ALBIN PROMOTION d.o.o.

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DEGUel®

zero waste management

ALBIN PROMOTION

WASTE to HEAT and ELECTRICITY

100 % input

20-30 % electricity

40-50 % heat

10-20 % of input for process heating

PROCESS INTRODUCTION

The problem of biomass, waste rubber, plastics and scrap tires has increased to such extent that there has been new ideas on how to reduce their quantity. Until recently, tires have been mainly deposited in landfills and used in the manufacture of asphalt, artificial reefs, river barriers, etc. Waste tires pose a serious threat to developed societies, because of their shape, size and physicochemical nature, and the fact that they are very hard to recycle in the conventional ways. The solution is “thermal processing”, which would reduce the burden on landfills and come up with new energy. In the process waste are used as input materials, from which we get fuels, like gas, liquid fraction and solid residue. Increasing oil prices and increasingly stringent environmental regulations regarding the handling of waste have accelerated research of that kind of process. It is a thermal process in the absence of oxygen (depolymerization in an inert atmosphere), which takes place at relatively low temperatures up to 500 °C or 700 °C, and involves the decomposition of the organic matters of waste. All products have approximately the same calorific value as fossil fuels and they have potential to replace them. Problem of these products is their quality and content of environmentally hazardous substances that could be released with further usage of products (for further processing, distribution, as a substance for other products, as a fuel).

Three types of products are obtained during the process: gas, liquid and solid fraction. Liquid and gaseous products are mainly used for energy and solid residue (charcoal) for material use. Purity and quality of gas, liquid and solid fractions depend on the composition of the input material. Before using products therefore it is necessary to clean them to meet the requirements that are determined by standards and regulations.

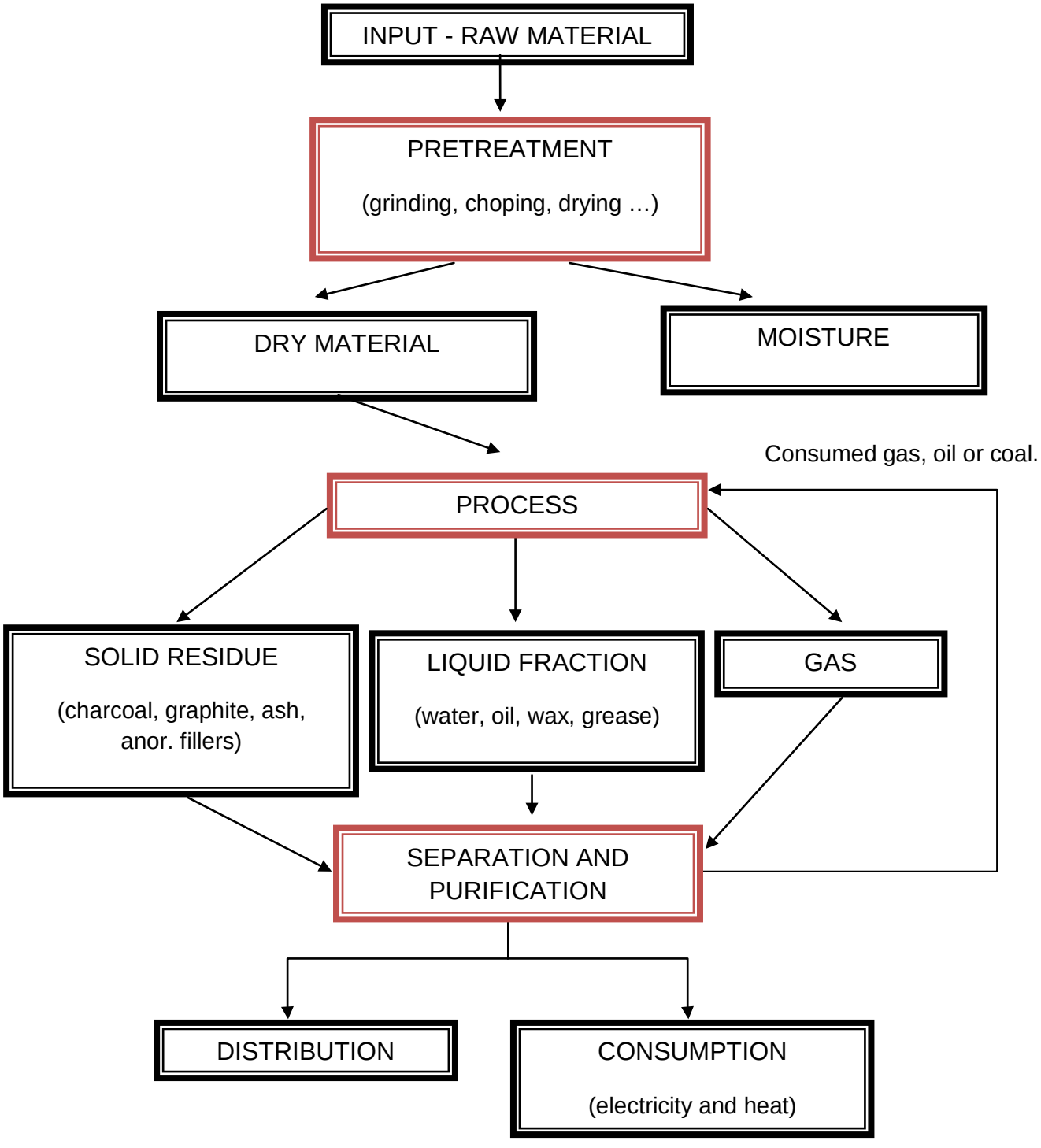
The solid residue may be used as a smokeless fuel, carbon black or activated carbon, as the main component of electrodes in electro-furnace processes, iron production in tire manufacturing, etc.

Gaseous and liquid “thermal processing” products represent complex hydrocarbons. Gaseous products consist primarily of hydrocarbons C1 to C6 (~80 vol. %), CO (~5 vol. %), CO_2 (~10 vol. %) and other impurities (~5 vol. %). The gas has a high calorific value of around 35 - 42 MJ/kg.

Liquid fractions represent a CH-like diesel oil fraction (the same distillation range), which has a high heating value of around 40 - 47 MJ/kg. Liquid fraction has promoted studies on its use for the replacement of conventional liquid fuels and as a source of chemicals and raw materials for the petrochemical industry.

Waste like scrap tires also contain high quality carbon steel wires and cords, which give tires tensile strength, elongation and bending stiffness. Between 8 and 15 wt. % of tire’s mass represent steel cords. Steel is an inert energy component, mixed with charcoal in solid residue that can be separated and distributed as a product.

BLOCK DIAGRAM OF THE PROCESS



BASIC INDUSTRIAL PLANT LAYOUT

Figure 1: Principal layout of DEGUel technology

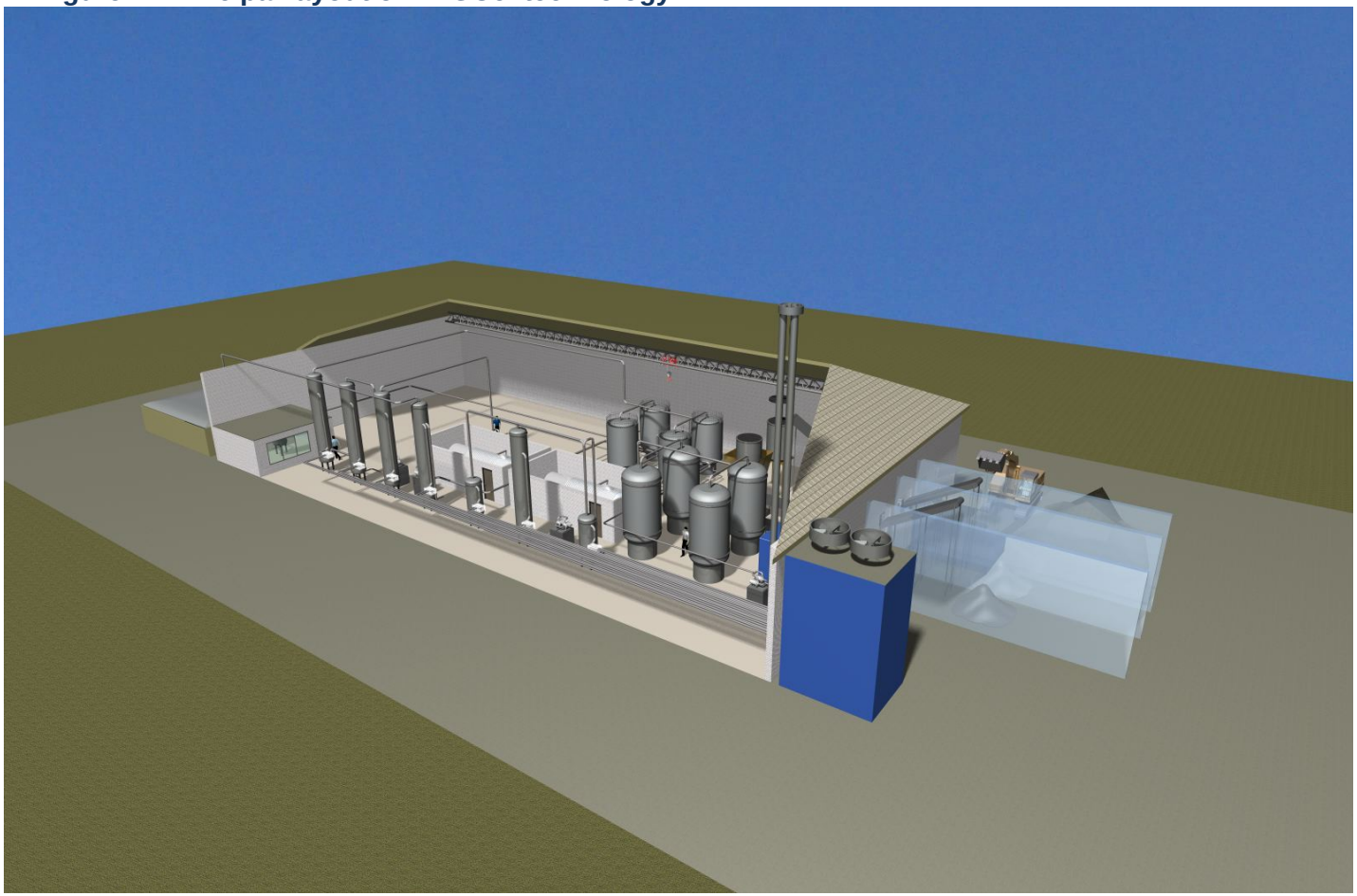
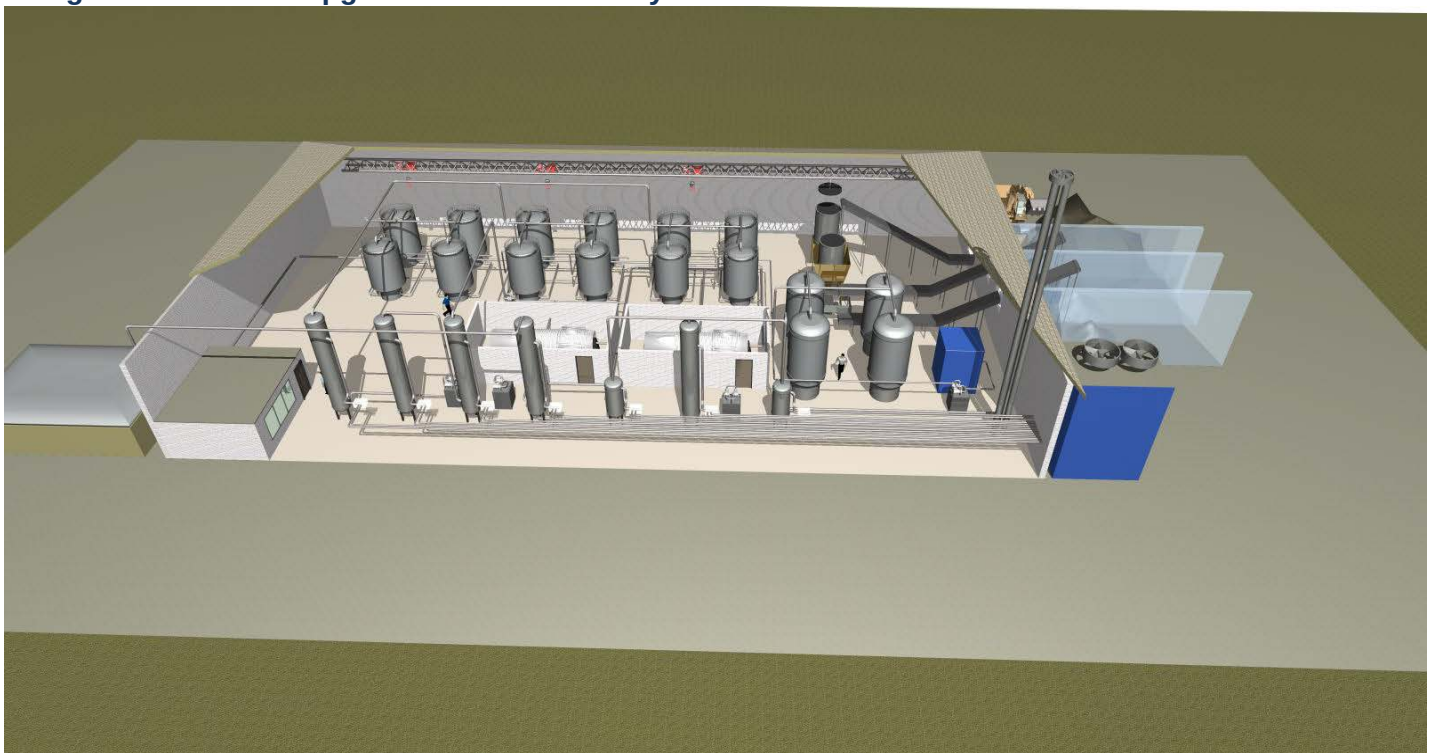
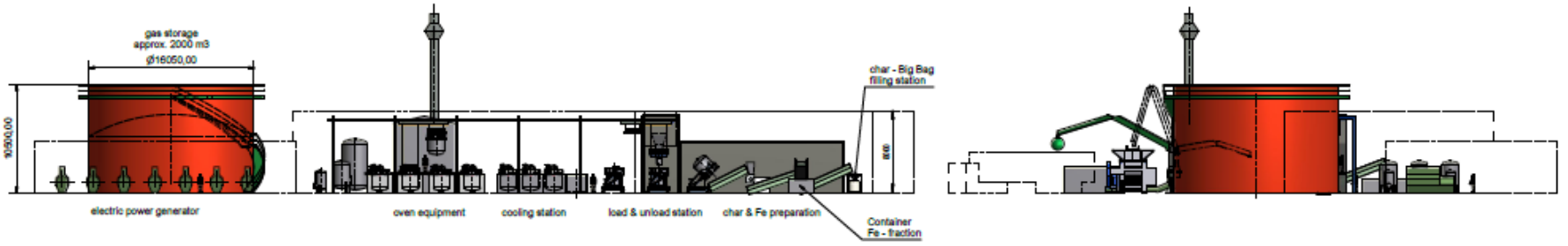
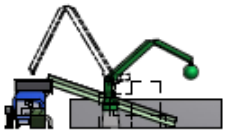
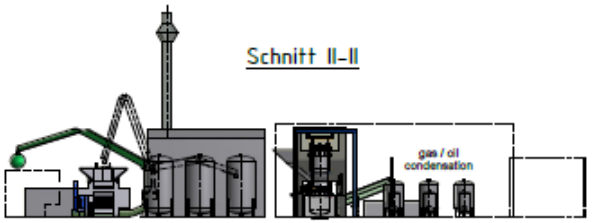


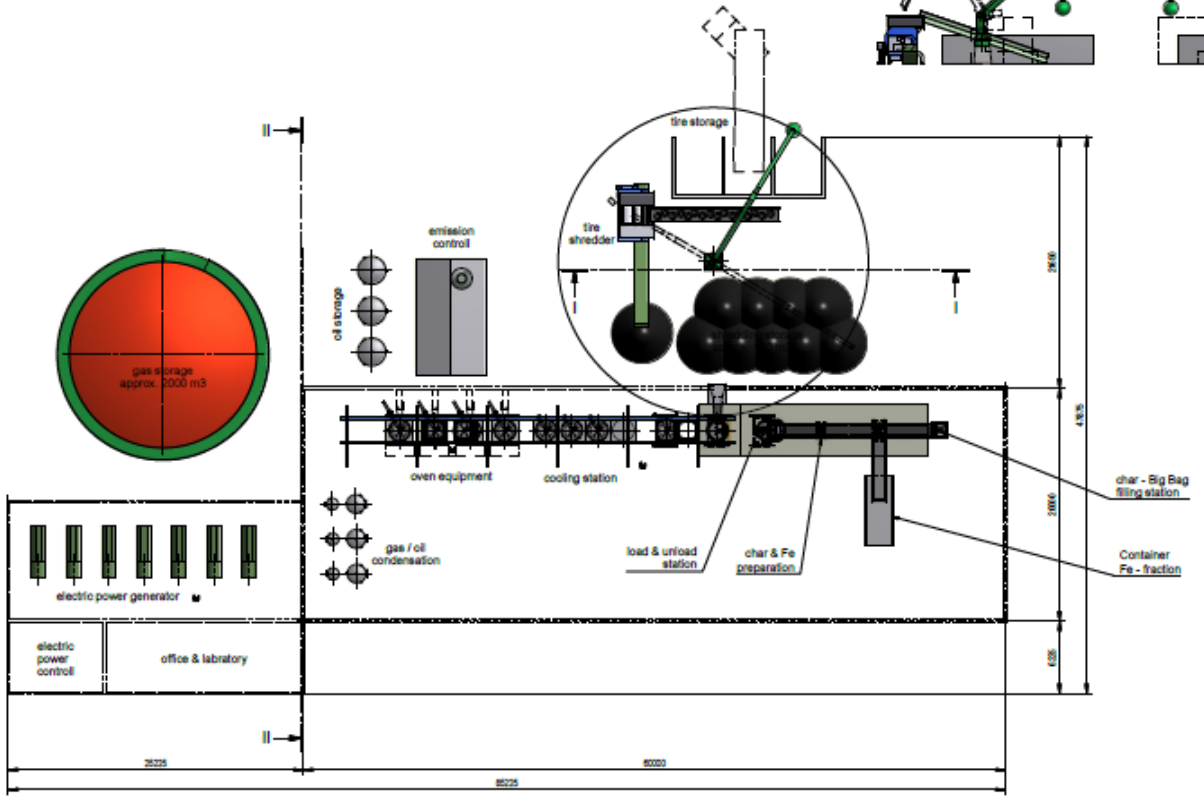
Figure 2: Potential upgrade of the DEGUel system. additional modules shown

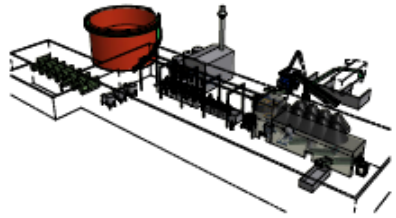












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		Datum	Name
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	gez.		

Das Urheberrecht an dieser Zeichnung verbleibt uns. Die Zeichnung darf ohne unsere schriftliche Genehmigung weder kopiert, noch vervielfältigt, noch dritten Personen zugänglich gemacht werden!

Maßstab 1 : 200

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Projektbezeichnung
DEGUEL

Projektnummer
3152

Zeichnungsnummer
3152-001-01-color

Baugruppe
total DEGUEL plant

Bauteil
general Plant Layout
size: 4 oven

MASS BALANCE FOR WASTE TIRES

Table 1: Mass balance for waste tires

	mass (kg)	volume (L)	wt. % moisture	wt. % (according to the raw material)	wt. % (according to the dry matter)
RAW MATERIAL (INPUT)	1000	~ 3200	100 %	100 %	/
MOISTURE	30	/	3,00 %	/	/
DRY MATTER	970		97,00 %	/	100 %
REACTION H_2O	0		/	0	0
REACTION H_2O + MOISTURE (DENSITY = 1,00 kg/L)	30	30	/	3,00 %	/
SOLID RESIDUE - charcoal + graphite	390	~ 1000	/	39,00 %	40,21 %
STEEL CORDS	100	/	/	10,00 %	/
OIL (DENSITY = 0,92 kg/L)	360	391	/	36,00 %	37,11 %
GAS (DENSITY = 1,80 g/L)	120	67000	/	12,00 %	12,37 %
CONSUMED ENERGY (first reactor)				6458 MJ	
CONSUMED ENERGY (continuous production)				3230 MJ	
PRODUCED ENERGY				29220 MJ	

Raw material should be dried before main process is applied.

GAS COMPOSITION FROM TIRES

Table 2: Gas composition from tires

METHANE	~ 22 vol. %
ETHENE, ETHANE	~ 22 vol. %
PROPENE, PROPANE	~ 11 vol. %
BUTENE	~ 19,5 vol. %
BUTANE	~ 4 vol. %
CO	~ 3 vol. %
CO_2	7 - 11 vol. %
SH_2	2,5 - 5,5 vol. %

ENERGY BALANCE FOR WASTE TIRES

DEGUel® proces			Date		Sheet	
AP-SLO- EU:	CUSTOMER	/	jan.12		1 of 1	*MASS Balance*

Mass balance and capacity calculation:
Calculation of the capacity is based on energy distribution. Process is calculated on XMW generator power for electricity.
Calculation is based on 1metric tone of INPUT in to the process.

mass balance - input material

	Wet	Dry
	Planned	Planned
	ton/ y	ton/ y
Waste tires	5000	5000
	0	0
	0	0
Total	5000	5000,00
	100%	100,00%

mass balance - outputs and products

output PRODUCTS:	100%	Variation of (%) product distribution (col. 2):	Mass balance for 1 metric Ton of INPUT (kg):	Mass balance per year
Gas	12%	(+8%, -2%)	120	600
Oil	36%	(+2%, -10%)	360	1800
Char	39%	(+8, -3%)	390	1950
Iron	10%	(+2%, -2%)	100	500
Total	97%		970	4850
Water	3%		30	150
		TOTAL	1000	5000
			kg	t

Calculation based on 1t of FEED material.

energy balance

1	2	3	4	5	6	7	8	9
Products	Calorific value (MJ/t):	Mass flow from reaktors (t/year):	Energy value of products (MJ):	Mass flow for running process (t):	Energy consumption of the process (MJ):	Mass flow of the available products (t):	Energetic potencial of the products (MJ):	kWh
Gas	39000	600	23.400.000	0	0	600	23.400.000	6.500.000
Oil	40000	1.800	72.000.000	0	0	1.800	72.000.000	20.000.000
Char	26000	1.950	50.700.000	0	0	1.950	50.700.000	14.083.333
		4.350	**146.100.000**	**0**	**0**	**4.350**	**146.100.000**	**40.583.333**
		t	**MJ**	**t**	**MJ/t**	**t**	**MJ**	**kWh**

Part of energy for process heating:		16,6%	

The base for calculation is 7200 working hours/year.
Convert kWh to MW = 1/7200000
Convert MJ to kWh = 1000/3600 = 0,27777

	Energy distribution:		kWh	MW
GAS	Total energy at the entrance:	100%	**6.500.000**	**0,90**
	electricity	38%	2.470.000	0,34
	potentially useful heat	40%	2.600.000	0,36
	heat loss	22%	1.430.000	0,20
DIESEL	**Energy distribution:**			
	Total energy at the entrance:	100%	**20.000.000**	**2,78**
	electricity	38%	7.600.000	1,06
	potentially useful heat	40%	8.000.000	1,11
	heat loss	22%	4.400.000	0,61
CHAR	**Energy distribution:**			
	Total energy at the entrance:	100%	**14.083.333**	**1,96**
	potentially useful heat	37%	5.210.833	0,72
	energy for process heating	48%	6.728.717	0,93
	heat loss	15%	2.112.500	0,29
EXHAUST GASES POTENTIAL FROM PROCESS HEATING	**Energy distribution:**			
	Total energy at the entrance:	100%	**6.728.717**	**0,93**
	electricity	0%	0	0,00
	potentially useful heat	50%	3.364.358	0,47
	heat loss	/	/	/
TOTAL	**Energy distribution:**		**WASTE TIRES**	
	Total energy at the entrance:		**40.583.333**	**5,64**
	electricity		10.070.000	**1,40**
	potentially useful heat		19.175.192	**2,66**
	energy loss from process heating		3.364.358	**0,47**
	energy loss from products		7.942.500	**1,10**

DESCRIPTION OF THE ELEMENTS

1. Equipment design and project planning

Project design, planning and selection of process equipment, design of the P&I diagram, planning the implementation of the project.

2. Elaboration of technical documents

Elaboration of the technical documentations with the instructions for operation.

3. Maintenance documentation

Documentation for maintenance and service.

4. Education and training staff

Documentation and methods for education and training of staff

5. Starting the installation, testing and trial operation for 60 days

Startup and testing of individual devices, run the entire plant and test operation for 60 days

6. Technical acceptance and handover

After startup and testing of the facility, technical inspections follow. Technical acceptance and handover of a facility in operation with all documentation must follow.

DESCRIPTION OF THE MANUFACTURING EQUIPMENT

1. Reception and transport

Devices for a material reception with small storage, automatic transport in the drying part of the process

2. Vessel

Reactors for the degasification and thermal degradation of the organic mass

3. Heating system for vessel

The system with heating oil for the reactors and dryers

4. Condensation system

System for condensing and cooling of hot gases with pump transport system and gas storage

5. System for gas cleaning and desulfurization

System for washing, absorption and neutralization of hazardous compounds from the gas phase with cooling and circulation. Equipment for separation of sulfur from the gas. Reactor for preparation and concentration of sulfur.

6. Electrical equipment, hardware and software

Power wiring and drives, instrument and control wiring, Instrumentation and control system for equipment and process based on PLC – PC , SCADA and software control system

7. Gas and diesel internal combustion engines with generators

Series of engines and generators for cogeneration of heat and electricity. Heat exchangers for utilization of available heat in other processes.

END