ESA AG
Energy Systems Applications

# Treatment center and Energy recovery of municipal solid waste

# Introduction

All over the world, especially in developing countries, we find very large amounts of waste that can not be removed and reused, but most of the time they always end up in landfills and at sea.

And often they are simply burned and cause a huge environmental impact.

In view of the goals of ESA projects, scrap tires, household and industrial waste can be recycled as high-calorie material and fed back into the energy cycle. In addition, sludge from paper mills and wastewater treatment plants can be recycled.

The waste recycling project consists of two parts (see below).

**STADLER Treatment and production RDF**

**CCC Energetic valorisation to fuel**

ESA AG
Energy Systems Applications

# Why is ESA involved in developing countries ?

- In Europe and in many countries of the world, it is all about the energy transition and, in particular, about renewable energies. However, this is still not enough despite Kyoto, Paris and Marrakech. Instead, for example, in Germany we are trying to block roads in cities for diesel vehicles in order to contribute to the climate.

- In other words, large amounts of $CO_2$ and methane are produced without being able to react quickly and with concrete measures.

- Especially in developing countries, which receive a large part of the waste generated in industrialized countries against payment.


Martin Kotzur, President  Prof. W.Schraufstetter, Inventor,  Klaus Lederer, CEO

ESA AG
Energy Systems Applications

# ESA AG group Holding

- **BIOCON GmbH, Company inventor de Prof. Schraufstetter**
- **AARONN Gmbh, Company electronic, Hardware producer**
- **COMRON Gmbh, Company electronic , Software producer**
- **STADLER GmbH, Company produce r of waste treatment**
- **EnVert Inc. Company CCC production , Canada**
- **ESA Tunisia S.A Managing platform of local operations**
- **BRE Sarl, Tunesien partner, CCC Setup and service**
- **ESA Berkane Moroccan operations unit**

Platform for renewable energy from waste

# Objectifs

**The CCC system for recycling of garbage in synthetic oils developed by ESA AG also has the following advantages:**

**environmental**

- Reuse of all types of waste
- Separation of organic components and inorganic components
- Avoid new landfills for waste
- Solve the problem of treatment leachate by pre-drying waste
- No groundwater contamination
- No odor from the air
- Fully enclosed CCC system
- no noise or dust exhausted

**Economic**

- Reduction of costs for collection, sorting and discharge
- Economic use of all residues
- Replacement of fossil resources through synthetic oils
- Reduction of the import quota of crude oil
- low production costs
- Abolition of subsidies on fuel

ESA AG
Energy Systems Applications

# Comparison of technologies : Advantages and weaknesses

| | | Comparison treatment | |
|---|---|---|---|
| | | | |
| Description | Bio-fermentation | Pyrolyse (varied by type) | Conversion catalytic CCC |
| Processus | not anaerob | absence of oxygene | 99% anaerob |
| Timerange | very slow | slow, no O2 injected | very fast ( 1,2 to/h ) |
| Inputs | organic material | Plastic, tyres | all types of waste containing carbon |
| | biologic fermentation | partial incinerated | 100% anaerob |
| Output Gas | Biogas, Methan, H2, CO | Gas, H2, CH4, CO, | Methan, Butan, Propane (2-3%) |
| Output fuel | none | combustibles liquid | Diesel, Cerosine, essence |
| Output solid | none | solid, Petcoke | carbon black |
| Residues | CO2 (NOx ) | CO2, CO, Nox | none , no harmful gas |
| | leachate | Petcoke, % dépends on type | $H_2O$ purified |
| | Solid remainders | Ash | Ash |
| Efficacity | < 40% méthan | various, depends on type | Municipal waste 30-45% |
| | 30% CO2, CO, H2 | | Use tyres 60-70% |
| | Remainders to discharge | | Plastics 70-90% |
| Application | Heat by gas motors | Cogeneration electricity | Cogeneration electricity |
| | Heating systems | post production of carburants | Tri-génération heat / steam |
| | | | Primary material for industrial reuse |
| | | | raffinated carburants |
| | | | Carbon black, ash for landfills |
| impacts | Open system | closed system (depends type) | Système totally closed |
| Gas | used | used | used for internal heating |
| Liquids | high water pollution | partial used | purified water, no leachate |
| Solids | pollution (discharge) | discharge | ashes ( landfill use possible ) |
| | purification required | purification (depend type ) | purification of sulfur ,and heavy metals |

ESA AG
Energy Systems Applications

# Société Stadler Gmbh partner <waste treatment>

**STADLER treatment of**

- **Industrial waste and alternative fuels**
- **lightweight and polymeric packaging**
- **household rubbish**
- **Paper and cardboard**
- **Plastic bottles and foils,**
- **Used Tyres**
- **Mixed composition/ Bulky waste**

**STADLER components**

- **Ballistic separators**
- **Magnetic separator**
- **Infrared NIR separators**
- **screen drum**
- **Routing techniques**

ESA AG
Energy Systems Applications

# Treatment center and production RDF ( 1. stage)

- Household and industrial waste must be treated in a specific manner before entering the CCC cracking reactor.
- This is done by:

A) Pre-grinding and commination

- Micro-Companies must be equipped with a truck in which a pre-shredder is already installed. This greatly reduces the volume.

B) Drying

- The treatment system may optionally be equipped with a dryer which largely eliminates the residual moisture, so that no leachate can occur and what must be chemically post-treated.

C) Granulation at a size of 5 to 20 mm (RDF)

ESA AG
Energy Systems Applications

# Sorting installations (examples)

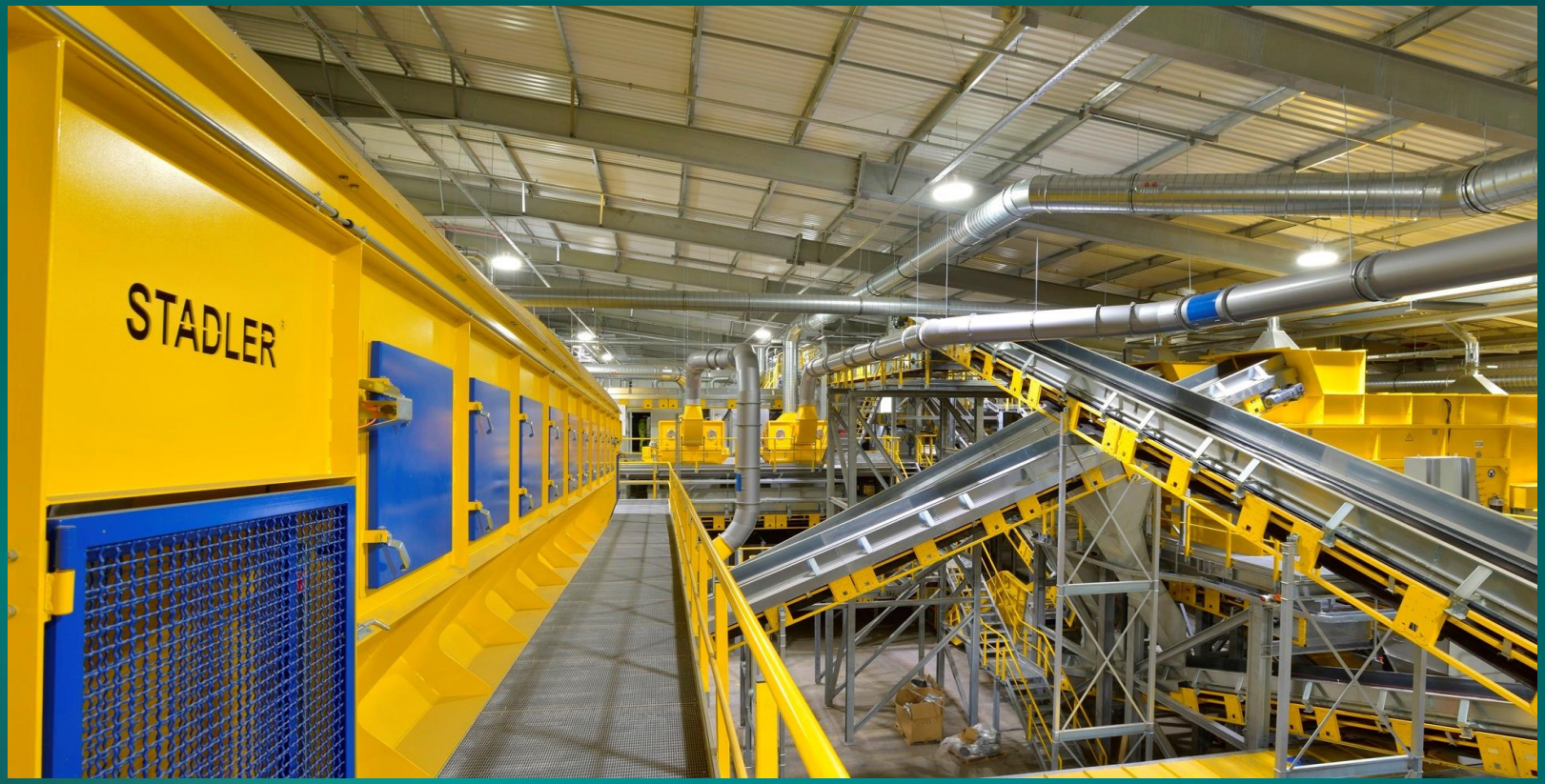
## ROAF, Oslo (Norway)

# Eco parc IV, Barcelona (Spain)


ESA AG
Energy Systems Applications

# Resur, Granada (Spain)

# Amey Cespa, Milton Keynes, England




ESA AG
Energy Systems Applications

## Energetic Valorisation ( 2. stage )

STADLER systems are the most advanced method of sorting and shredding various types of waste, which has been proven in 60 countries. The end product RDF (Refuse Derived Fuel) can no longer be used directly as secondary fuel in most countries due to its high environmental impact.

**What is the solution ?**

**As a result of RDF production, CCC depolymerization occurs**

**The ESA CCC system is unique in the use of RDF in synthetic fuels and / or primary materials.**

ESA AG
Energy Systems Applications

# Presentation of the CCC technology

The process for converting solid carbonaceous substances into liquid synthetic oils used in this project is based on several patents by Professor Wilfried Schraufstetter, a partner of the ESA AG group. The following describes a method by which depolymerization of the starting materials high-quality synthetic fuels can be produced. The essential part of the process has been known for more than 40 years through the catalytic conversion of fossil fuels by synthesis and subsequent condensation of liquid hydrocarbon vapors in the distillation columns.

The state of the art today is an industrially sustainable factory.

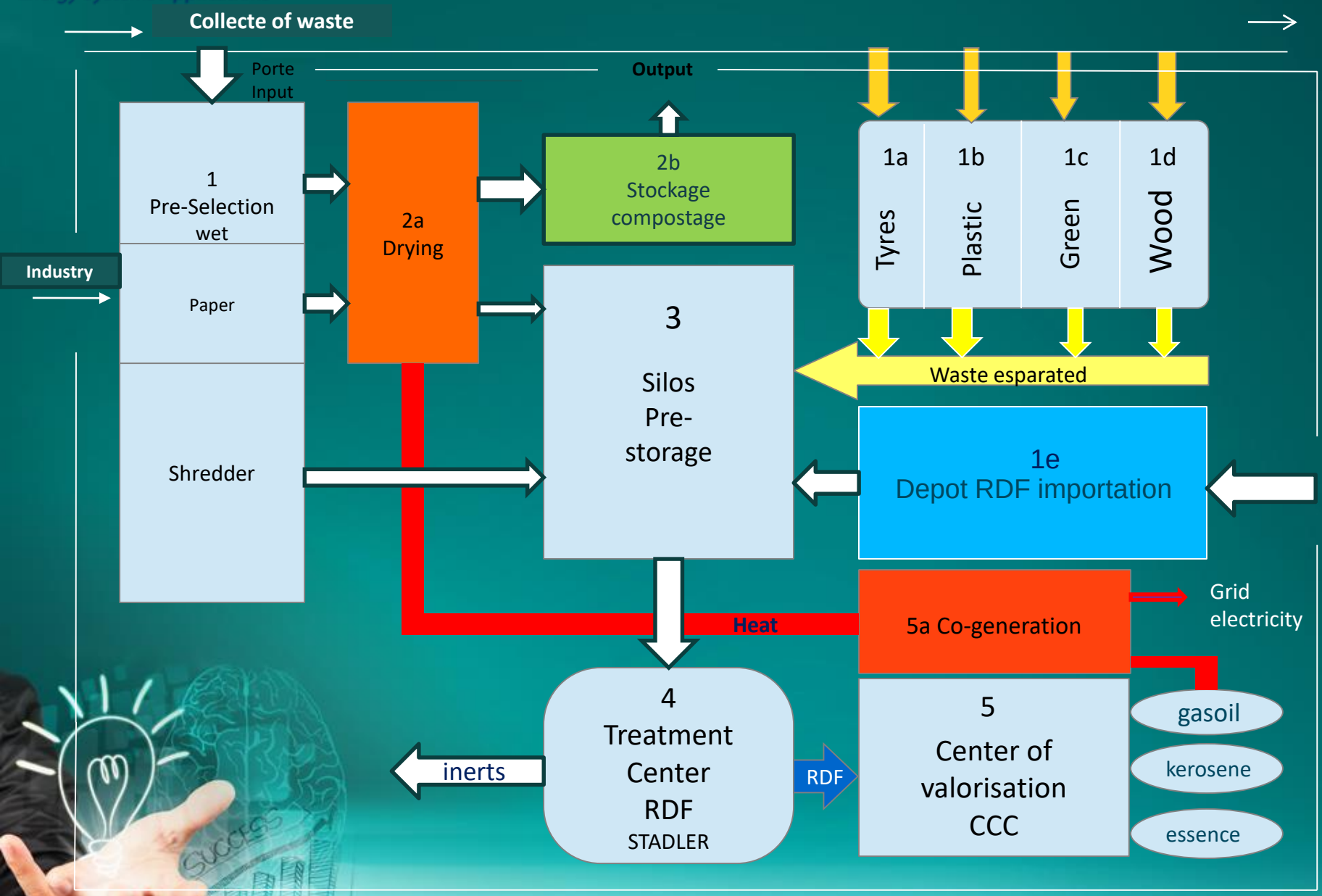
ESA AG
Energy Systems Applications

# Description of the CCC process

- The chosen name "Cold Catalytic Conversion" was born about this essential stages of treatment.
- RDF pretreated waste (dried and granulated) fed to an extruder where they are compressed
- (Evacuation of the air). Then they will be with the Catalyst. These are then depolymerizedd by a Temperature of 380 ° C (cracked) .In addition to ensuring the absence of oxygen in the thermal process, the measurement of the constant oxygen content is carried out.
- The reactor operates almost without pressure (less than 1bar), so there is no danger from the operation itself. At the outlet of the reactor the oil vapors evaporate
- The resulting substances are condensed, purified and collected in different tanks, depending on the chains of Hydrocarbons ready for further use.

ESA AG
Energy Systems Applications

# Example of site ‘‘Treatment and valorisation center‘‘



ESA AG
Energy Systems Applications

# Project diagram

Réception MSW/Industriel
Pneus
Plastique
Papier, Carton

Micro-compagnies


Tri ( STADLER )

Fraction humide

Boues papier
Boues d'eau
Margines d'Olives


Stockage RDF
fraction seche

Extruder
Fraiseuse
Mixage




Centre
de
control



Chauffage

Gaz

Separateur/ Tamis

Vapeur

Katalysateur

Reservoir

Filtres

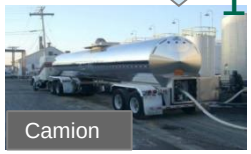
Carbon black

Cendres

Eau


Vente

Decharge





**Schema d'usine CCC- complete**



29/12/2019

ESA AG
Energy Systems Applications

# Options of applications

The following 3 tables show the characteristics of the operating costs of the reactor (28 to / day) compared to the 2 main parameters
a) Cost of primary material (purchases, free, payment)
b) Type and composition of materials (RDF, tires, plastic)

The estimate of the selling price is based on the price O.M.R. Ex refinery (net) less 20-25%

The end products of the CCC process are various synthetic fuels
The use offers different possibilities depending on the customer's wishes
Electricity generation and heat utilization through combined heat and power
Fuels for trucks, cars and planes
Fuels for industrial plants with high energy requirements
Raw material for the production of new oil-based products

# Summary of performance CCC

On the production of petroleum distillates, the gross market price is compared with the operating costs for the production of synthetic oil from all types of waste.
The operational and administrative production costs were assumed to be constant for all different inputs. (RDF, tires, plastic)
The production costs per liter therefore depend on only two parameters:
Calorific value 3 kWh RDF  8.5 kWh plastic
Fee of the input material + 15 € / tonne free -> -10 € / tonne
The use of household waste gives the worst result of crude oil in because of its low calorific value and energy consumption
in connection with drying to avoid leaching.

| Results : ( per liter ) | CCC | Barrel crude | Economy |
|---|---|---|---|
| **Production cost of carburants** | **0,05-0,12 €** | **6,36-19,08 €** | **25-70 %** |
| **Performance results for 21 Million tons/year** | **8,7 MW** | **electric** | |
| | **14,7 MW** | **thermic** | |

ESA AG

Energy Systems Applications

# Thank you for the attention