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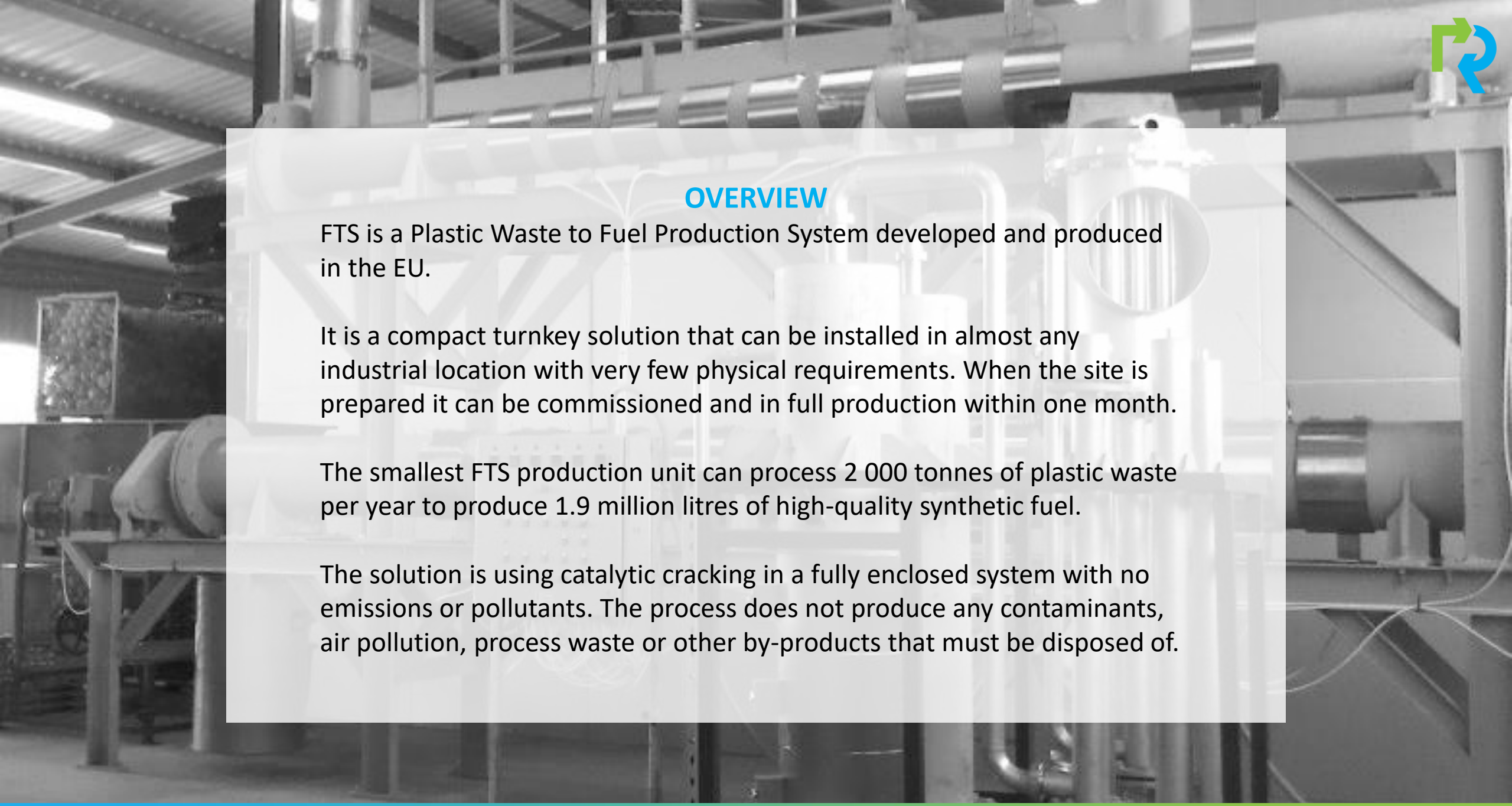
FTS PLASTIC WASTE TO FUEL PRODUCTION SYSTEM

System & Operations Description

R250 R500 R1000



OVERVIEW

FTS is a Plastic Waste to Fuel Production System developed and produced in the EU.

It is a compact turnkey solution that can be installed in almost any industrial location with very few physical requirements. When the site is prepared it can be commissioned and in full production within one month.

The smallest FTS production unit can process 2 000 tonnes of plastic waste per year to produce 1.9 million litres of high-quality synthetic fuel.

The solution is using catalytic cracking in a fully enclosed system with no emissions or pollutants. The process does not produce any contaminants, air pollution, process waste or other by-products that must be disposed of.

THE FTS PLASTIC WASTE TO FUEL PRODUCTION SYSTEM

The FTS system uses catalytic cracking to convert plastic waste, municipal waste, bio-mass or a combination of materials to a high-grade synthetic fuel suitable for diesel engines like power generators or ship engines. It operates 24/7 with a minimum of 335 production days per year (8 000 hours). The catalytic cracking takes place in a fully enclosed reactor heated by ceramic elements without any emissions of any kind.

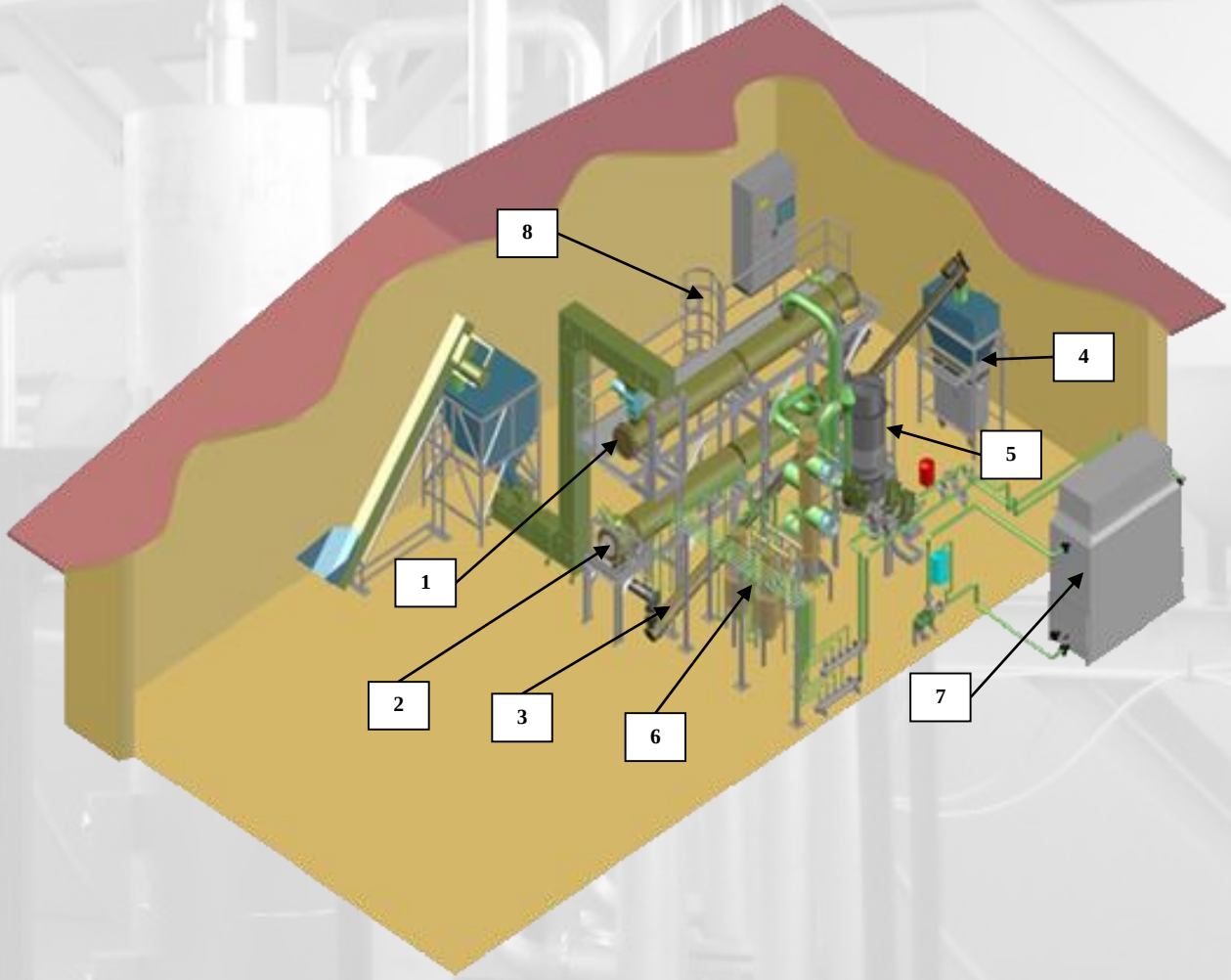
FTS comes in three standard turnkey modules handling from 2 000 to 8 000 tonnes per year of plastic waste. The R250 production unit can be delivered as a fully self-contained system in the form of three 20-foot shipping containers and can be installed in any location even outdoors.
The system is fully scalable using the three different basic modules (R250, R500, R1000) as building blocks to meet any kind of volume requirements. It can be remotely monitored and operated to secure scalability and quality control.

The optimal input raw material is cleaned PE and PP plastic waste, and most plastic types can be processed with various grades of efficiency. High contamination and water content will reduce the process efficiency without influencing the output product quality. PET is not recommended due to the low energy content, but can be processed with lower efficiency. FTS can also process sorted municipal waste and bio-mass after removal of glass, metal, stone, ceramics and other non-inert elements.

THE FTS SYSTEM COMPONENTS

The FTS system consists of the following basic parts:

1. Thermal pre-reactor (fully thermally insulated)
2. Thermal reactor (fully thermally insulated)
3. Cooled two-stage screw worm conveyor (to remove carbon from the reactor)
4. Carbon residuals container
5. Condenser assembly
6. Gas purifier system
7. Autonomous closed-loop cooling system
8. Steel construction and working platform



FTS PROCESSING

Feedstock material can be any kind of plastic or sorted municipal waste, bio-mass or a combination of materials with glass, metal, stone and other non-inert materials removed. The input material can be contaminated, wet and dirty without any influence on the quality of the output products, but high contamination and water content will cause lower process efficiency.

Shredded feedstock material is continuously conveyed to the pre-reactor via the filling port. The material is dried and pre-heated in the pre-reactor with a working temperature of 50-300 °C. The dried feedstock material is then transported from the pre-reactor into the main reactor through a closed extruder. The material is compressed in the extruder to provide airtight displacement of the reactor. The pre-reactor and main reactor are heated by external electric ceramic heaters.

The reactor is a thermal device where the desulfurized raw material is undergoing a depolymerization-thermochemical process under anaerobic conditions and turned into hydrocarbon molecular chains. The reactor has an operating temperature in the range 350-690 °C. Hot steam and gas are generated in the reactor in the opposite direction of movement of the material, thereby ensuring high thermal efficiency.

The main reactor operates at a slight vacuum. The resulting vapor and gas are sucked out into a closed system. Carbon residuals are disposed of via a two-stage cooled worm conveyor connected to the reactor outlet.

The system is using specially developed catalysts to boost the cracking reaction.

PRODUCTION LOCATION REQUIREMENTS

The process does not produce any contaminants or air pollution and does not require any chimney nor air venting system. The only emission is CO_2 from burning the process gas in a gas generator (if run in low-carbon mode) to provide the necessary electrical power for heating the reactors and system operation. The production units can be sited in any location deemed suitable subject to local regulations.

The solution is very compact with minimal space requirements. The smallest unit can be delivered as a self contained system in container units and operate outdoors with no roof. A production unit will typically require 50m^2 of floor space and total area requirements can be further optimized if required.

The plastic feedstock storage space requirement is dependent upon the logistic agreement with the plastic waste supplier. To avoid disruption it is recommended to have enough storage for 2 full days of operation.

- The R250 production unit will process one full trailer load in two days.
- A typical plant with 5 x R250 units processing 10 000 tonnes/year will require 2.5 trailer loads/day.
- A storage space for 5 trailer loads is the recommended minimum.

- Storage for the fuel produced is likewise dependent upon the logistic agreement.
- The R250 unit produces 5 650 litres/day.
- A plant with 5 x R250 units will require storage tank capacity of 22 600 litres/day.

MANPOWER REQUIREMENTS

The operation of the FTS units is highly automated leading to minimal manpower requirements. 1 FTE is capable of handling one standalone production unit, and a plant with more units will prove more economical as the staffing requirement falls below 1 FTE/production unit.

The feedstock material needs little preparation except separating unsuitable content then shred to a maximum diameter of 5 cm before feeding into the FTS unit. Personnel will be required dependent upon the quality and condition of the raw material received.

ENERGY CONSUMPTION

- The R250 production unit has a power consumption of 180 kW electricity (mainly for heating the pre-reactor and the reactor for the catalytic cracking process).
- This electrical energy can be supplied as electricity preferable from a clean external energy source or it can be provided by burning the produced process gas in a gas generator.
- If the power source is an external electrical energy supply, preferably from a clean source, the produced synthetic fuel is 100 % CARBON NEUTRAL.
- If the power source is provided by burning the produced process gas in a gas generator the fuel is LOW CARBON with a carbon footprint reduction of 80-90 % compared to fossil fuel.
- After process start-up in LOW CARBON mode, sufficient gas results for the production unit to be fully self-sufficient without any need for external energy.

PROCESS OUTPUT

The production process delivers three main components: synthetic fuel, synthetic gas and solid carbon residuals. The ratio between the output components depend on the feedstock material used with PE/PP plastics rendering the highest fuel ratio of 80 %.

The synthetic fuel is suitable for all kinds of diesel engines although use in heavy machinery like power generators and ship engines are recommended. The fuel is of high quality with characteristics very similar to the EN590 diesel standard with regards to energy content, sulphur content, density, viscosity and boiling point and can be mixed into fossil EN590 diesel.

The synthetic gas is always the cheapest option and usually used to generate the necessary electrical power for process operation in comparison to supplying external power; the production unit provides the exact amount required for the chemical process leaving no surplus gas. If powered by external energy the synthetic gas will be pure and available for sale.

The solid residual carbon-mass has an energy content comparable to coal and sold as fuel for concrete production or incinerators.

The process does not produce any contaminants, air pollution, process waste or other by-products that must be disposed of.

TECHNICAL PARAMETERS

BASIC PARAMETERS OF THE FTS PLASTIC WASTE TO FUEL PRODUCTION SYSTEM			
Model	**R250**	**R500**	**R1000**
Feedstock Material Processing Capacity	250 kg/hour 6 tonnes/day 2 000 tonnes/year	500 kg/hour 12 tonnes/day 4 000 tonnes/year	1,000 kg/hour 24 tonnes/day 8 000 tonnes/year
Product: Synthetic Fuel	235 l/hour 5 650 l/day 1 880 000 l/year	470 l/hour 11 300 l/day 3 765 000 l/year	940 l/hour 22 600 l/day 7 530 000 l/year
Product: Synthetic Gas	42 kg/hour 1 020 kg/day 340 tonnes/year	85 kg/hour 2 040 kg/day 680 tonnes/year	170 kg/hour 4 080 kg/day 1 360 tonnes/year
Product: Solid Carbon Residuals	7 kg/hour 180 kg/day 60 tonnes/year	15 kg/hour 360 kg/day 120 tonnes/year	30 kg/hour 720 kg/day 240 tonnes/year
CO_2 Emissions: Using External Electricity	0	0	0
CO_2 Emissions: Using Process Gas	318 tonnes/year	570 tonnes/year	1 010 tonnes/year
Power Consumption	180 kW	320 kW	570 kW
Volume Autonomous Cooling System	5 m^3	8 m^3	15 m^3
Service Life	15 Years		
Operation Principle	Continuous catalytic cracking in screw reactor		
Raw Materials	Plastic waste, separated municipal waste, biomass		
Voltage System	3 / PEN, AC 50 Hz, 230 / 400 V, TNS		
Rated strength of electrical insulation	1500 V		
Voltage of Control Circuits	230 V		
Nominal Current	200 A		
Voltage of Auxiliary Circuits	24 V DC		
Rated Working Voltage	400 V ± 10 %		
Type of Heating	Electrical resistance		
Power Consumption Control System	900 W		
Maximum Nominal Reactor Temperature	690 °C		
Cooling Method	Closed-loop water cooling		

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