Proposal for Sorting of Waste

Project EXPARK, Kuala Lumpur, Malaysia

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The aim of the sorting is to obtain a uniformly fuel according to the firing diagram.

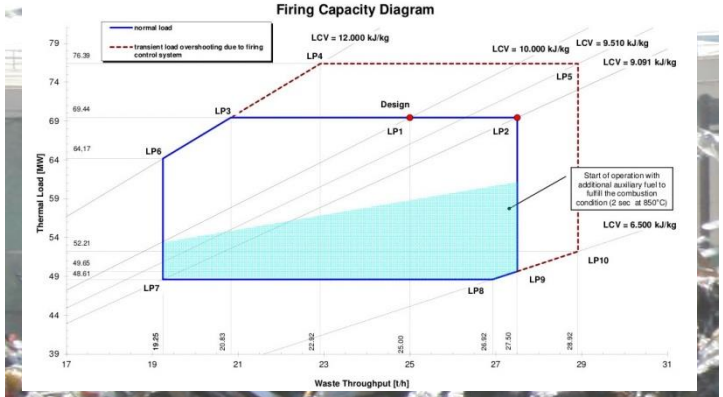
The part of waste with the highest water content is undoubted the organic part, like kitchen waste, food leftovers, fruit and vegetable residuals which has usually more than 85 % humidity.

Usually the organic fraction in MSW is also the largest part of weight.

Getting a fuel which is uniformly as most as possible the water must be removed but also not burnable impurities e.g. like glass, stones (pottery), metals and other trashes shall be separated.

According to the given specification for the project "……..", the daily input of (non-sorted) MSW shall be 800 tons.

The daily working time for a sorting facility is specified as 12 hours per day (2 shifts).



Waste sorting could be made automatically or in manually way by hand

Unfortunately there is no waste specification regarding their composition available.

Hence we have calculated a „waste model“ based on literature sources and study results in Germany.

The waste composition shown in the tables below is typical for middle size cities in central Europe.

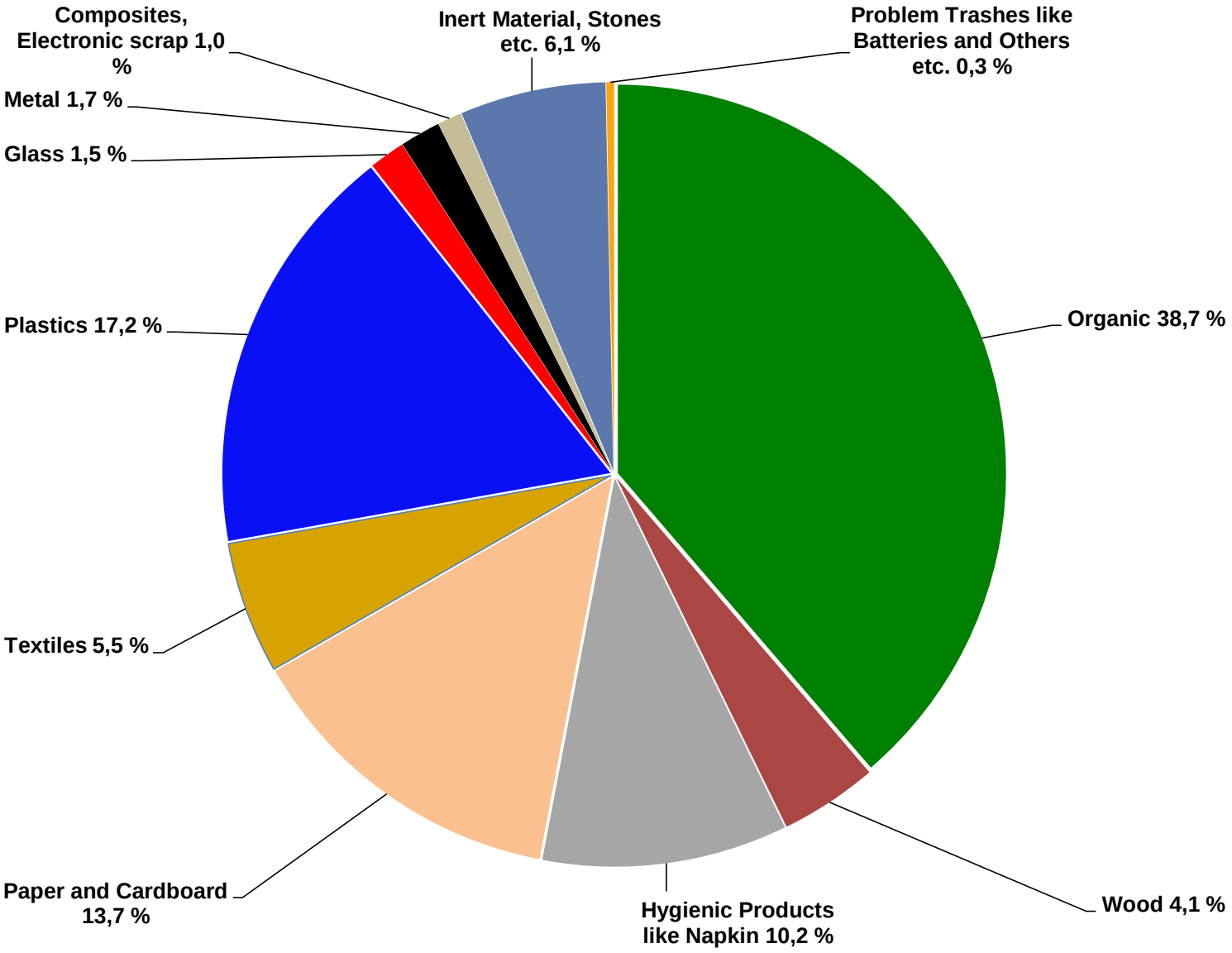
Please note the displayed waste fractions and it shares as well as the estimated humidity of each fraction is an estimation to enable a realistic calculation of a sorting plant.

The original waste in ……. may be different to German waste in its composition but also the waste may be different depending on season and collecting areas.

But the waste must be rich enough in combustible parts with an suitable energy content complying the requirements of the power plant performance (see firing diagram).

Typical composition of Waste (Model 800 t/d):

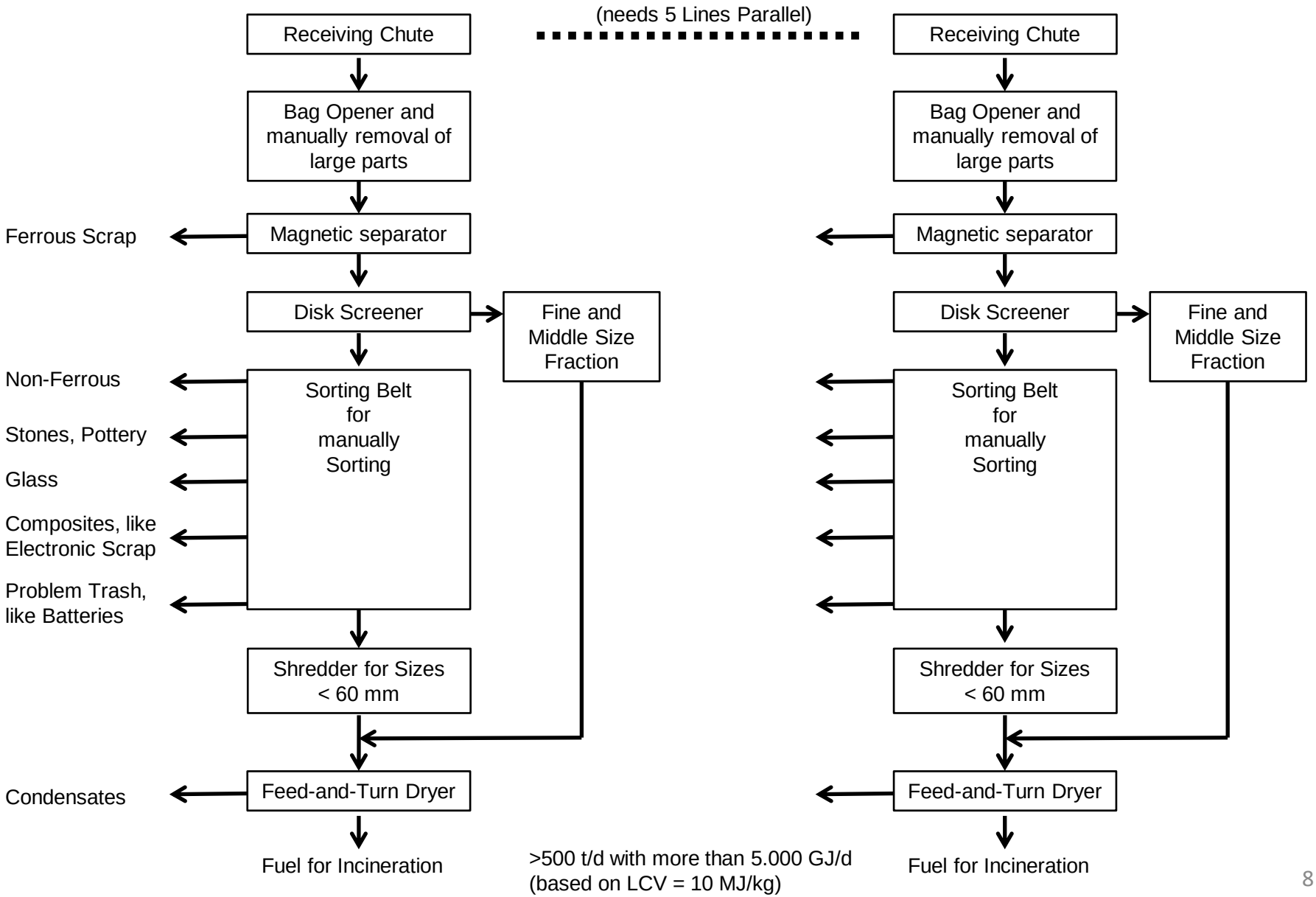
- Organic Waste (wet)	310 t/d	ca. 15 % solid	ca. 85 % humid
- Wood Waste	32 t/d	ca. 80 % solid	ca. 20 % humid
- Hygienic Products, like Napkins etc.	82 t/d	ca. 50 % solid	ca. 50 % humid
- Paper and Cardboards	110 t/d	ca. 95 % solid	ca. 5 % humid
- Textiles	44 t/d	ca. 90 % solid	ca. 10 % humid
- Plastic Waste	138 t/d	ca. 99 % solid	ca. 1 % humid
- Glass	12 t/d	100 % solid	0 % humid
- Metal	13 t/d	100 % solid	0 % humid
- Composites, Electronic Scrap	8 t/d	100 % solid	0 % humid
- Inert Material, Sand, Ash, Stones Stones, Pottery and Tableware	49 t/d	ca. 75 % solid	ca. 25 % humid
- Problem Trashes like Batteries and others	2 t/d	100 % solid	0 % humid
Sum (average solid/humid)	800 t/d	ca. 58 % solid	ca. 42 % humid


Composites, Electronic scrap 1,0 %
Inert Material, Stones etc. 6,1 %
Problem Trashes like Batteries and Others etc. 0,3 %
Metal 1,7 %
Glass 1,5 %
Plastics 17,2 %
Organic 38,7 %
Textiles 5,5 %
Paper and Cardboard 13,7 %
Hygienic Products like Napkin 10,2 %
Wood 4,1 %

We propose manually sorting, why?

- **The Investment costs are much lower than for an automatically sorting facility**
- **Low in operational costs and easy in maintenance.**
- **Better plant availability than for automatically sorting devices.**
- **Much better sorting quality by hand than by machines.**
- **Easy to pick out valuable Material like PET bottles without more investment and without changing machinery.**
- **Not at least the social aspect:**
  - **Up to 80 new jobs could be created.**
  - **For lower qualified peoples.**
  - **Accordingly many families get income and get more quality of life**

For 800 t/d MSW; working time 12 h/d



Mass balance of sorting:

- Waste Mixture as shown on page 5	800 t/d	ca. 58 % solid	ca. 42 % humid
<u>Less noncombustible impurities</u>:			
- Glass	- 12 t/d	100 % solid	0 % humid
- Metal	- 13 t/d	100 % solid	0 % humid
- Composites, Electronic Scrap	- 8 t/d	100 % solid	0 % humid
- Problem Trashes like Batteries	- 2 t/d	100 % solid	0 % humid
- Large Inert Material like Stones, Pottery Tableware etc.	- 15 t/d	100 % solid	0 % humid
Remaining wet Fuel:	750 t/d	61 % solid	39 % humid
<u>Less Water</u> (evaporated by dryer):	246 t/d	0 % solid	100 % humid
Available dry fuel material	504 t/d	80 % solid	20 % humid

Main parts of sorting plant:

<u>Receiving chute</u> or receiving hopper.

Could be made as free standing bunker filled by wheel loader,

or embedded into floor for filling directly by delivery trucks.

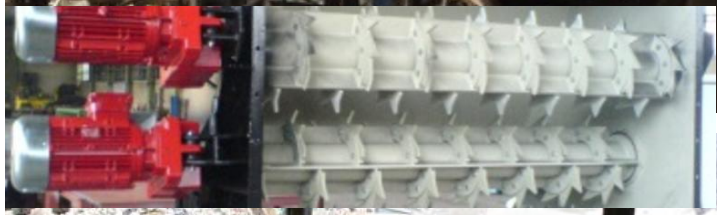
The function is the steady dispensing of waste to the sorting belts.

<u>Bag opening</u> and pre sorting.

The waste bags could be opened by using automatic devices as part of the hopper but also manually with hand tools.

Workers would remove large parts on this place before it could disturb the following line.

(It is unbelievably but from time to time also children bikes are found in household waste).



Magnetic Separator and Disc Screen.

On this place ferrous metals are removed automatically.

Also the fine and middle size waste fraction will be removed automatically on this place.

Sorting Belt.

For manually sorting are several picking places along the band. Usually the belt with of sorting belts are 1.2 m maximum. The belt speed shall be 1 - 2 m/s.

This means picking must be made from two sides. Each picker picks only one kind of waste out. For example one pair of sorter is responsible for taking out glass, another pair picks out only electronic scrap, etc.

The sorting belt is arranged on a bridge and under each sorting place is a box in which the workers drop the removed parts.

Depending on the quantity there could be placed containers or the material is stored as bulk and removed by front loader.

Shredding and Drying.

On the end of each sorting line a shredding unit is placed in which the sorted waste will be cut into pieces of < 60 mm. This is requested by the following drying process.

Because of the very inhomogeneous material we recommend the use of feed-and-turn dryer technology.

With the dryer the fuel will be dehydrated as well as the material has the required LCV.

The sorting plant could be installed into simple industrial hall.

Occupational Safety and Healthcare

Already by designing such a manually sorting plant but especially by operating of the plant some rules must be taken into account:

- **The working area on the picking places must be well aerated and the waste air has to be sucked off.**
- **That's a technical simple solution. Either at the side of the sorting bands or over them specific suction channels shall be installed.**
- **The workers have to wear suitable gloves and apron, protective goggles, face mask, closed shoes, and other suitable Personal Protective Equipment.**
- **Workers shall not eat, drink or smoke in working areas. The plant must provide suitable rest areas.**
- **The disposal chutes, the disc screener but also the feed chute of shredder must be secured against fall in.**

Average cost estimation

The sorting plant with all required operation and social rooms could be installed into a simple industrial hall. We estimate that at least 5 parallel sorting belt lines must be installed in order to sorting the daily waste input of 800 tons within 12 hours per day. The following indicated investment costs are understood with +/- 20 % tolerance.

Per Sorting Line:

- Receiving chute with dosing belt	ca. 90 T€		
- Pre-sorting band with bag opening	ca. 40 T€		
- Magnetic separator	ca. 50 T€		
- Disc-Screener	ca. 100 T€		
- Sorting Belt (ca. 16 – 18 m long)	ca. 50 T€		
- Cutter/Shredder	ca. 90 T€		
- Dryer	ca. 250 T€		
- Specific steel construction	ca. 50 T€		
- Other conveyors equipment	ca. 40 T€		
	ca. 760 T€	x 5 Lines =	ca. 3,800 T€
General steel construction, and installations			ca. 1,200 T€
Air conditioning, condensation of exhaust air from dryers etc.			ca. 500 T€
Building (ca. 60 m long x 30 m with x 20 m height)			ca. 2,500 T€
			ca. 8,000 T€

We estimate investment costs of ca. 8.0 Mio. EURO respectively 9.0 Mio US$