THERMO CATALYTIC CONVERTER PLANTS

TCC-4000 GII
INTRODUCTION OF THE COMPANY

FUKON Aktiengesellschaft, established in Liechtenstein in 2007, has shifted its focus over the past years and recently it operates as a venture capital enterprise, focusing on investment opportunities in the renewable energy sector. These days, Fukon A.G. addresses processing of waste and materials for recycling by using state of the art industrial research and development elements in the technology it applies.

The company invests into waste utilization plants using patented waste management solutions and know-how through its subsidiaries in Hungary and Poland.

An important recent milestone was the commissioning of a TCC-4000 GII Thermo Catalytic Converter Plant (Generation II), producing oil from segregated plastic, rubber or even carpet, as raw materials. The pilot project was built in Fehérvárcsurgó - Hungary in 2012.

TECHNOLOGY DESCRIPTION

UTILIZATION OF PLASTIC AND RUBBER WASTE

Rubber and plastic materials are special parts of the organic waste as these are practically non-destructible. Eliminating them by simple means or by incineration is not a good solution, as the free carbon particles (in the form of thick smoke) heavily pollute the environment, together with the toxic particulars sticking to these particles.

The production of rubber is based on the chemical technology called polymerization.

By reversing this process, with the simultaneous input of heat energy the large molecules breakdown to smaller molecules.

The depolymerization process – provided it is achieved by using heat energy – is called thermo catalytic transformation as long as the reaction sphere is sealed airtight.
Part of the plastic waste might be recycled by traditional methods, but there are some plastics, due to production or other reasons (polluted, etc.) which cannot be recycled. In case of those plastics which cannot be recycled, the reversed polymerization technology can be also used as these are oil by-products as well.

Our technology is based on thermo catalytic depolymerization.

The essence of the process is - see 1 illustration – that the slowly decomposing organic wastes (rubber, plastic) are shredded to 20-25 mm pieces, then delivered by a screw-driven device into an oxygen free, heated, airtight sealed reactor, where the waste is transformed to hydrocarbon-steam and gas-phase. At the end of the procedure a slag by-product is separated.

The produced carbon steam-phase is leaving the equipment and enters a multiple condenser system, where suitable liquid-phases are formed (similar to the fractional distillation process, but compared to the traditional distillation procedure, operated under conditions which are much more simple and economic).

The thermo catalytic system is designed as a block system meaning that it has modular characteristics, i.e. smaller and larger capacity units may be constructed, step by step capacity increase can be easily achieved in a modular way.
Out of the process the following products are produced:

**Product oil (liquid phase)**
Characteristics:
- Density: 0.8266 g/cm³
- Cetane index: 53
- Sulphur content: 110 mg/kg
- Kinetic viscosity: at 40 degree C.: 2.23 mm²/s

**Product-gas (gas phase)**
Characteristics:
- Heating value: 54 MJ/Nm³
Slag/Pyro-coke (soot)
Characteristics:
Heating value: 15-16 MJ/kg

Steel – in case of tires
Stringy scrap metal

PROCESS FLOW OF THERMO CATALYTIC CONVERSION
ENERGY PRODUCED FROM OIL

The end-product of the technology may be utilized as follows: the produced by-products of the product-oil may be sold, as there is a market demand for these, or the oil produced may also be used by high capacity, low revolution diesel engines to produce electricity. In case of the latter method, the emission of the waste gases are filtered to prevent any pollution to the environment.

Beside the production of electricity, there is a possibility – provided there is a demand for it – of thermal energy heating. The heat of the thermal energy is ~90/70 Degree Celsius. This can be used in heating systems or in such heating system technologies, which are capable to be operated by this heat energy. From the emission of the motors waste gas of the internal combustion at 6 bars pressure, over-heated steam may also be produced.

ENVIRONMENTAL PROTECTION ASPECTS

Taking into consideration the requirements of the most up-to-date process technology for the described activity the equipments deployed meet the most demanding technical expectations. When designing this technology the main goal was the low emission of waste materials and the high energy efficiency.

The process is the final stage of a waste management system where the collected, mixed, comingled and contaminated waste is transferred to harmless stage, and the energy deriving from the waste is utilized.

When defining the emission limits of the polluting materials processed by the technology, it turned out that the main characteristics were compounds of chlorine and fluorine. Because of the low content of chlorine and fluorine of the treated feedstock these are not typical for the waste-gas of the designed technology.

The water requirement of the technology is minimal, therefore there is no water outlet, thus the surface and under-surface water are not effected. Noise pollution is minimal, and by selecting the most suitable site, the noise effect can be limited to industrial areas.

The thermo catalytic technology is a closed system. The processing units are designed to provide the lowest emissions under normal circumstances. Under normal production circumstances, the toxic emission of the technological line does not exceed the internationally accepted and permitted limits.
**ADVANTAGES OF TECHNOLOGY**

External energy (propane-butane or natural gas) is needed only until the reactor reaches the operating temperature, afterwards it will produce the necessary product-gas for captive use. From here on the thermocatalytic system becomes self-fuelling, as the fuel gas is produced by processing of the waste materials.

The thermo catalytic technology and the complex thermo catalytic – electricity producing block system has a small footprint, and can be easily be located in an average Regional Waste Processing Center, fitting into an optimum production structure.

The thermo catalytic system is automatically operated from the feeding till the final outputs, off-time of production is minimized.

The process is controlled and monitored in each production phase by an adjustable controlling unit that plans and controls the given heating data of each process step. The automatic shut-down of the operating line is also controlled by a sophisticated safety mechanism.

**EACH PRODUCTS CAN BE UTILIZED**

**SALES OF PRODUCED ELECTRICITY**

The main product of the thermo catalytic power station is electricity. The electricity may be sold as follows:

- Open sales on the electric market
- Directly to consumers (i.e. to industrial plants, local municipalities)
- In regulated feed-in systems for alternative energy (like in the EU countries).

**SALES OF OIL**

An economic solution would be the use of the oil in internal combustion engines generating „green electricity“. Supposing that this activity is subsidized the result would be a quicker return of the cost of technology.

Provided that the produced oil of the thermo catalytic power plant is not fully utilized to produce electric energy, the remains balance may also be sold. If the oil price level is favorable, it is profitable to sell the oil to oil companies for further refining. N.B: A distillation unit can also be added to the thermo catalytic process, ensuring a higher quality distillate with higher added value.
SALES OF THE PRODUCT-GAS

The produced gas is primarily used for operating the plant.

The produced gas may also be used by gas operating generators to produce electricity which is may also be sold.

The produced gas - after being treated according to directives of various regulations – may be stored in tanks and later be utilized at a suitable location.

The produced gas after suitable filtering may be used as renewed energy - mainly for operating public transport.

SALES OF PRODUCED THERMAL ENERGY

The produced thermal energy is suitable to provide heat to the nearby settlements using district heating systems (therefore when choosing the site of the investment it can be a decisive factor could be the distance to a city using district heating.)

The produced thermal energy is also suitable for cooling, therefore even in summer the utilization of the thermal energy is solved. The thermal energy can be consumed in cooling houses, near the power station.

SALES OF SLAG/PYRO-COKE

The heating value of pyro-coke is equal to the heating value of brown-coal.

The advantages of investing in a thermo catalytic power station.

The return of the invested capital is 6,5 – 7,5 years.

With the sales of thermal energy sub-projects and sales of by-products the ROI can be less than 6 years.

Calculating the negative cost of land filling the ROI can be less than 4 years.