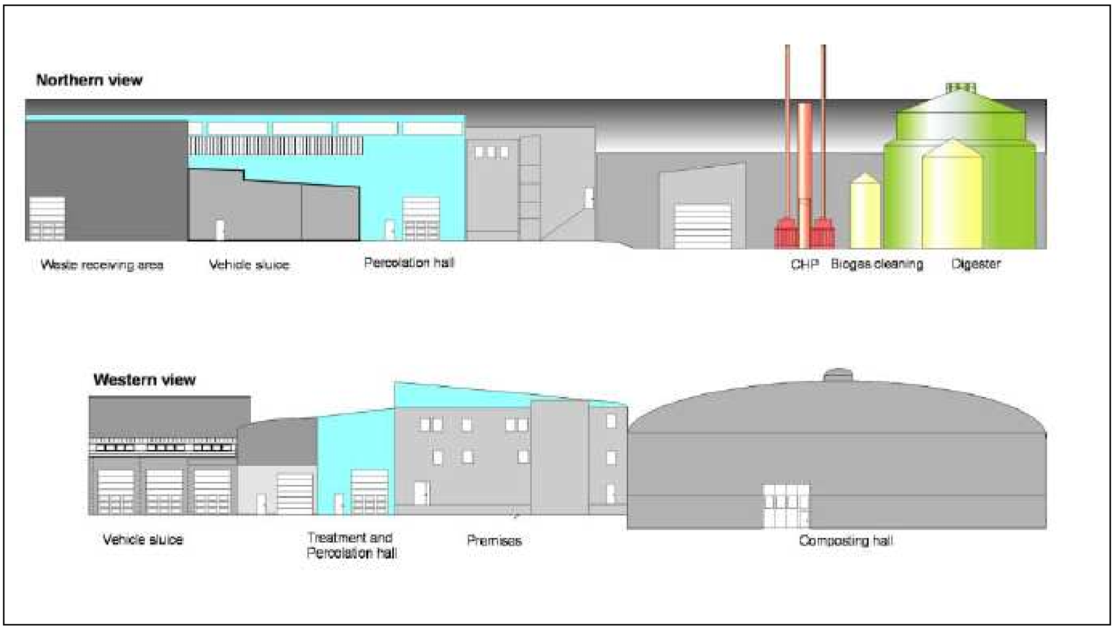
Heilbronn (U-Plus UmweltService AG) MBT Plant



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Part funded by

CASE STUDY – CENTALLY SEGREGATED BIOWASTES

Heilbronn (U-Plus UmweltService AG) MBT Plant

INTRODUCTION

The Heilbronn MBT plant was built by ISKA GmbH. ISKA GmbH is a subsidiary of U-Plus UmweltService AG, which is one of the biggest waste disposal companies in Germany. The plant is also owned and operated by U-Plus UmweltService AG who have the long term contract to treat municipal residual wastes in the area. Plant capacity is 88,000 tpa, and currently around 80,000 tpa is accepted. The plant processes the residual waste from approximately 625,000 inhabitants in the city of Heilbronn and 2 surrounding rural districts. As with Buchen, Heilbronn is situated in the Bad Wurttemburg region of Germany where kitchen waste is not source separated, and the Heilbronn site treated approximately 80,000 tpa of the residual waste stream that also contained kitchen waste. Construction was started in March 2004 and the plant was started up in June 2005. The ISKA procedure can be flexibly engineered to meet client requirements, and the modular nature of the system facilitates this. This can be demonstrated by comparing the different scales and layouts and costs of the plants at Heilbronn and Buchen. The Heilbronn site has 2 percolation lines, with the rest of the plant designed around these. The Heilbronn plant was built to a smaller scale than the Buchen plant, with much less space available. As such the process is very space efficient. The capital costs were significantly higher than the Buchen plant, per tonne of waste throughput (€338/tonne at Heilbronn compared with €278/tonne at Buchen). Figure 1 represents an aerial view of the site during construction. Strict local conditions were an important factor in the decision to build an ISKA plant. The site is only metres away from an important regional river, and all tanks needed to be ‘double-hulled’ as an extra safety measure before planning was approved. This added to the costs of the project as described below. The stabilised end product is disposed of on an external landfill. Seven employees (per shift) are required to run the plant, which works on 2 shifts, for 6 days per week. At the time of the visit the Heilbronn plant was operating at 130% of designed capacity, to clear a backlog of wastes.

As can be seen in Figure 1 the Heilbronn plant was built in a small site, in an industrial area. Visual impact was not an issue given the industrial surroundings, particularly the cooling tower in the background. The blue cylinders are the percolators, around which the system was built. The construction area immediately to the left of the percolators is the composting hall, and immediately to the right (where the crane is) is the area where the waste reception area and mechanical treatment phases were built. The total area used was 20,000 m^2, of which 8,400 m^2 is taken up by buildings, and 5,400 m^2 of which is taken up by the composting hall (ISKA Promotional Information). This corresponds to an area of 4.4 tonnes of waste treated per m^2 of land, or 0.227 m^2 per tonne of waste processed if the plant was operating at its full capacity.

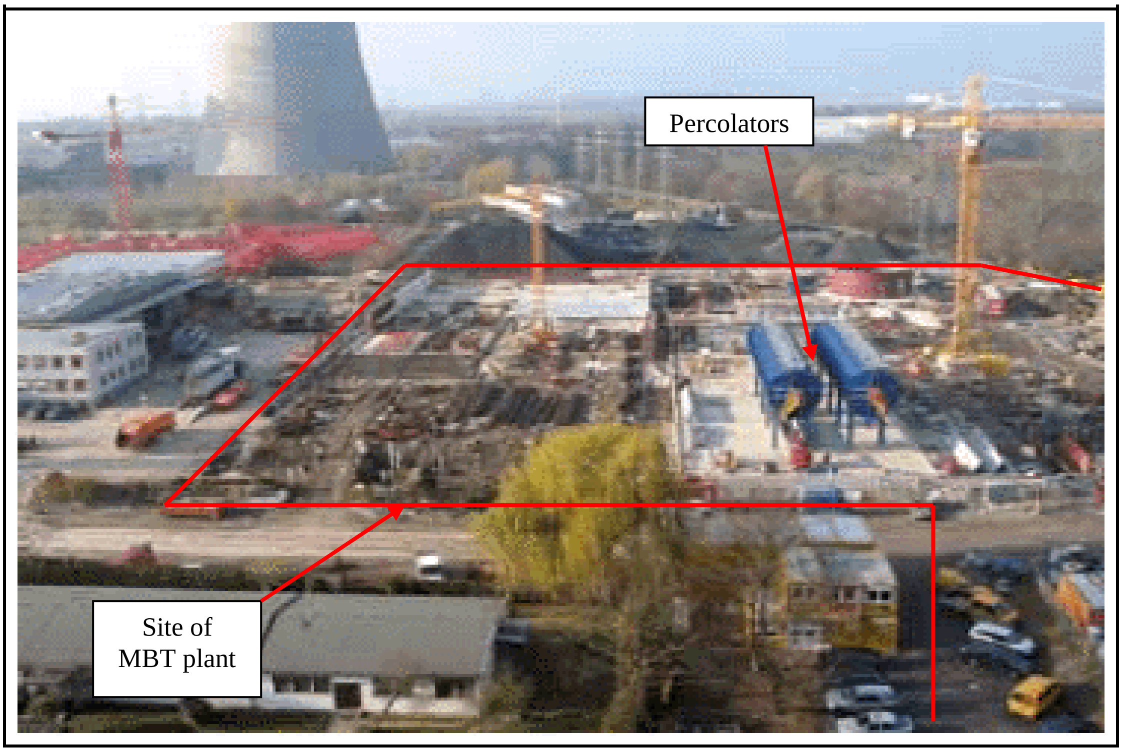

Figure 1 Aerial photograph of Heilbronn Site in construction phase (Environmental Expert website [b], accessed June 2006)

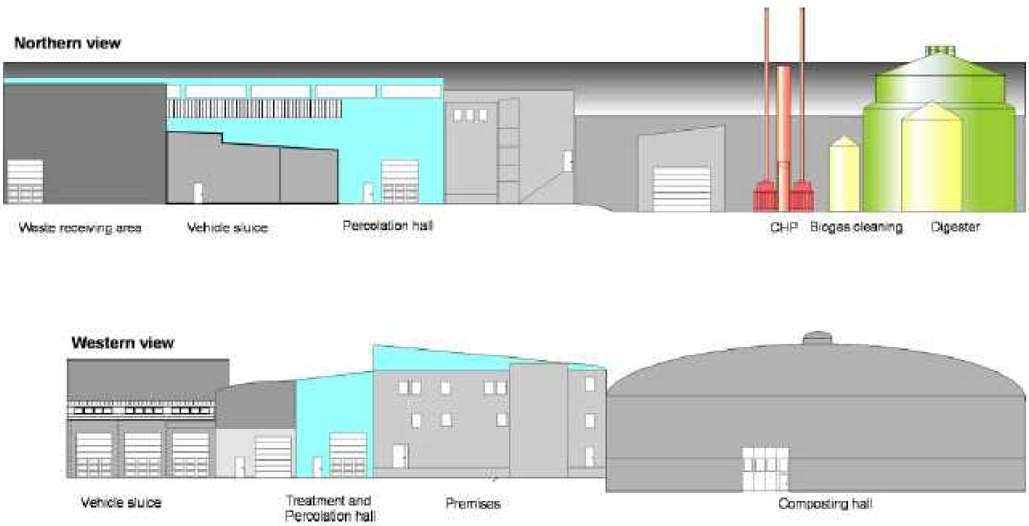

Figure 2 Planned layout at Heilbronn (ISKA Promotional Information)

Other than scale and layout, the Heilbronn system is technically identical to the Buchen system. See the Buchen case study for a technical process description and discussion. The process flow diagram is the same as the process at Buchen, and is shown in Figure 3.

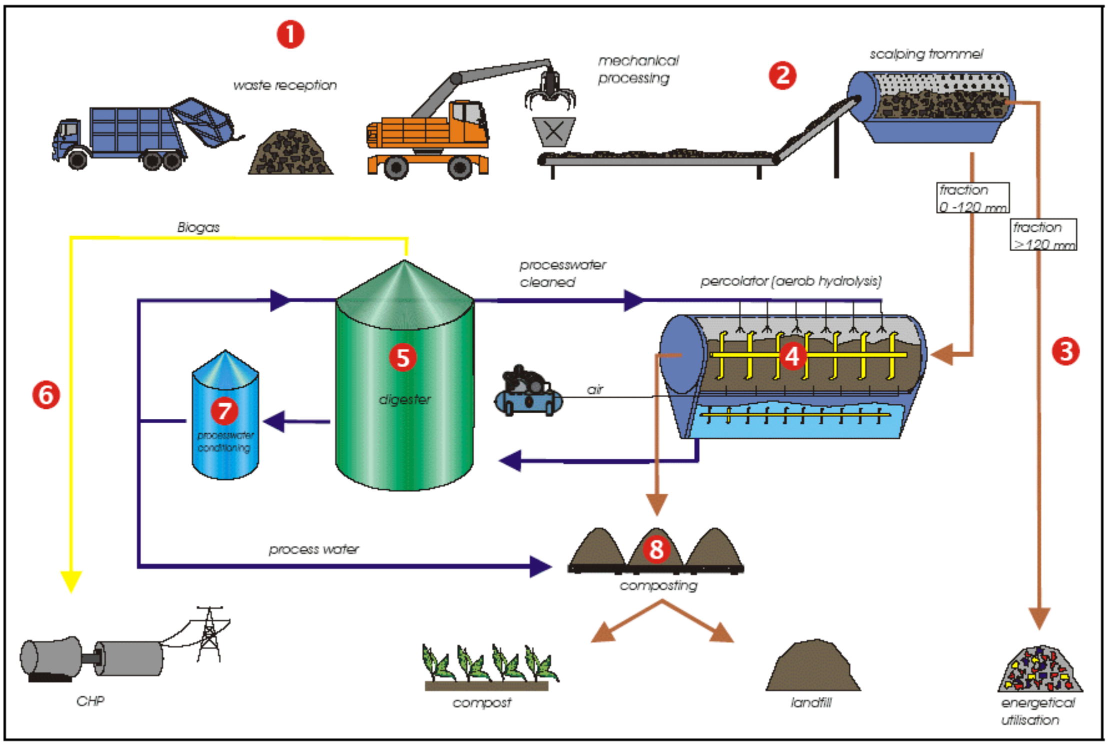

Figure 3 Process flow diagram of Heilbronn MBT Plant (Environmental Expert website [a], accessed February 2006)

Note
This diagram is slightly inaccurate, as all of the CLO goes to landfill.

PRE-TREATMENT

After the weighbridge, lorries reverse into one of the three bays (one open, two behind skips in Figure 4), and empty their loads into the covered wastes reception area. In the top left of Figure 4 is a rain water storage tank. Immediately to the right of the waste reception bays is the mechanical separation hall, while the taller building immediately to the right of this is the composting hall.

In the covered reception area, waste is picked by a crane (Figure 5) and put into a hopper falling into a slow speed shredder. From the slow speed shredder the waste is automatically moved by conveyor to the mechanical separation stages (Figure 6), which commence with the trommel sieves (Figure 7).

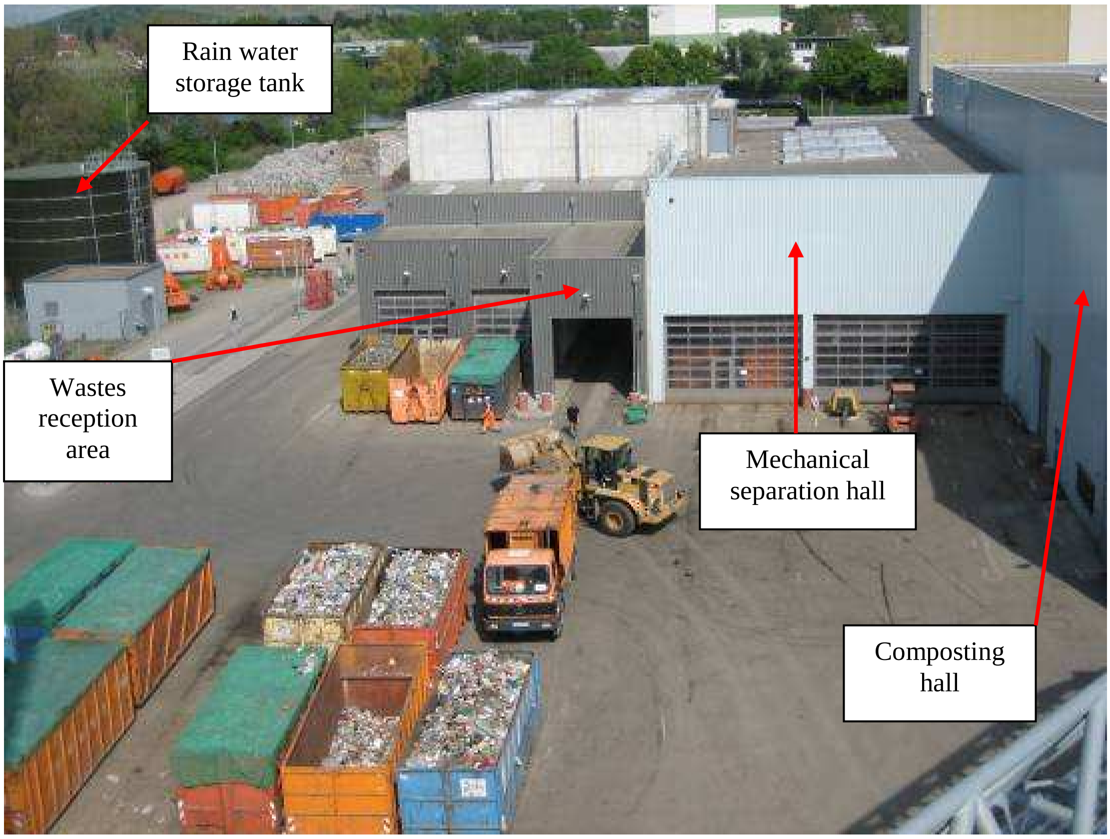

Figure 4 Wastes reception area (outdoors) at Heilbronn

Figure 5 Wastes reception area (indoors) at Heilbronn

Figure 6 Mechanical separation stages at Heilbronn

Figure 7 Inside trommel sieve at Heilbronn

As with the trommel screen at Buchen, oversize materials are sent via conveyor to be baled and transported to an incinerator. Undersize materials are passed via conveyor to the percolators, which are shown in Figure 8.

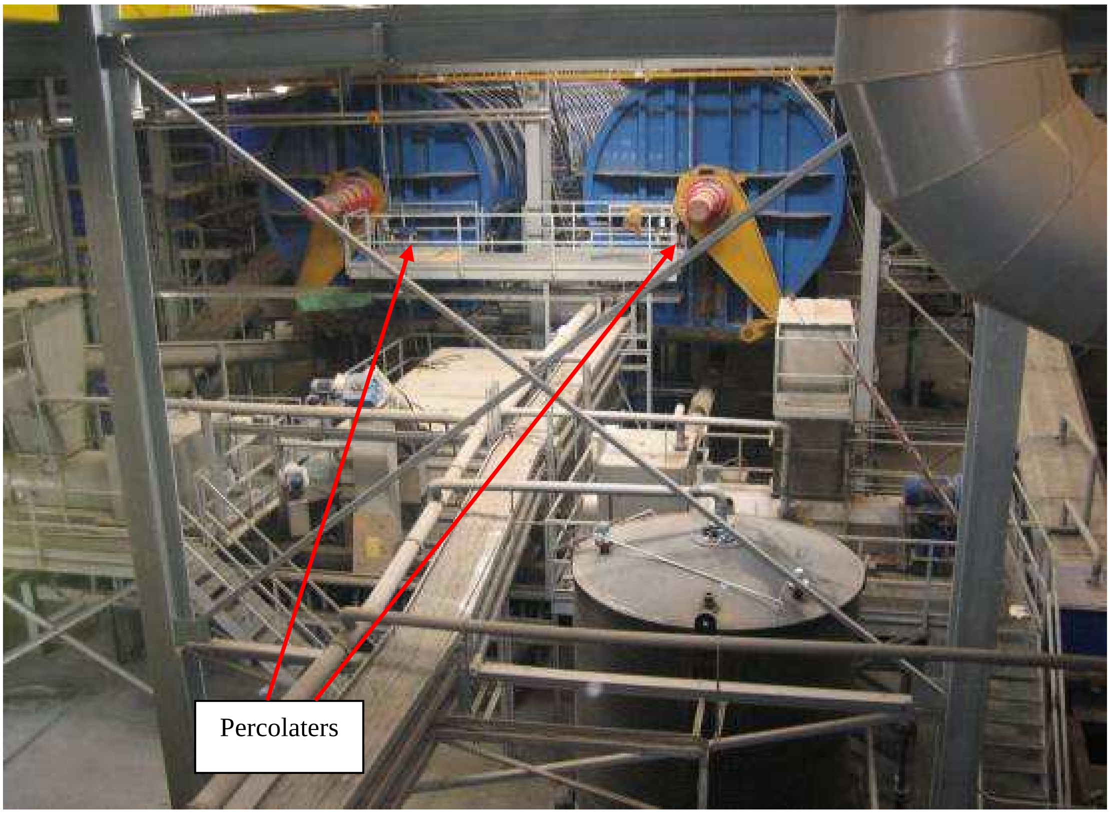

Figure 8 Percolators at Heilbronn

Material moves through the percolator by means of a rake in the base. A screw conveyor discharges the material and it is pressed. After percolation, the percolator liquor is de-gritted and de-watered the solid phase is sent to an in-vessel composting stage, and the liquid phase, containing 2% TS sent for anaerobic digestion.

ANAEROBIC DIGESTER

The anaerobic digester (Figure 9) is designed and operated in the same fashion as those at Buchen. As with the Buchen plant digestion is mesophilic (35 – 40^{o}C). Testing carried out before construction indicated that for this substrate in these hybrid filter reactors, mesophilic digestion was energetically favourable to thermophilic digestion, as any extra biogas production was not sufficient to provide the extra heat required. More details are available in the Buchen case study.

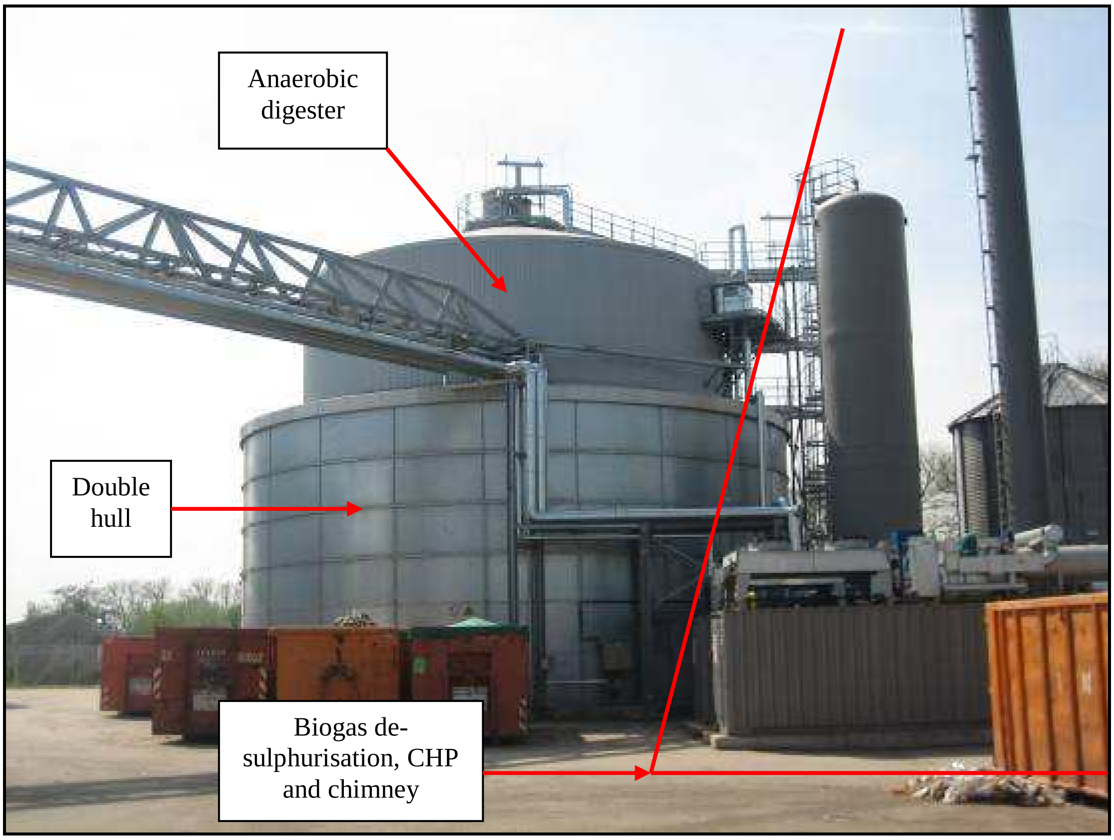

Figure 9 Anaerobic digester at Heilbronn

Note the 'double-hull' on the digester, which it was necessary to add as an extra safety measure before planning was approved. The double hull significantly increased the capital outlay.

POST AD TREATMENT AND DIGESTATE

After passing though the percolators, AD or IVC processes, the solid biostabilised output is loaded on to trucks (at the point shown in Figure 10) and transported to the landfill site, approximately 6 km away.

Figure 10 CLO/biostabilat loading bay at Heilbronn

BIOGAS UTILISATION AND ENERGY PRODUCTION

Approximately 4,000,000 m^3 of biogas is produced per year, which amounts to 50 m^3/tonne of residual waste entering the plant, or approximately 100 m^3 per tonne of organic waste entering the anaerobic digester (only percolator liquor is anaerobically digested). Roughly, the yield from a percolation system accounts for about 70 – 80% of methane produced using other methods with similar feedstocks (Vandevivere *et al.*, 2003). The Heilbronn site is a net user of energy. No energy balance for the system was given. The low level grey structure to the bottom right of the digester (Figure 9) is the CHP unit. The gas storage vessel, biogas de-sulphurisation unit and CHP stack chimney can also be seen to the right of the digester. The overhead piping coming from the CHP unit towards the left of the picture is the exhaust gases from the CHP unit to the regenerative thermal oxidation process. As at Buchen, the gas collection, upgrading, piping and use are all sub-contracted to the same company. In this case the sub-contactor is Pro2 AnlagenTechnik GmbH (Willich, Germany, www.pro-2.net).

EXHAUST GAS TREATMENT

Exhaust gases are treated by thermal oxidation. As at Buchen this represents a major cost and use of heat and electricity.

COSTS AND ECONOMICS

The capital cost of the whole MBT plant was approximately €27 million. The landfill site is owned by the region, and ISKA currently pay €53/tonne to dispose of their biostabilised output. Payback time was estimated at 15 years, at current prices, but increased gate fees would reduce this, and increased landfill charges would increase it. The cost of the project was increased slightly due to the limited space available, and severely due to the proximity of the site to a river. The site also suffers significantly (as compared to the Buchen site) in terms of extra costs due to its smaller throughput (€338/tonne compared to €278/tonne in terms of capital costs). Operating costs were estimated at €35 – 55/tonne (including finance), as at Buchen, approximately half was spent on exhaust air treatment (Kutterer, Personal Communication, 2006). Exhaust air treatment legislation in Germany is particularly stringent, and in the UK this would not represent such an expense. As mentioned in the Buchen case study, the incinerator is also owned by ISKA.

MASS BALANCE

The mass balance for the system is identical to that at Buchen, due to the processes treating the same wastes in the same area with the same process. The mass balance is shown in Figure 11.

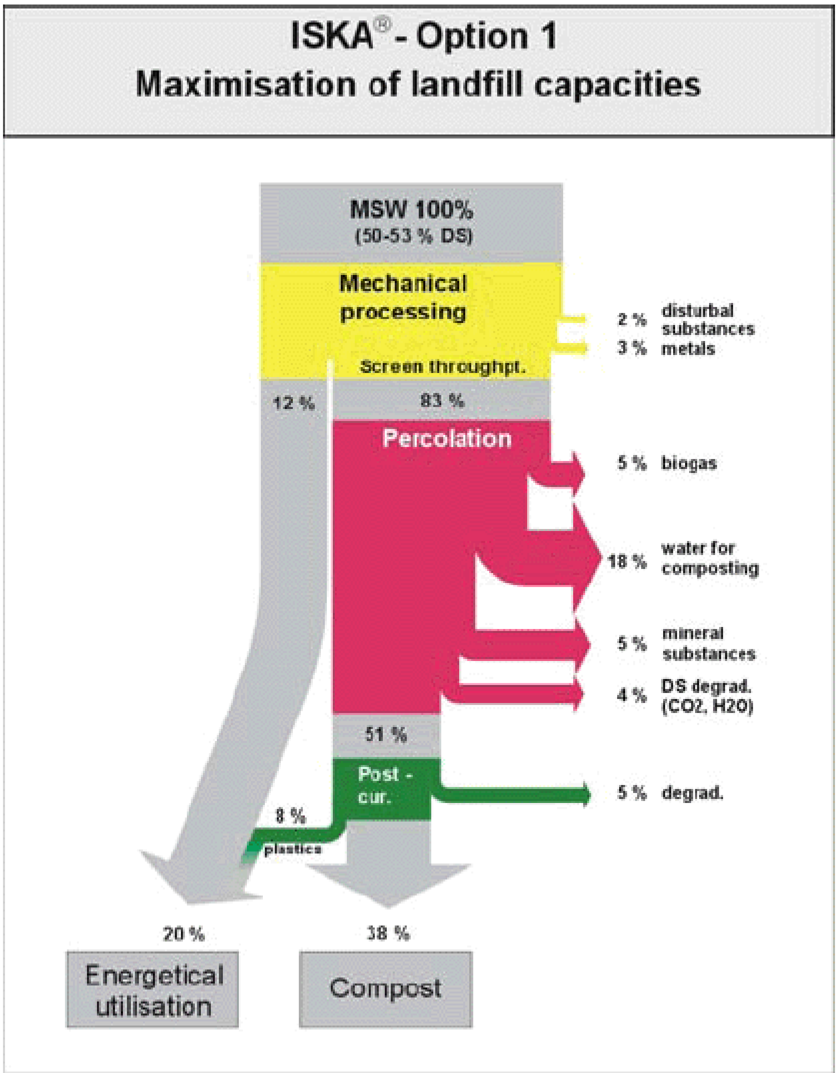

Figure 11 Mass balance of ISKA process (Environmental Expert website [b], accessed June 2006)

It can be seen that the process diverts 60% of the incoming residual waste from landfill under normal circumstances. In the mass balance above, the pink section labelled 'Percolation' incorporates both percolation and anaerobic digestion. It can be seen that 5% of the incoming residual waste (by mass) is converted to biogas.

VISUAL AND LOCAL IMPACT

The plant was sited in an industrial area, beside heavy industry including a scrap-yard, and a power station. The highest point on the plant is the CHP chimney, but as can be seen in Figure 12 the whole plant was dwarfed by a nearby power station.

Figure 12 ISKA Plant at Heilbronn (power station in background)

As at Buchen, odour and dust/particulates inside the plant were noticeable, indicating that perhaps the odour extraction/fresh air re-circulation system was not ideal. It should be pointed out that dust/particulates should be expected given the nature of the plant and the waste it is processing. The odour inside the plant buildings was strong at Heilbronn, where due to the space limitations the composting hall is joined on to the mechanical separation stages. Aside from the high dust levels, housekeeping was very good, despite the site operating above capacity to catch up a backlog that had developed. Again, as with Buchen, there was no noticeable odour outside the buildings, indicating that the thermal oxidation exhaust gas treatment system was working well. The plant was not particularly noisy, and its industrial location meant that even if it were, noise would not have been a problem.

CHALLENGES, DISCUSSION AND CONCLUSIONS

From a wastes treatment and recovery perspective the ISKA system at the Heilbronn MBT plant ideally fits local requirements. In terms of cost/throughput, it would have been more economic at a larger scale (such as Buchen), but this was not necessary. In terms of throughput for the space available Heilbronn compares well with other MBT configurations, mainly because of the small area required for such a high throughput. This is possible mainly because percolation system reduces the residence time in both the AD and composting phases.

Energetically, the plant is not as favourable as some other configurations. For example not all of the organics are treated anaerobically, therefore potential biogas is lost, and secondly the percolation systems require hot water and aeration. It must be mentioned that although the percolation systems require energy input, they are heated by waste heat produced on-site, so the whole site is usually roughly energy neutral (excluding energy from incineration of extracted RDF). The thermal oxidation of exhaust gases is also energy intensive. With regards to water use and wastewater production, the system is well planned and engineered.

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