biopower plant
- 5'000 - 10'000 t. of compost per year
- > 10'000 t. of compost per year

- biogas station for vehicles



Biopower Pratteln

(1) ENTRANCE / EXIT

(2) WEIGHING

All material deliveries recorded by weight.

(3) STRUCTURE-RECEPTION HALL

Waste shredded and screened. Fine material for fermentation. Coarse material for composting.

(4) LIQUID INTAKE / STERILISATION

Organic waste, waste oil and fat, meat waste dumped, crushed and sterilised at 133°C.

(5) MIXER / FEEDER

Fine material, wet sterilised material, pressing water mixed and added to fermentation reactor.

(6) FERMENTATION REACTOR

Bacteria converts biomass to biogas anaerobically in 15 days at 55°C in darkness. Biogas removed.

(7) DRAINAGE

Non-degraded material pressed. Solids fall into composting hall. Water falls into tank.

(8) INDOOR COMPOSTING

Pressed solids from fermentation reactor and coarse material are mixed. Microorganisms compost material over 8 weeks and under intense ventilation.

(9) SUBSTRATE AND COMPOST STORAGE

Composted material stored, sifted and mixed according to use. Used in covered and uncovered horticulture, agriculture, sports field construction and engineering.

(10) BIOFILTER

Exhaust air filtered by biological filter made of tree bark, peat, compost and heather.

(11) BIOGAS TREATMENT PLANT

Biogas: 60% methane, 35% CO_2, 5% various gases. Biogas compressed and dehumidified. Methane separated and flows into gas grids and supplies gas stations.

(12) OFFICE / WORKSHOP

(2) Delivery and weighing of organic waste

(3) Large reception hall for waste

(5) Mixing of fine material, wet sterilised material and pressing water

(7) Drainage of non-degraded material

Biopower Pratteln

(8) Indoor composting

(9) Storage of compost and substrate

(11) Biogras treatment

(11) Biogas treatment

Compost produced by Biopower Pratteln

8000 tonnes per year

Compost from Biopower Pratteln is used in the countryside and in the city gardens. However Sabine Hosch from the Basel-Stadt Compost Advice expressed her concerns about the quality of the compost. As Biopower plants also receive food waste from places such as restaurants, its raw waste material has quite a high salt content. This is detrimental to plant growth.

source: BVB, Basel

20 banana peels

= 1 [km] by car

Biogas produced by Biopower Pratteln:

1,8 million tonnes per year

Methane from the fermentation process is captured to form Biogas. Carbon dioxide and other gases are removed and the gas is cleaned to upgrade it to the standard of pipeline natural gas. It is then added to the existing natural gas network.
Biogas from the Biopower plants is available as car fuel from natural gas (Erdgas) pumping stations. In 2007, Biogas powered 1338 vehicles via the natural gas network. If Biogas was substituted for all car fuel, 1 million litres of fossil fuels can be saved annually and the production of 1200 tonnes of CO_2 emissions can be avoided.

Economics of Food Waste Management

In 2010 a comparison was made by Basel-Stadt between centralised composting, decentralised composting and incineration, as 41% of all disposed household waste consists of organic waste that can be recycled.

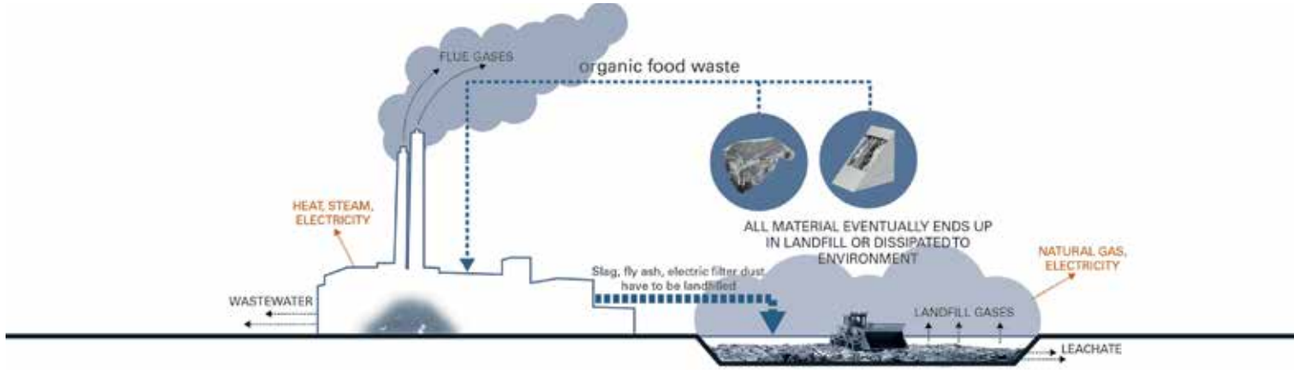
	INCINERATION	CENTRALISED COMPOSTING	DECENTRALISED COMPOSTING
			
ECOLOGICAL ADVANTAGES	**No significant advantages overall in general**		
	Emits less greenhouse gases than composting and fermentation (which produce methane)	More advantageos for very wet or liquid waste	Public needs to be educated on proper utilisation of compost for decentralised composting to perform
DESIRE OF SOCIETY	**Interest in composting and fermentation and expressed willingness to pay, but no clear preference for centralised or decentralised**		
		71% prefer area-wide collection 56% prefer bring system	57% willing to begin composting with cost-free composting space and counselling
COST OF IMPLEMENTATION	**Disposal of organic waste in household waste:** 227 CHF / tonne (current cost)	**Reducing normal waste collection to once a week:** 284 CHF / tonne **Implementing organic waste collection once a week:** 284 CHF / tonne **Use of Bioklappe:** 360 CHF / tonne	**Full expansion of Compost Advice (Kompostberatung):** 84 CHF / tonne **Partial optimisation of Compost Advice (Kompostberatung):** 81 CHF / tonne

Decision

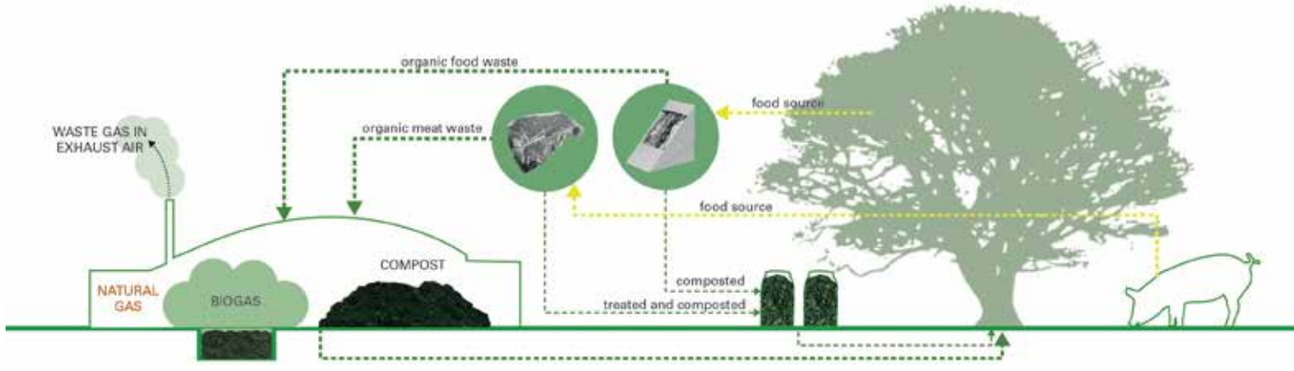
Based on its evaluation that ecologically, all three methods are equal, Basel-Stadt decided to continue with current disposal of organic waste through incineration, along with other combustible waste. It also decided to adopt partial optimisation of Compost Advice, the method that incurs the least extra cost, so that more people are able to begin personal composting.

Linear and Cyclical Ways of Treating Food Waste

In 2010 a comparison was made by Basel-Stadt between centralised composting, decentralised composting and incineration, as 41% of all disposed household waste consists of organic waste that can be recycled.



Incineration and Landfilling
Although useful energy can be recovered from the incineration and landfill processes, which help to offset the cost of operation, it remains that these processes generate toxic products that pollute the environment. It is also a non-renewable one-way process, and any nutrients left in the food waste will never be recovered.



Composting and Fermentation
These processes produce methane, which is a carbon gas emission. However this can be captured to use as biogas, which replaces fossil fuels as sources of energy. It is also a regenerative process that recycles nutrients.

Recycable Food Waste

Recyclable food waste consists of discarded food packaging that can be recycled. These mainly include cardboard, PET bottles, glass jars and bottles, alumnium cans and tin cans. Other materials like plastic film may be recycled in one country but not in another.

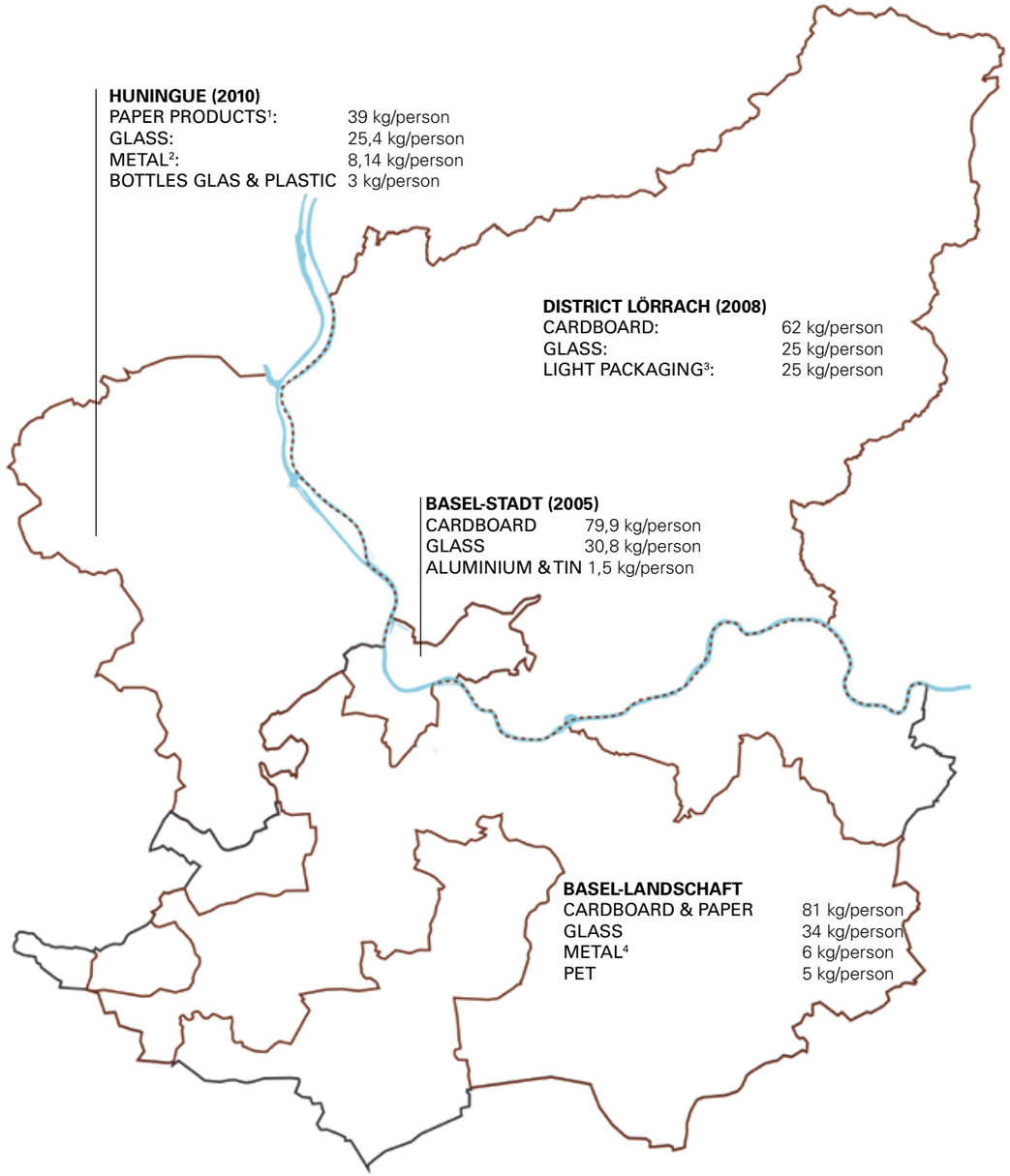
Recycling of paper & cardboard in Lottner AG

Recycling of cardboard in Lottner AG

Recycling in Metro-Basel

In Metro-Basel, individual recycling companies specialise in particular materials. For example Lottner AG specialises in the recycling of paper and cardboard.

The global recycling industry handles more than 600 million tonnes of recyclable material every year. **The international trade of recyclable materials is huge but very difficult to track, as it is not controlled by central governing authorities. Many companies themselves do not know where the material eventually ends up**, though Lottner AG observed a general northward movement of materials, from Switzerland to southern Germany to northern Germany, and then to Rotterdam where it is shipped to China.



(1) Paper, cardboard, newspapers, magazines, food cartons
(2) Aluminium, steel
(3) Bottles, cups, aluminium cans, Tetrapak, films
(4) Aluminium cans, tins, coarse metal

Overview of Recyclable Waste Management

Recyclable waste sorted in the household. Cardboard can usually be collected door-to-door. Materials like alumnium cans and PET bottles have to be deposited at collection points. Other more specialised waste like coffee capsules may be recycled at recycling stations. These materials are then sent to factories to be processed into new products.

recycable food waste sorted in the household

Cardboard

Aluminium Cans

PET bottles

Glass

Tin Cans

Coffee Capsules

Door-to-door collection
Certain recyclable materials such as cardboard are collected regularly door-to-door

Collection Points
Materials like alumnium cans and PET bottles can be deposted in collection points scattered throughout the city

Recyclable waste is eventually transported to recycling stations

Recycling Station
Other materials may be accepted directly at large recycling stations run by private companies

Sorting
Waste is sorted by hand

Factories for Reprocessing
Sorted recyclable materials are sent to factories in the region as well as overseas to be processed into new products

Incineration Plant
Unsuitable materials are sent to incineration plants to be burnt

Efficiency of Recycling

Although many materials are sent for "recycling", in reality they are being "downcycled" – the newly reprocessed material may have degraded in quality compared to the original material, and can only be used for other purposes. This is especially true of complex composite products that cannot be properly broken down into its individual materials.

Cardboard

Recycled products:
Cereal boxes, egg cartons, pencil barrels, grocery bags, cellulose insulation materials
Limits to recycling:
Cardboard can be recycled 4 to 5 times before its quality degrades, and it can only be processed into other materials like animal bedding.

Glass

Recycled products (primary):
Glass products
Recycled products (secondary):
Ceramic sanitary wares, flux agent in brick manufacture, astroturf, recycled glass countertops, water filtration media, abrasive, aggregate.
Limits to recycling:
Properly sorted glass is endlessly recyclable. Complex glass products like window panes and lightbulbs may not be recyclable.

PET/Plastics

Recycled products:
Polyethylene bin liners and carrier bags, plastic bottles, flooring and window frames, building insulation board, DVD and CD cases, garden furniture and fencing, garden sheds and composters, seed trays, fleeces, fibre filling for sleeping bags and duvets, office accessories
Limits to recycling:
Most plastics degrade during reprocessing and can only be recycled once. Plastics from drink and milk bottles are usually downcycled into non-recyclable materials.

Non-Ferrous Metals

Recycled products (aluminium):
Window frames, building structures, roofs, transport vehicles, cans and foil, wire, cooking and tableware
Recycled products (tin):
Cans (tinplate), car components, springs, tin oxide coatings for glass
Limits to recycling:
Can be recycled endlessly as properties are stable throughout reprocessing.


Körnerstrasse, Lörrach


Seevogelstrasse, Basel


Feldbergstrasse, Basel


Wittlingerstrasse, Basel


Grenzacherweg, Riehen


Parkallee, Allschwil

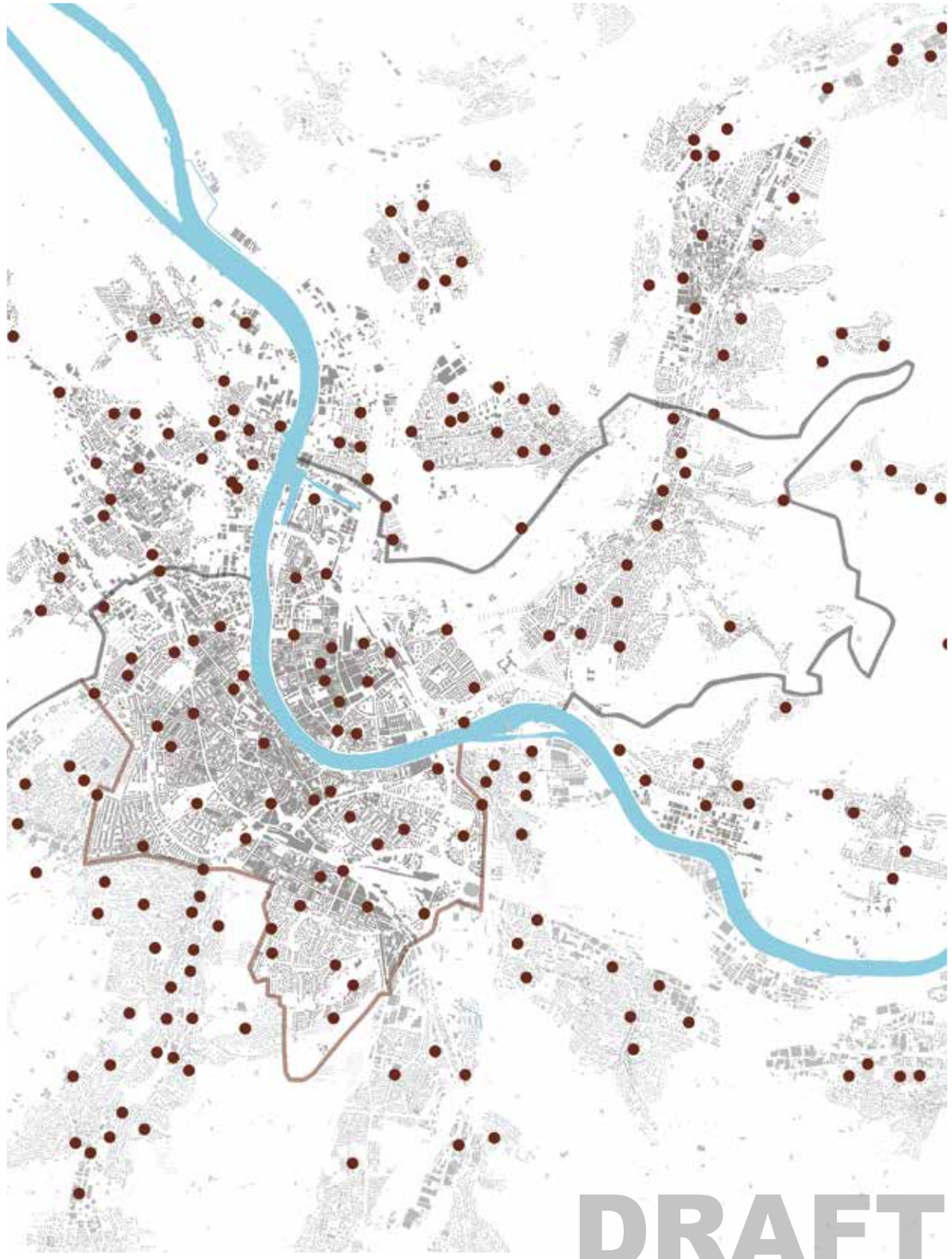

Neubadrain, Binningen source: Google Earth


Coop, St. Jakob Strasse, Muttenz


Bielerstrasse, Oberwil

Collection Points

Collection points are small stations scattered throughout the city where people may bring certain recyclable materials.



Collections Points in Metro Basel


unsorted recyclable material


sorting by hand


sorted material


sorted material compacted in cubes


cardboard food packaging


PET bottles

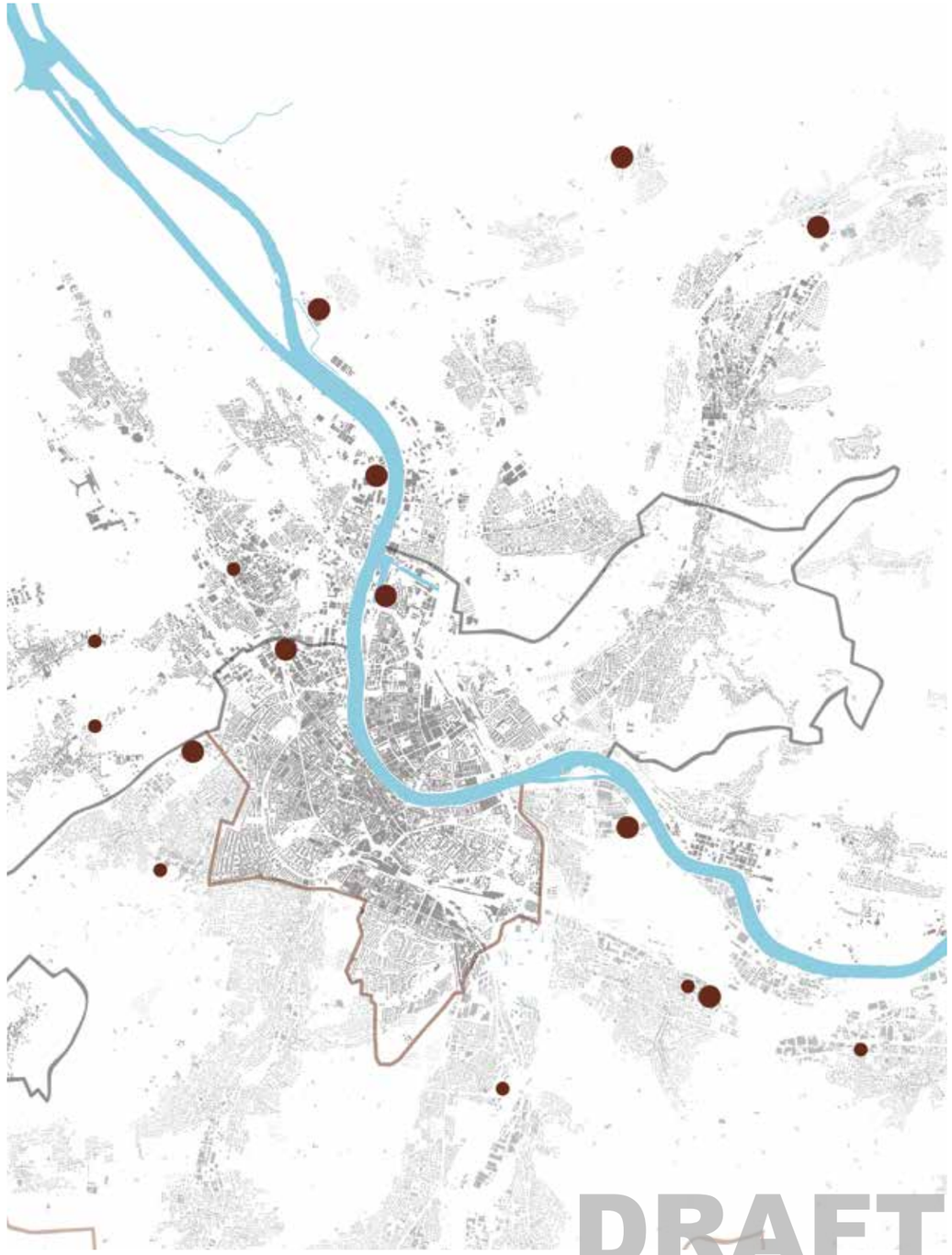

aluminium & cans


tins


plastic wrapping and films

Recycling Stations

Recycling stations are larger recycling facilities where the public can bring recyclable waste and bulky waste for disposal. Waste is sorted by hand, then dispatched to factories for re-processing or to incineration plants if unsuitable for recycling. The recycling stations are usually operated by private companies, such as Lottner AG and Remondis in Basel-Stadt. Recycling parks can be seen as big scale collection points, which later mostly deliver their materials to the recycling stations.



Recycling Parks and Stations in Metro-Basel

SOCIAL DIMENSIONS

having examined the technical aspect of food waste in Metro-Basel, it is important to turn our attention to the core reason why all this food is thrown away in the first place. The key to that lies in the subjective attitudes of people, as well as behaviours that we have taken on as members of a visual, materialist and capitalist society.

Volunteers preparing a Food bank in Matthäuskirche, Basel

CULTURE OF WASTE

There are many factors contributing to the amount of food waste generated at the retail and consumer levels. These can be seen through the lenses of human attitudes and systemic behaviour.

Human attitudes

A lot of food waste is generated as a result of how we behave around food. For example, consumer preferences in food appearance are exploited by supermarkets for greater sales, creating food waste in the process. Upon closer examination, many of these behaviours seem to be illogical and completely unnecessary.

Retail: Supermarkets

Much of the waste at the retail level stems from the need to satisfy consumers' desires and exploit their preferences, so as to encourage them to spend more.

Overstocking
Supermarkets routinely overstock, so as to give an impression of abundance to consumers. The oversupply eventually results in food that is not bought and consumed, which inevitably ends up in the trash.

Trimming
Supermarkets trim food products to satisfy consumer visual taste, for example removing outer leaves from vegetables, even though leaves might already have been removed by the producer or processor before sending it to retail. This results in a great mass of food lost simply to make food look good.

This practice also perversely gives consumers the impression that all food looks perfect, thereby encouraging ridiculous visual standards that have nothing to do with the actual taste or nutritional value of the product.

Consumers

Consumers often fail to plan their food shopping and cooking. These irresponsible buying habits, combined with ignorance about the edibility of older food products generate a lot of food waste.

Bad planning
Lack of or bad planning in shopping and cooking often results in overstocked refrigerators. The extra food becomes stale and is often discarded without being consumed.

Ignorance and fear
Consumer ignorance about the edibility of food compounds the problem of bad planning. Many consumers are unable to tell if old food can still be eaten, and many are unwilling to try for fear of falling ill or dying from eating old food, almost in an irrational way.

Many consumers do not know that most food can still be eaten for a certain period of time after its expiry date. Expiry dates are set by processors before the food actually goes bad.

Systemic behaviour

On a macro level, part of wasteful human behaviour stems from the systems we live in.

Governmental standards on "acceptable food"
Organisations such as the OECD and UN set international standards* on the visual standards of fruits and vegetables, to an extent that is almost absurd. While some concerns are genuine, for example mouldy produce, some are purely cosmetic concerns.

While these guidelines are supposed to be based on mainstream standards of visual quality, they also conversely define consumer taste by limiting the variety of visual quality available. Below are some apples deemed unacceptable.

* International Standards for Fruits and Vegetables (OECD)

Immature apples

Mechanical damage

Severe scab exceeding 1 cm^2

Consumerism and throwaway culture
Since the advent of mechanical mass production in the 20th century, consumers have had an increasing multitude of cheap products to choose from. The low cost of production made it possible for consumers to simply discard old products that they don't want to use anymore. This throwaway attitude carries over to food culture, and is acknowledged in food products like instant meals.

Capitalist economy
In the capitalist economy, goods and services are valued in monetary terms. However it is problematic when food is valued only for its monetary cost, instead of other values such as cultural, culinary and nutritional. Decisions that seem logical according to the free market are in fact absurd when considered in real life. For example, farmers deciding to burn their crops instead of selling them, as the cost of harvesting is higher than the possible income from its sale.

"Tischlein deck dich" collecting food at Howeg AG

Re-Distributing Food Waste

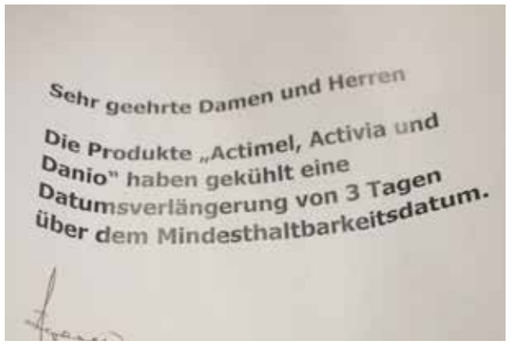
Different organisations in the Metro-Basel are fighting against the "wasteful thinking" attitude regarding food. Consumerist society has led to valuing food based on economic principles, resulting in over-production and therefore food waste. The organisations try to protect food against this "throwaway" culture and deliver it to people in need.
In our case study on "Tischlein deck dich" we observed this system. It is an organisation supported by food retailers and distributers. Their main hub is in Winterthur, Zurich. From there food is transported everyday to Basel and delivered to people in need who have special food stamps.

Main Players in Basel
Basler Tafel (Schweizer Tafel), Pratteln
Tischlein deck dich, Winterthur
Restaurant du Coeur, St. Louis
Die Tafeln, Lörrach
Caritas, Basel

Basel's "Tischlein deck dich" truck collecting the food from Winterthur at Howeg AG just next to the KVA Basel. Howeg is a food distributer and supports the organisation with the transport of 3 t. of food every week from Winterthur to Basel.

Storage facility at Howeg with 400 kg of food from Winterthur. 83 kg of fresh products, 302 yogurts, 100 packets of apple juices, 120 Dr. Pepper soft drinks, 100 corn chips, 480 pear purees, 104 muffins and 100 packages of biscuits.

After exchanging food in Pratteln with Basler Tafel (collects and delivers 3 t. of food every day) the food gets deliverd every Friday to Matthäuskirche, Basel



Most of the food cannot be sold anymore. Therefore it is given to "Tischlein deck dich". Reasons can be: overproduction, expiration, size or new packaging design. Quality of the food is mostly the same as in the store.

Cabbage which is too big to sell in the supermarket is split up into two pieces and given away

All the food got delivered to people with food stamps,

Freegan Movement

Freeganism [noun]
The practice of reclaiming and eating food that has been discarded (also known as „dumpster diving"), as a protest against the waste of food in shops, restaurants, farms, factories and homes. As „anti-consumerists", Freegans often also lead alternative lifestyles that minimise participation in the conventional economy and minimise resource consumption.

Freegans of Villa Rosenau, Basel
Peter and Jane (not real names) are Freegans who live in Villa Rosenau, a housing collective of 10 to 20 members, on the border between Basel-Stadt and Saint-Louis. They dumpster dive as a political statement against waste and the capitalist economy.
Usually they dive in the rubbish containers of supermarkets in the tri-national region of Metro-Basel. Switzerland is preferred, as the two expiry dates (sell-by date and consume-by date) ensure that even discarded Swiss food is fresher than food in German supermarkets.
More than half of their food (which also feeds the rest of the collective) comes from dumpster diving, and about a quarter from organisations like Basler Tafel that redistribute discarded food. They usually do not get sick eating food from rubbish containers, but occasionally get stomach upsets.

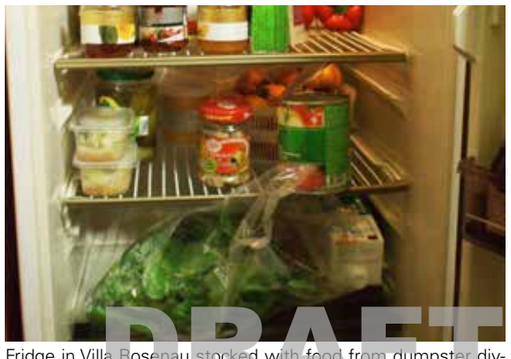

Villa Rosenau, located on the borders next to KVA Basel. Previously an abandoned house with illegal squatting, it now has a 7-year contract with the city.


Dumpster diving begins ideally at 9.10 pm, 10 minutes after the supermarkets close, to avoid competition.


Trash containers in Switzerland are usually locked, and have to be opened with tools, which is illegal.


1/3 of a single „well-stocked" rubbish container can have more than a week's supply of food.


Food is usually brought home on „Long John", a retrofitted bicycle with a space for carrying the cartons.


Fridge in Villa Rosenau stocked with food from dumpster diving and from Basler Tafel.

Food obtained from 30 minutes of dumpster diving in Allschwil on 10. November 2011

Audit of Nutrients

17 BANANAS
17 x 105 cal = 1785 cal
Vitamin C (17%)

42 TANGERINES
42 x 37 cal = 1554 cal
Vitamin C (31%)
Vitamin A (10%)

10 ORANGES
10 x 62 cal = 620 cal
Vitamin C (51%)

20 TOMATOES
20 x 15 cal = 300 cal
Vitamin C (26%)
Vitamin A (20%)

20 CHERRY TOMATOES
20 x 0.8 cal = 16 cal
Vitamin C (15%)
Vitamin A (10%)

2 LEMONS
2 x 17 cal = 34 cal
Vitamin C (51%)

3 LIMES
3 x 20 cal = 60 cal
Vitamin C (32%)

26 GRAPES
2 x 1 cup = 124 cal
Vitamin C (6%)

4 KIWIS
4 x 46 cal = 184 cal
Vitamin C (117%)

6 FIGS
6 x 46 cal = 184 cal
Dietary fibre (7%)

2 CAULIFLOWERS
2 x 25 cal = 50 cal
Dietary fibre (10%)
Vitamin C (77%)

25 WHITE MUSHROOMS
25 x 4 cal = 100 cal
Dietary fibre (4%)

4 SUGAR BEETS
4 x 35 cal = 140 cal
Dietary fibre (9%)
Vitamin C (7%)

4 PAPRIKA
4 x 15 cal = 60 cal
Dietary fibre (5%)
Vitamin C (99%)

2 BOTTLES CHAMPAGNE
2 x 182 cal = 364 cal

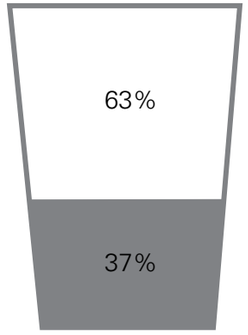
TOTAL: 5575 calories

Recommended daily intake of calories: 2000-2600 cal
Mainly fruits and vegetables represented here, without foods rich in carbohydrates.

Rheinboard, Basel

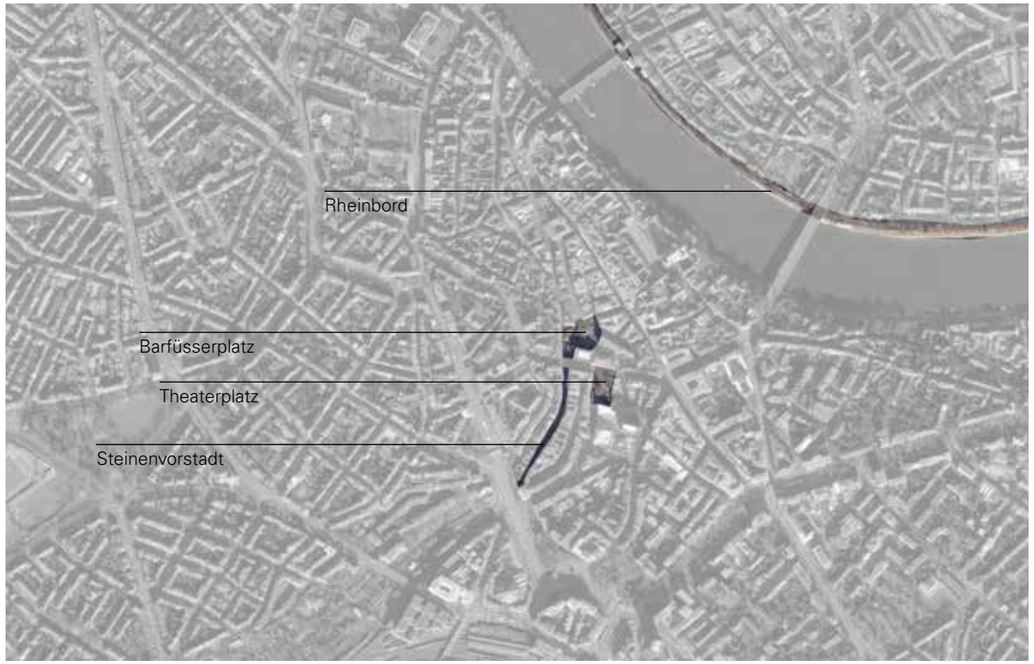
Littering in Basel

In 2003, the University of Basel conducted an investigation into 4 public spaces, and the total amount of waste accumulated over 12 hours. It revealed the bad habit of simply leaving waste on streets, squares and parks, although disposal options were readily available in the vicinity, such as trash cans. Of the surveyed sites, the deepest, most “inner-city” picnicking areas showed the highest rate of littering.

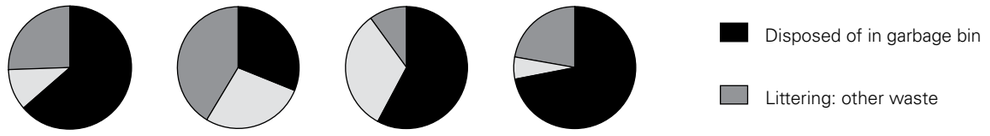


capacity useage of garbage bins in Basel

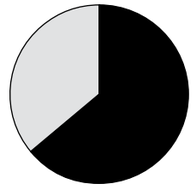
source: University of Basel, 2005



Mapof investigated public spaces



source: University of Basel, 2005



average amount in swiss public garbage bins

source: University of Basel, 2005

(IN)VISIBILITY OF FOOD WASTE

In Metro-basel, as is in many parts of the developed world, the removal, processing and disposal of waste has become an almost unseen process, despite the integral role it plays in the day-to-day functioning of the city. In Basel, the most visible landmark of waste, the KVA Basel, is often mistaken to be part of Novartis, and completely unconnected to waste in the minds of people.

CONCLUSION

How much food waste does Metro-Basel produce? Over the course of our investigation into the food waste of the region, we did not encounter any solid numbers or statistics on how much food waste is produced in the region. In our interviews with different parties, speculated numbers varied quite widely:

Martin Lüchinger, Office of Envir. and Energy:
Not a lot of food is wasted

Barbara Schuhmacher, Linie-E at KVA Basel:
About 15% of incinerated food waste is packaged edible food

Rosemarie Benzinger, Basler Tafel:
About 50% of food is wasted.

It is true that food waste as a phenomenon is very difficult to trace. It spans across all consumed food types, in every location inhabited by people, and at all levels from agriculture to consumption to disposal. Empirically, perhaps the only way to estimate food waste is to compare the amount of purchased calories to the amount actually consumed – data that is very difficult to collect. This might explain why there are virtually no statistics or even in-depth studies of food waste.

Or perhaps we just don‘t like to discuss food waste. It is

a shameful topic; we are all aware that a lot of resources go into the production of food, and we are also aware that many people suffer from hunger and malnutrition. Consequently we are reluctant to admit that we – those with the financial ability and power to easily obtain food – throw it away so freely.

While investigating this topic, we encountered great reluctance to discuss food waste. People become defensive when it is suggested that they waste food. Supermarkets decline to be interviewed. Restaurants insist that no food waste is produced. Do we really not know how much food is wasted, or do we just not want to talk about it?

This reluctant attitude to confront our food waste is evident in how we treat it, which can be summarised as „out of sight, out of mind“. Great pains are taken to ensure that waste is swiftly and efficiently whisked out of sight from the city. It is brought to an incineration plant on the margins of the city, which happens to resemble the pharmaceutical plants of Novartis located in the same area. Eventually toxic by-products from incineration are transported far away to landfills located in the middle of rural landscapes, completely invisible to the city.

The process of food waste management, while not completely opaque, has a low degree of transparency. The removal and processing of food waste is a daily process

integral to the functioning of the city, yet few people see it. Our perception of the city and its functions is not congruent to the way it really functions; there is an entire landscape that we are not aware of.

This impacts the way we understand and treat food waste. When a person has to live next to his own waste dump, he is immediately affected by the odours and pollution that are consequences of his waste production. However when he simply has it disappear from his doorstep for a small fee every week without knowing where it goes, he will not be inclined to produce less waste, because he simply does not understand the scale of the problem involved.

In a way, this is not just a topic about food waste, but part of the ongoing discussion of how technology – in this case waste management technology – changes the way we perceive and act in the city. In rendering our waste more invisible, perhaps we are implicitly encouraging people to waste more.