



WASTE



TO



OIL



CASSANDRA OIL CO

From waste to oil with new ground breaking technology

Environment.

The company's focus is :

- to reduce waste going into landfill
- to deliver cost effective and environmentally-friendly processes



Market Leading Technology.

The CASO technology is based on a patented reactor, that enables production of oil from materials containing hydrocarbons. A proven market leading platform utilising catalytic cracking .

Production.

These systems produces synthetic crude oil. Production rates of up to 2 tonnes of oil per hour, depending on specific feed-stock and other variables.

Key Stats

Cassandra Oil was founded in 2011 and is listed on the Swedish stock market Nasdaq First North since 2012.

The founder, Anders Olsson is a holder of multiple patents prior to the CASO Technology invention.

CASO platforms are currently operational in: Sweden, Iraq and Spain

The company is based in Västerås, Sweden and has 20 employees and consultants. As well as field engineers on international sites.

Key Recycling Markets

Tires/rubber



Plastics



Oil/sludge



WASTE MATERIALS SUITABLE FOR THE CASO TECHNOLOGY



PLASTICS

90 million mt of plastic waste goes into land fill per year in the western world.

10 million mt – Europe
1 million mt – Uk.

Within EU the regulations around the dumping of waste are constantly getting stricter.



WASTE TIRES

1 tire per person/year is disposed annually in the western world.

=10 Million Mt. A fire in a tire mountain would be an environmental catastophy. Certain areas of discarded tires are large enough to be seen from space.



HEAVY OIL AND SLUDGE

The heavy part of the crude oil has historically been dumped straight into the environment in many oil producing countries and this is an enormous source of raw material for Cassandra Oil

LANDFILL STATISTICS IN EUROPE



No waste including more than 7% hydrocarbon allowed in landfill by 2020.

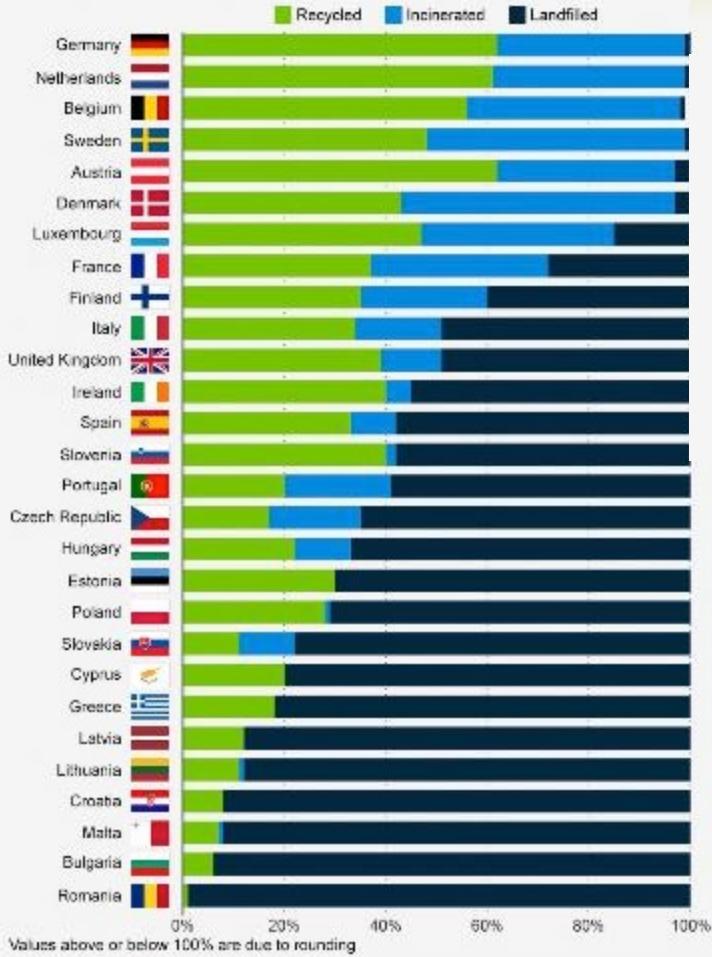
UK landfill deposit fee @ £ 82,50 per mt which is higher than most European countries.

RECYCLED + COMPOSTED

INCINERATED

LANDFILLED

Waste management in Europe



EU LEGISLATIONS 20% by 2020

Renewable energy directive

- The Renewable Energy Directive establishes an overall policy for the production and promotion of energy from renewable sources in the EU.
- It requires the EU to fulfil at least 20% of its total energy needs with renewables by 2020



LEGISLATIONS



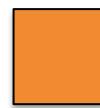
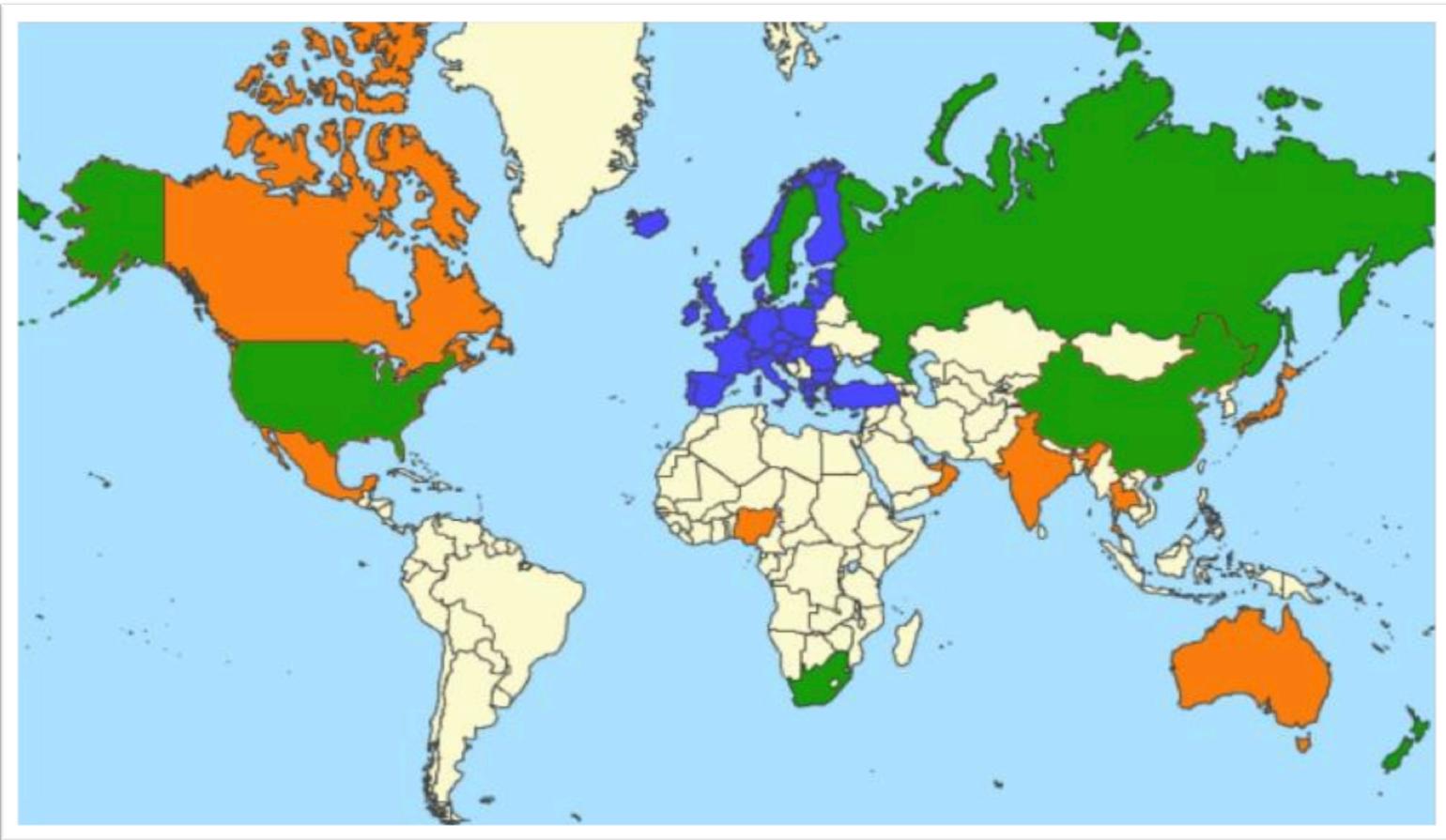
PRODUCER RESPONSIBILITY

The law defines the legal framework and assigns the responsibility to the producers (tyre manufacturers and importers) to organise the management chain of end of life tyres.

Countries with a Producer Responsibility regime: Belgium, Bulgaria, Czech Republic, Estonia, Finland, France, Greece, Hungary, Italy, the Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden and Turkey.

By professionalising the service providers – collectors, sorters and reprocessors – the goal is to significantly improve the recovery rate and traceability and develop applications with added value which utilise the full potential of the properties of rubber.

PATENTED TECHNOLOGY



Applied National



Applied EPO



Approved

INVESTMENT/ OPERATION COST OF OIL EXPLORATION

Cost analysis published 30/12, 2013
in Dagens Industri, Sweden by Olle Aronsson

Country or region	Project type	Cost of Investment \$000/ barrel / day	Operational Costs (\$/barrel)
Brazil	Ultra deep sea drilling	45-55	15-20
Canada	Oil sand	100-120	25-30
Iraq	Traditional exploration	10-15	2
Kazakhstan	Deep sea drilling	70-80	15-20
Saudi Arabia	Traditional exploration	15	2-3
USA	Oil shale	90-100	8
West Africa	Deep sea drilling	70-80	25-30

Cassandra Oil figures

Cassandra Oil

CASO 600

15-30

20-25

IRAQ- OIL LAKES AND CONTAMINATED SOIL



Cassandra Oil provides a tailor made solution that address a broad spectrum of customer needs.

A specific solution is provided after an in-depth understanding of the unique project specifications and analytical tests.

The CASO Technologies have been developed to meet or exceed strict regulations regarding treatment of hydrocarbon waste materials.

Cassandra Oil's temporary site situated by Bajwan crude oil trap on North Oil Company's territory in Iraq.



Iraq- plan of permanent site

MIXED WASTE FROM THE OIL INDUSTRY= RAW MATERIAL

W
M

Oil lakes- a threat
to the environment

Plastic oil barrels, a waste
product from refineries which
can be processed in CASO.



SAUDI

Cassandra Oil and TECO (Tomorrow Environmental Company) have agreed to form a joint company based in The Kingdom of Saudi Arabia with the main intention to process oil waste products relating to TECO's licence with ARAMCO.

The JV will also process other hydrocarbon rich waste such as used tires.



CASO SPAIN PROJECT

Sacyr

Sacyr group (www.sacyr.com)

Spanish company with 70,000 employees with operations in construction, real estate, energy and waste management.



Energy Plants

Waste Treatment

Electrical Installations

Oil & Gas

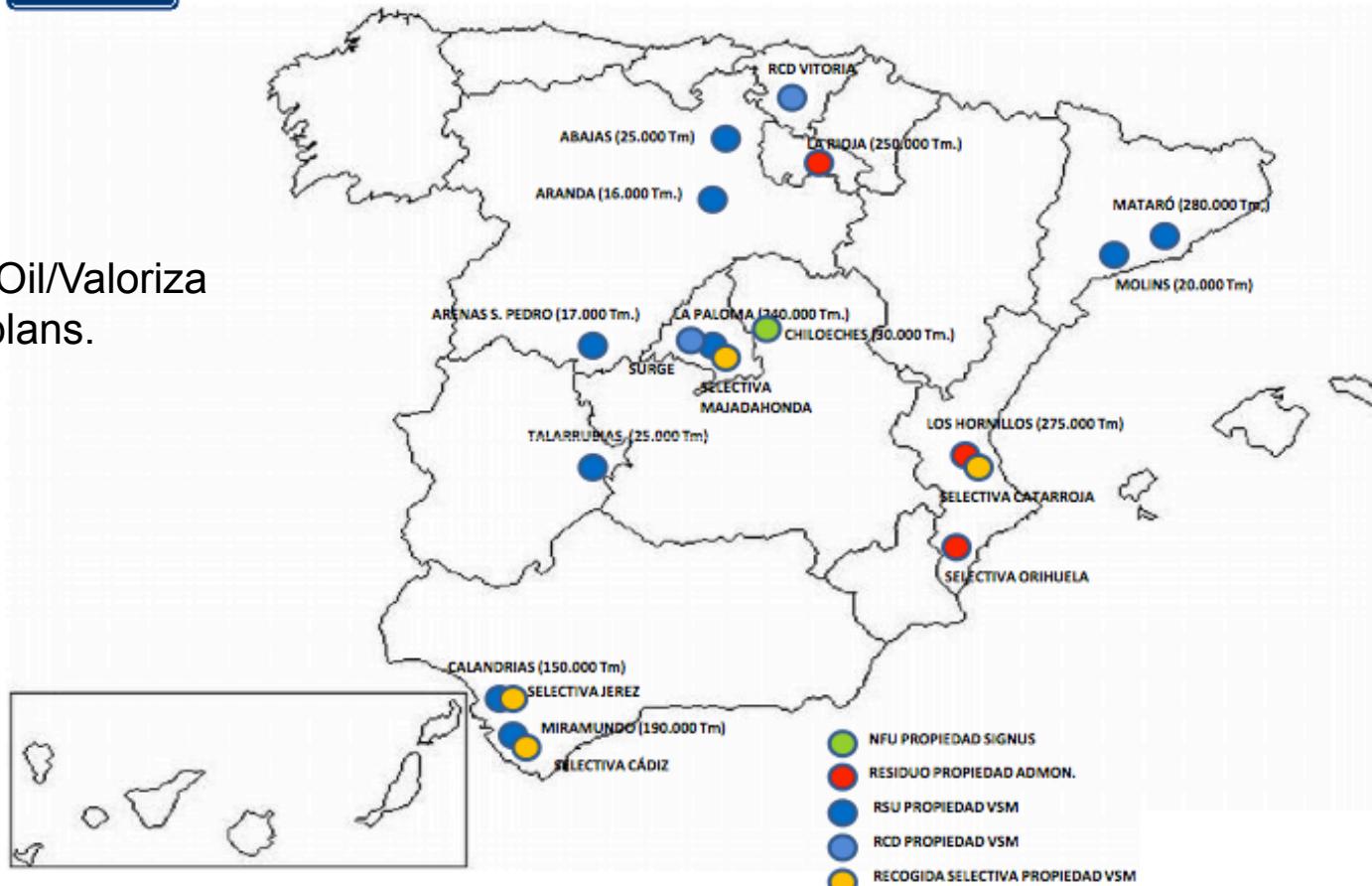
Sacyr and Cassandra Oil have joined forces to implement the first CASO WtE plant in Spain to process waste plastics and waste tires into energy.

CASO SPAIN PROJECT



Dimensionamiento Plantas con presencia de VSM

Cassandra Oil/Valoriza expansion plans.



CASSANDRA OIL- VALORIZA SITE IN JEREZ



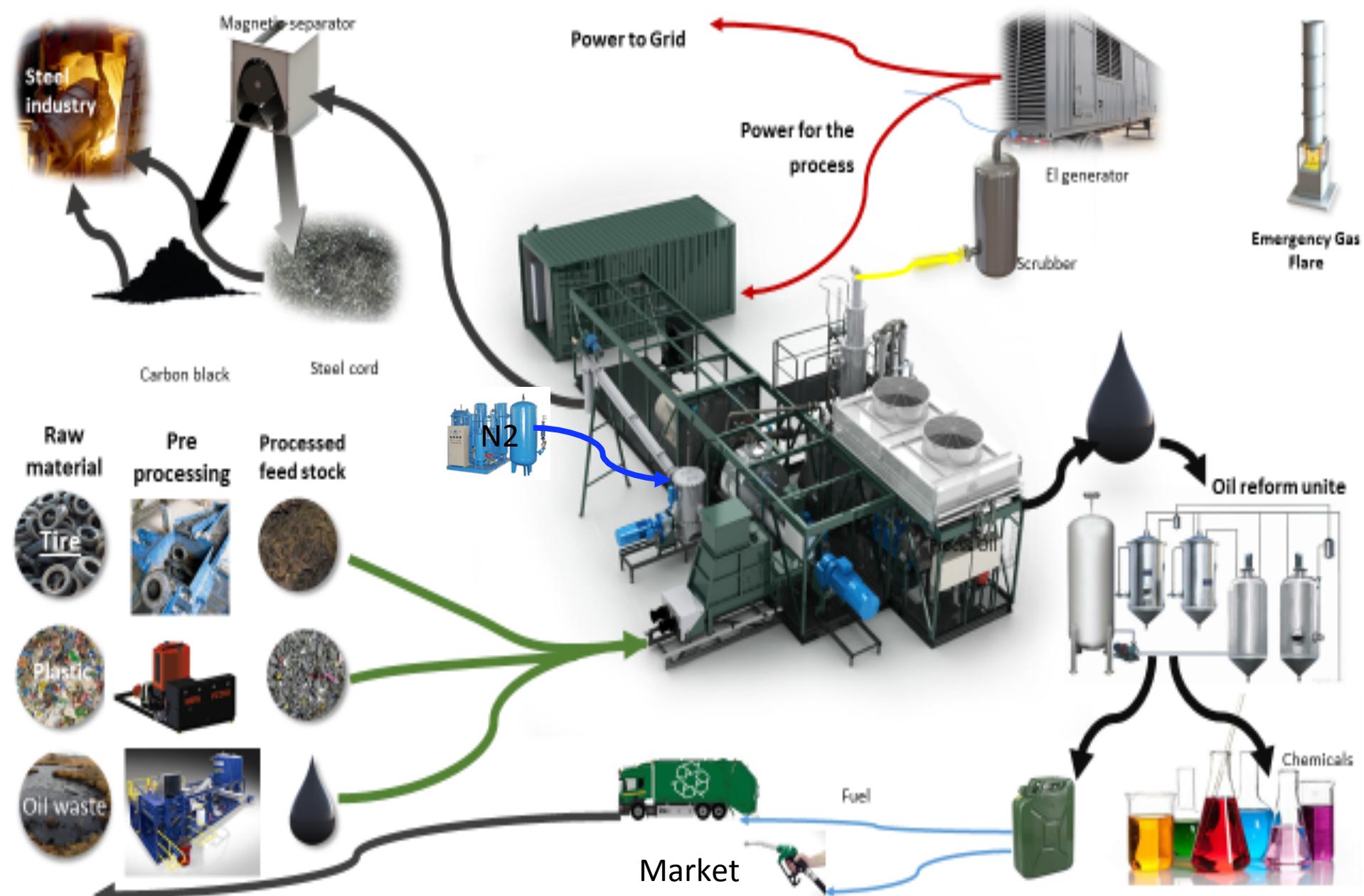
▲ 44milla

CASO 600 @ JEREZ SITE



Plastic
Tires

CASO CIRCULAR ECONOMY WASTE RECYCLING FLOW



CASO CIRCULAR ECONOMY WASTE RECYCLING FLOW

Råvaror

Generellt krav är en fukthalt <5%, vilket kräver förbehandling eller säkerställd hantering.

Mindre föroreningar i form av sand, jord, papper och trä stör inte processen.

Däck

- Klippning av däck till ca 5x5 cm, ingen separering av stålcord nödvändig

Plast

- Krossning till ca 5x5cm, sortering för att få bort PVC, järn och större främmende objekt

Oljesludge

- Säkerställa att oljesludgen har en viskositet som gör den hanterbar i processen

CASO CIRCULAR ECONOMY WASTE RECYCLING FLOW

Processgas, icke kondenserbar, en blandning av gaser som sträcker sig från Metan till Pentan.

Möjliga tillämpningar av processgasen som kommer att bero på vilken marknad och kund som anläggning kommer att befina sig på

- Värme- och kraftgenerering i tex värmekraftverk för fjärrvärme
- Egen el- och värmegenrering för drift av anläggning samt kringprocesser
- Förädla gasen till en kommersiell produkt, tex gasol

Kolpulver och stål

- Kolpulver har många möjliga tillämpningar, allt från förbränning till insatsvara i tex tillverkning av nya däck, färgpigment mm.
- Stål återförs till stålindustrin för återanvändning

Processolja

Vi arbetar aktivt med olika tillämpningsnivåer, val av tillämpning kommer att bero vilken marknad och kund.

Oljan är en råvara för att producera nya däck, plaster eller andra produkter.

Raffinaderi

- Oljan är jämförbar med Brent Crude och kan användas för framställande av drivmedel och andra kemiska produkter

Marin diesel

- Fördela oljan till ett drivmedel anpassat för tex sjöfart eller som en inblandningsprodukt.

Petrokemisk industri

- Oljan kan vidareförädla till en mängd specialprodukter tex white spirit, specialoljor mm



CASSANDRA OIL - REPLACING FOSSIL OIL

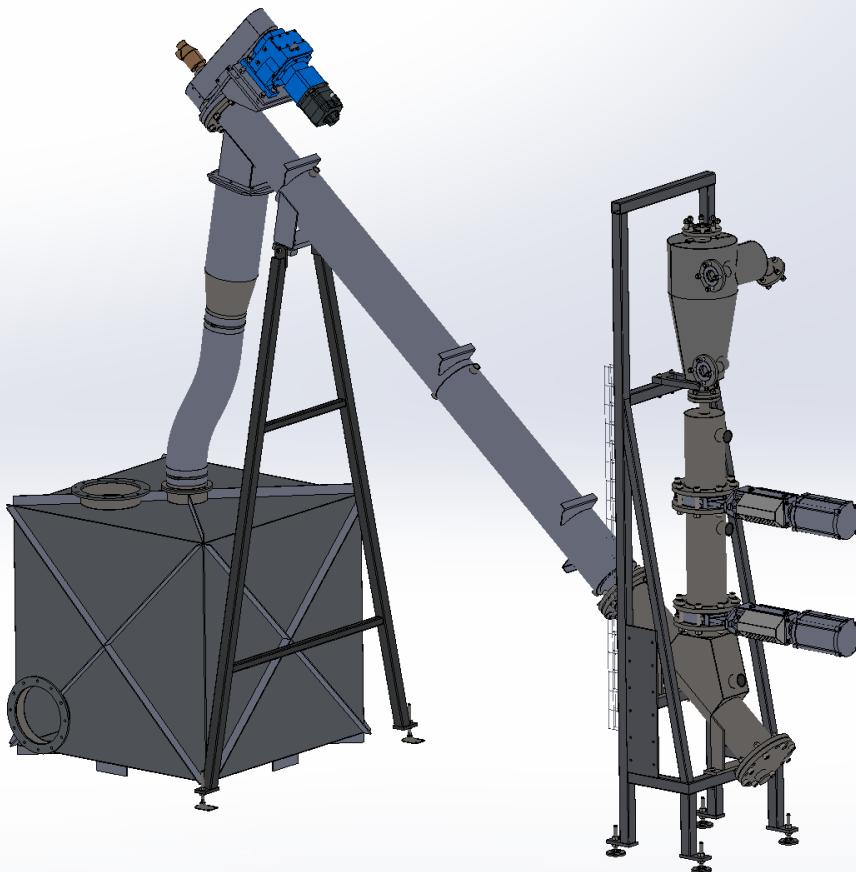
OIL FROM THE GROUND IS REPLACED WITH OIL FROM WASTE

1mt of plastics = 0,9 mt of oil

1 mt of tires= 0,45 mt of oil

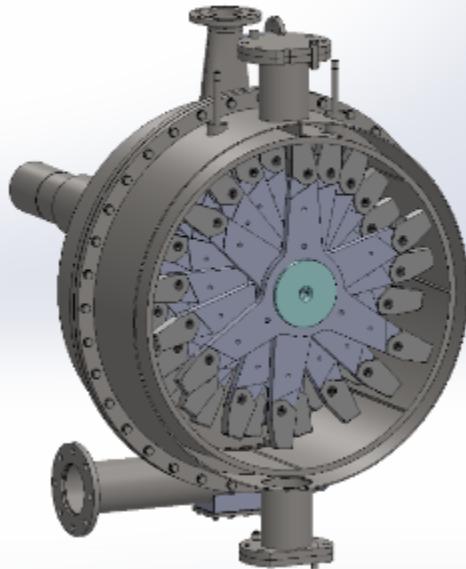
1 mt of oil sludge= 0,8 mt of oil

CASO TECHNOLOGY



Process oil out

VAD ÄR KRACKNING?



5 stycken grundläggande mekanismer

Initiering

Väte abstraktion

Radikal sönderdelning

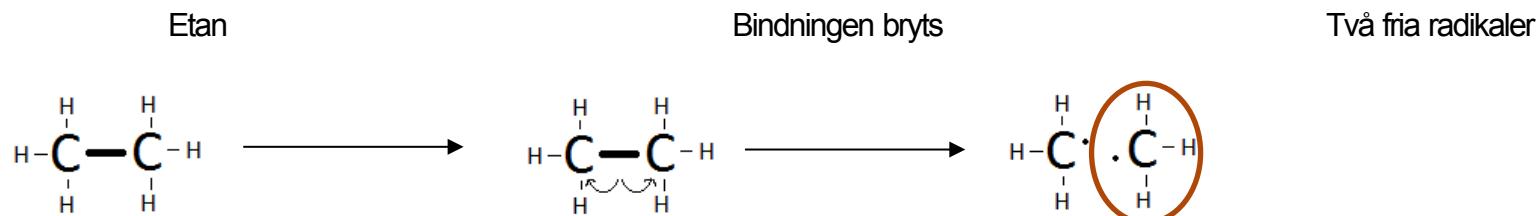
Radikal addition

Terminering



Initiering

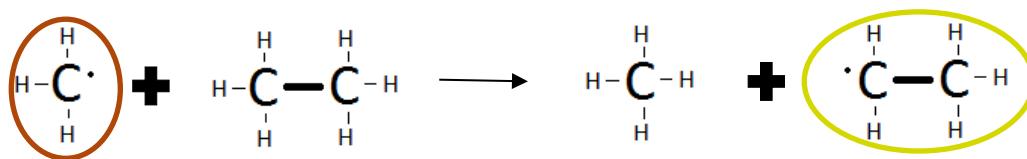
– Värmeenergin bryter bindningen mellan kolatomerna.



– Två fria radikaler har bildats, vilka är mycket benägna att reagera vidare och uppnå en stabilare form

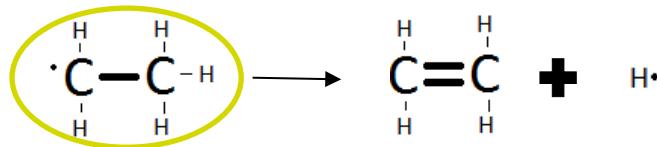
Väte abstraktion

– Radikalen flyttar en väteatom från en annan molekyl



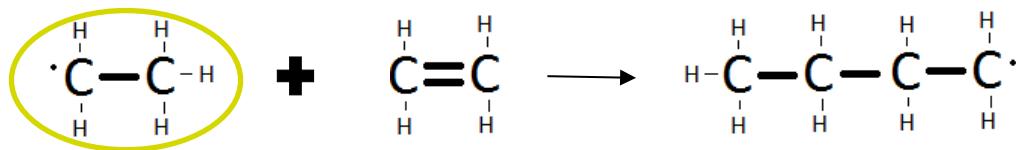
Radikal sönderdelning

- En fri radikal bryts upp till två molekyler, en alken och en nyformad fri radikal



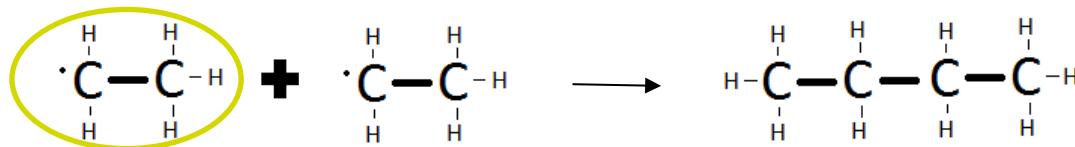
Radikal addition

- Inversen av radikal sönderdelning.
- En större fri radikal skapas
- Resulterar i tyngre produkter



Terminering

- Två fria radikaler slår ihop sig
- Krackningsreaktionen stoppas



MEKANISMER

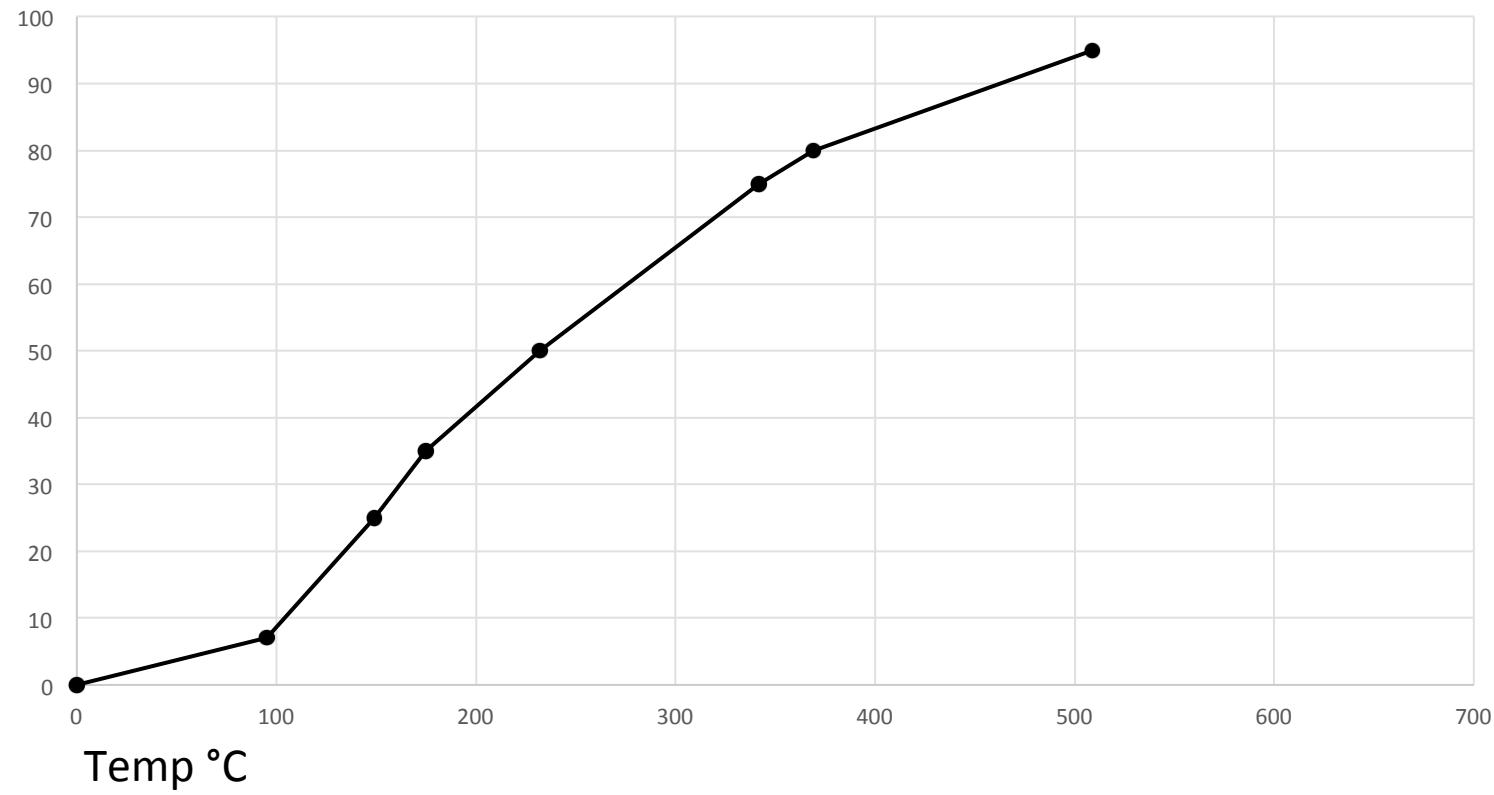
Sker spontant under hela krackningsprocessen

Målet är att klippa de långa kolkedjorna till lagom längd

När produktgasen lämnar reaktorn stoppar krackningsmekanismerna

DISTILLATION CURVE

vol%



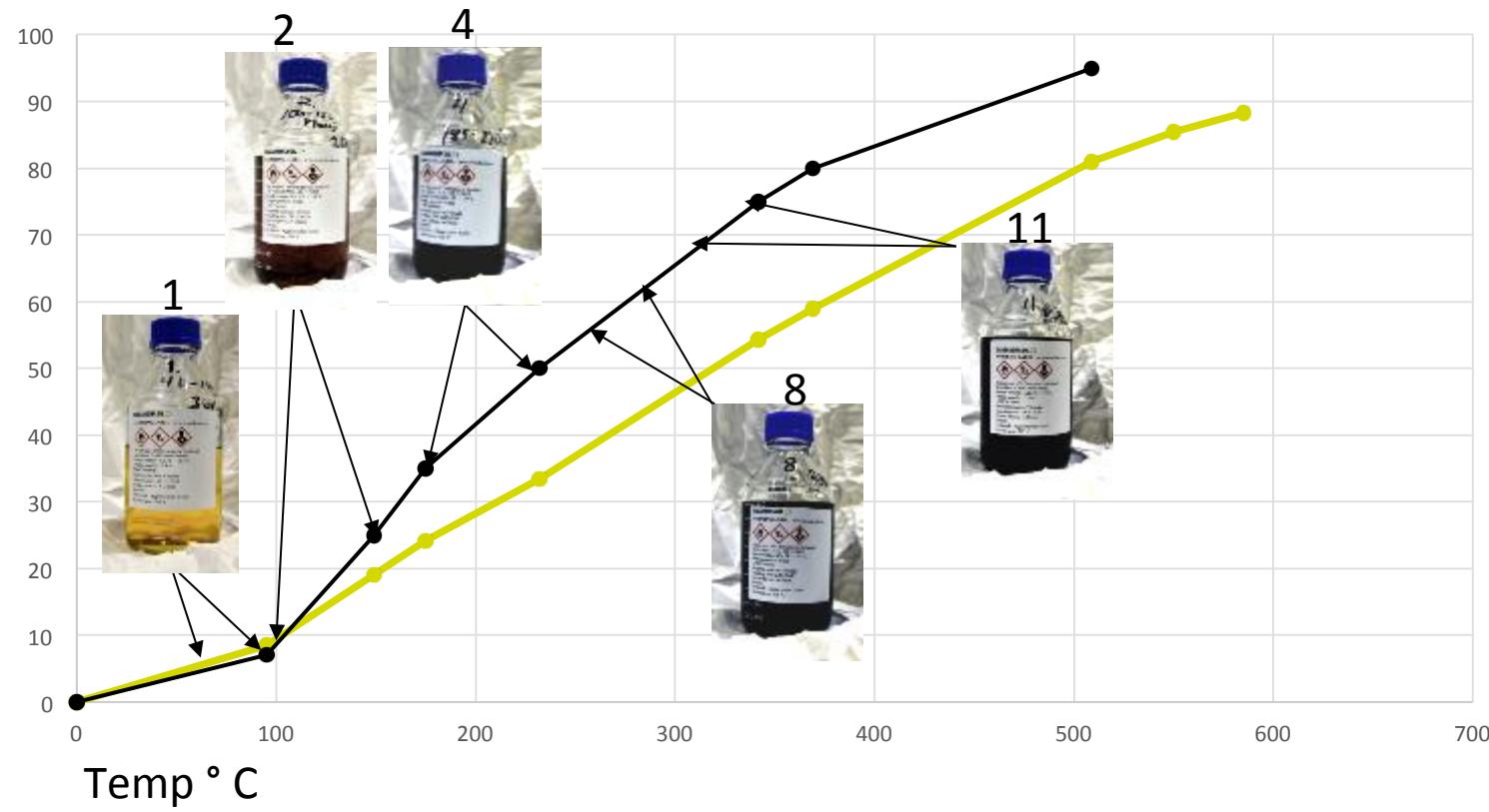
—●— CASO Plastic Oil Saybolt

DISTILLATION CURVES

Distillation Curves

Comparing CASO waste plastic oil with,
Brent Crude (BP Assay), CASO oil from tires
(SAYBOLT test),

Vol%



Brent BP

CASO Plastic Oil Saybolt

CASSANDRA OIL



Tallolja

VS



Olja från plastgran

- Cirkulärt samhälle
- 20% år 2020
- Ersätta fossil råvara

