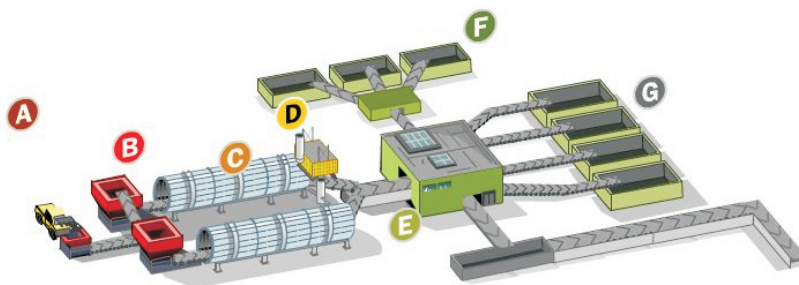




## WASTE TO ETHANOL PLANT

The proposed WWP/ET waste to ethanol facility is capable to recycle 120 tons of Municipal Solid Waste (MSW) per day. The waste is sorted into its main components – metals, plastics and glass for resale locally. The organic element or, so called biomass (including cellulose – paper and carton), is converted into bio-ethanol.



### Technological Process

The plant receives municipal waste from pavement waste collection vehicles. Then it is sorted to separate bio-mass and valuable materials that can be sold for recycling. Ethanol production consists of two main elements:

#### 1. Biomass preparation



The process of recycling solid waste into sanitised biomass is a unique patented technology to produce biomass from solid waste generated by households.

Prepared clean biomass from sorting plant is fed into shredders and then into the VVPs. These spin continuously at 60 revolutions an hour, high pressure steam is injected into the machine at 10 bar and at a temperature of 160°C, thus sanitising and reducing the volume of the biomass by up to 60%. As proven, use of VVPs increase the final production volume of bioethanol by 25%.

## 2. Production of Bio-Ethanol:

Acid hydrolysis is used to break down the solid feedstock into sugars (cellulose and hemicellulose contained within the biomass). This produces a sugar rich, acidic liquid. This liquid is treated with lime to neutralise the acid and is then filtered. The filtered sugar solution is pumped to a fermentation vessel. Yeast is added and fermentation begins. The fermentation process emits carbon dioxide as a by-product.



Once fermentation is complete, the liquid is filtered and the yeast is removed. Some of the yeast is recycled and excess will be used as a fuel. Distillation of the liquid concentrates the mixture taking it from a 10% ethanol solution to around 98%.

Residue - Lignin is sold as fuel for heat/power plants.

Bio-ethanol as additive to petrol is traded very intensively. Prices of the actual trades generally are based on PLATTS weekly market scan pricing data. Bio-ethanol in Northern Europe currently trades at about \$1250.

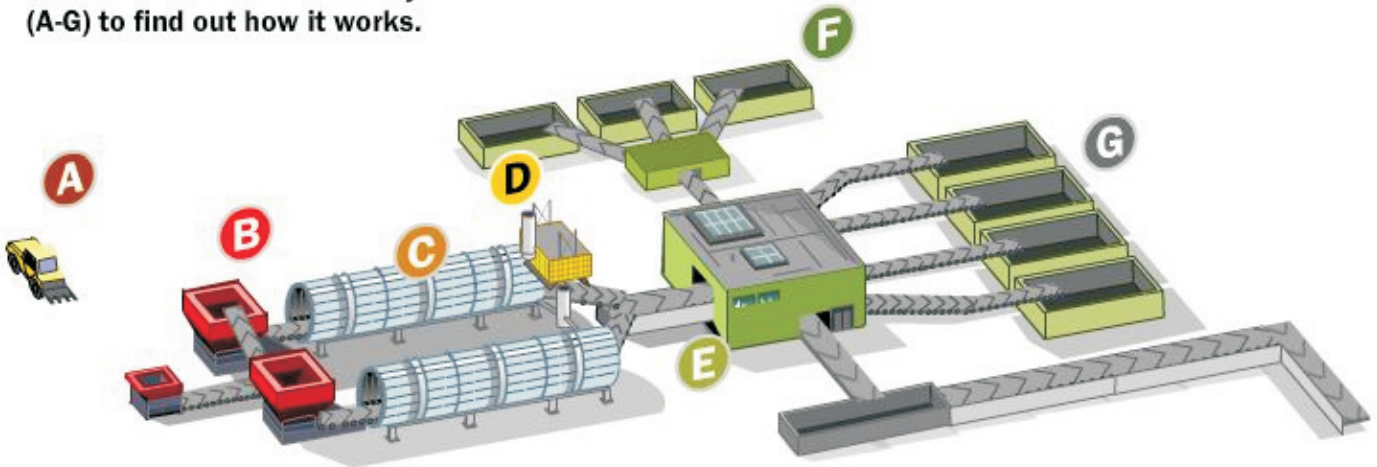
Recyclables materials sorted from municipal solid waste are metals, plastics and glass, technological process of ethanol production additionally produces synthetic gypsum (sold to cement or dry mixtures producers), CO<sub>2</sub> and lignin.

The waste sorting and bio-ethanol plant can be situated on about 5000 sqm land plot where 1600 sqm are under roof. The plant will employ 16 people.

Electricity connection with 750 KWh is needed. Capacity and water/sewage supply with capacity 35000 cbm per year is needed.

## Overview of the facility

Choose an area of the facility (A-G) to find out how it works.



### KEY

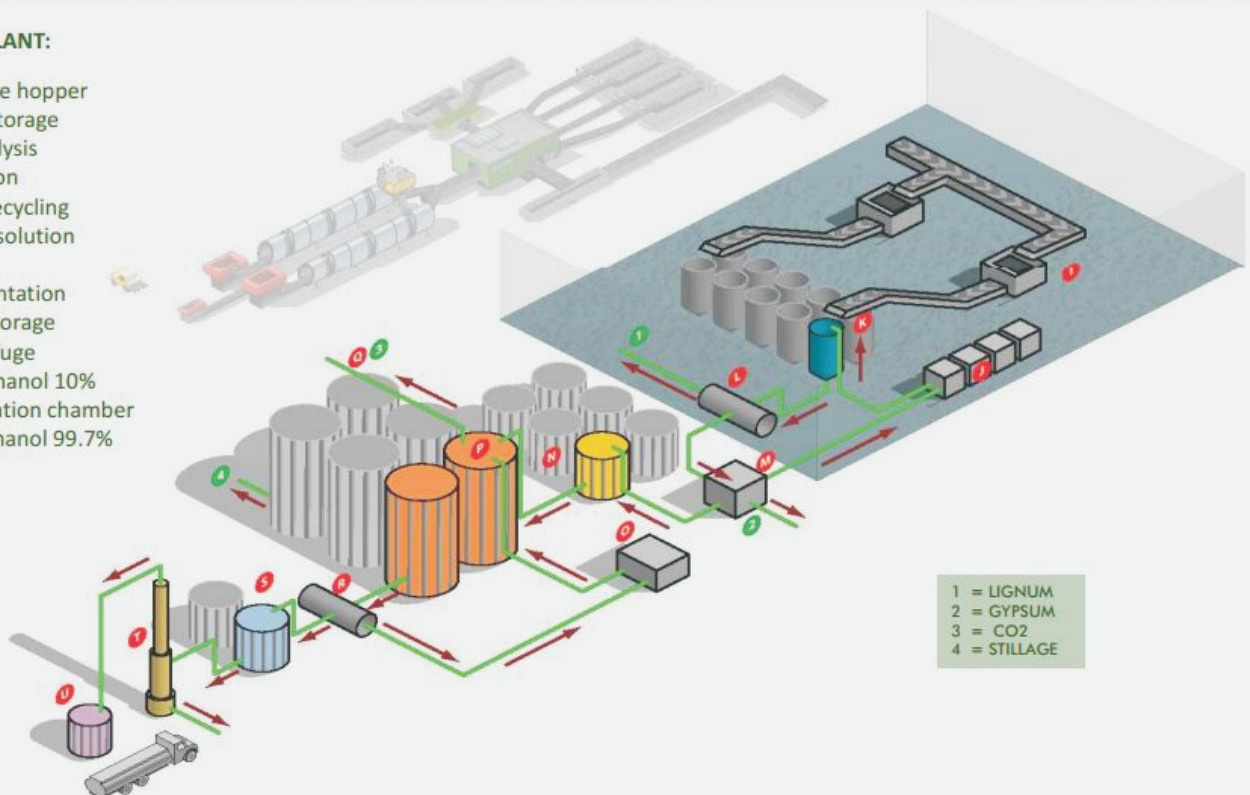
#### Standard facilities

- |                                      |                              |
|--------------------------------------|------------------------------|
| <b>A</b> Tipping and loading area    | <b>E</b> Sorting Chamber     |
| <b>B</b> Shredding and feed hoppers  | <b>F</b> Plastics separation |
| <b>C</b> Vantage Waste Processor x 2 | <b>G</b> Sorted Material     |
| <b>D</b> Odour Remover               |                              |

## Ethanol production facility

### KEY TO PLANT:

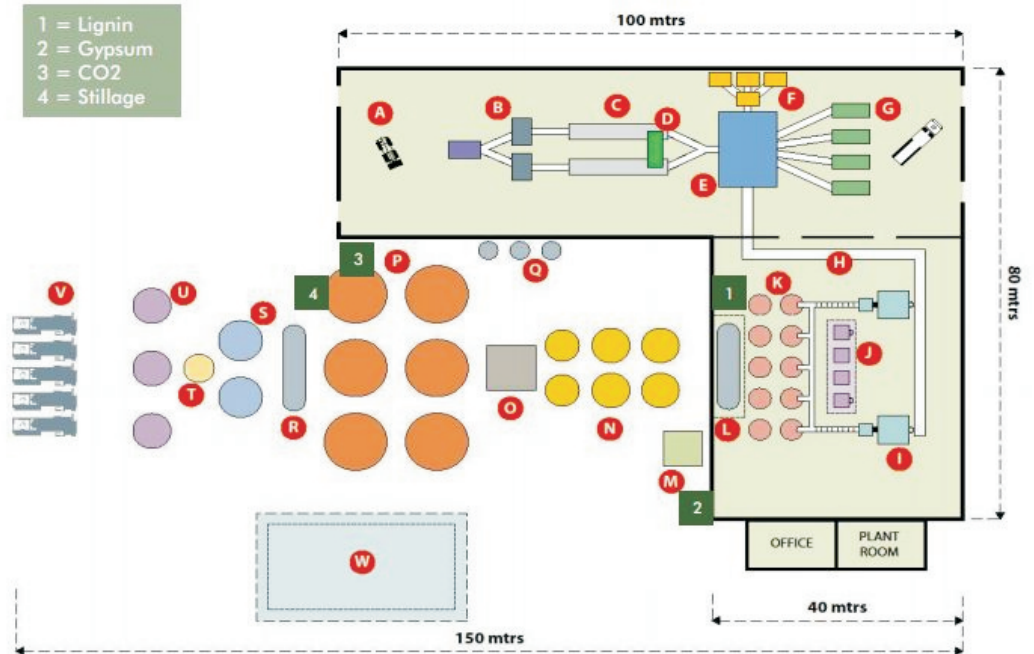
- I Storage hopper
- J Acid storage
- K Hydrolysis
- L Filtration
- M Acid recycling
- N Sugar solution
- O Yeast
- P Fermentation
- Q CO<sub>2</sub> storage
- R Centrifuge
- S Bio ethanol 10%
- T Distillation chamber
- U Bio ethanol 99.7%



# Typical plant layout – key to all areas

## KEY TO PLANT:

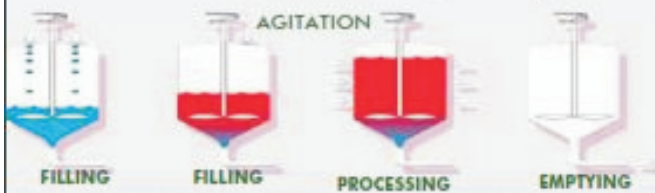
- A Pre sorting and loading area-
- B Shredding and feed hoppers
- C Vantage Waste Processors x 2
- D Odour removal
- E Sorting (general)
- F Sorting (plastic)
- G Material storage
- H Conveyor for biomass
- I Storage hopper
- J Acid storage
- K Hydrolysis
- L Filtration
- M Acid recycling
- N Sugar solution
- O Yeast
- P Fermentation
- Q CO2 storage
- R Centrifuge
- S Bio ethanol 10%
- T Distillation chamber
- U Bio ethanol 99.7%
- V Electricity generation
- W Water treatment



## ETHANOL PRODUCTION

### HYDROLYSIS (batch process)

Breaks down the solid feedstock (cellulose & hemicellulose contained within the biomass) into sugars



After acid treatment, the liquid is filtered to remove solids. These solids contain **lignin** which, when dried, can be used as a solid fuel to fire the boiler. The remaining 'sugar rich' acidic liquid is neutralised with lime and then filtered, the resulting solid is '**gypsum**' which has many uses, particularly in the building industry

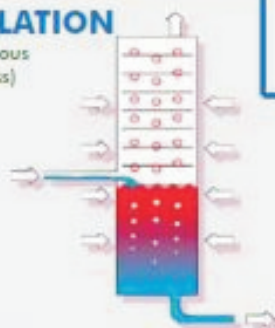
### FERMENTATION (batch process)

BACTERIA BEING TRAPPED AND ELIMINATED BY ANTI MICROBIAL



The sugar rich solution is pumped to the fermentation vessel after which yeast is added. Once fermentation is completed, the liquid is filtered and the yeast (which has increased) is removed. Some is recycled and any **excess yeast** can be pelletised and used as a fuel. The fermentation process also provides carbon dioxide as a by-product which can be sold

### DISTILLATION (continuous process)



Distillation takes the fermented mixture from a 10% ethanol solution and concentrates it to approx 99%. This is achieved in two stages, The first stage is conventional distillation which will result in approx 94% ethanol. The second stage removes the remainder of the water via a molecular sieve resulting in approximately 98.7% ethanol