Producing biodiesel from advanced and waste feedstock

BioTheRos Alternative and renewable fuels

Challenges for a producer of biodiesel from waste feedstock

Feedstock

UCO

Animal fat (CAT.3)

POME

Plant

Pretreatment

Acid esterification

Transesterification

Distillation

Market

RED III (UDB)

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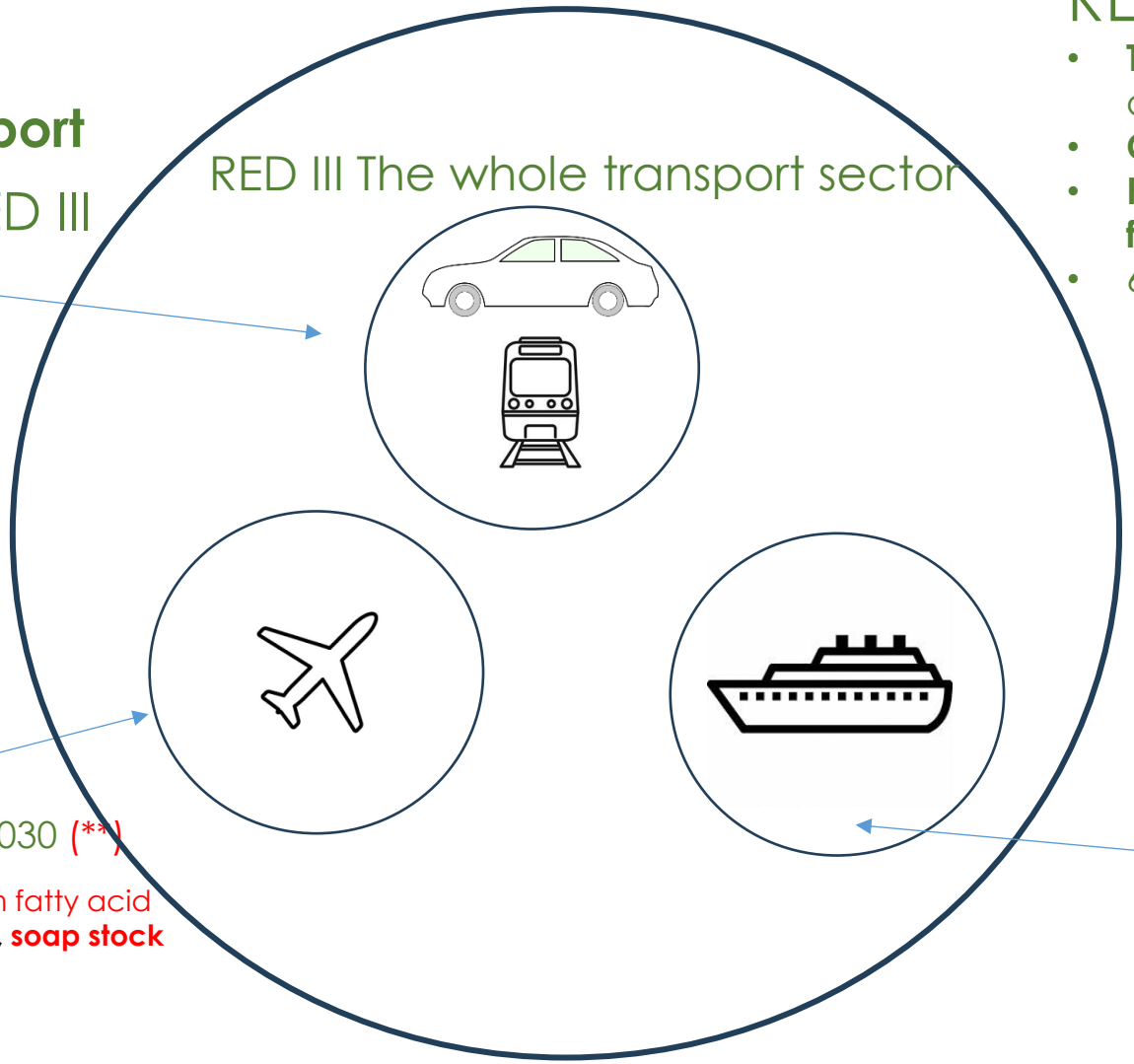
Legislative framework EU

RED III

- **Transport target** (14,5% GHG reduction or 29% energy content) in 2030
- **Cap 7% on food and feed crops**
- **Flexible cap 1,7% on Annex IXB (waste feedstock)**
- 65% GHG savings for new installations

Road and rail transport

Mandates within RED III



REfuelEU Aviation (x 1.2)

Blending mandate

min 2% SAF 2025 → min 6% SAF 2030 (**)

(**) exception food and feed crops, palm fatty acid distillate, palm and soy-derived materials, **soap stock and its derivates**

REfuelEU Maritime (x 1.2)

- GHG reduction

min 2% 2025 → min 6% 2030 (*)

(*) exception food and feed crops

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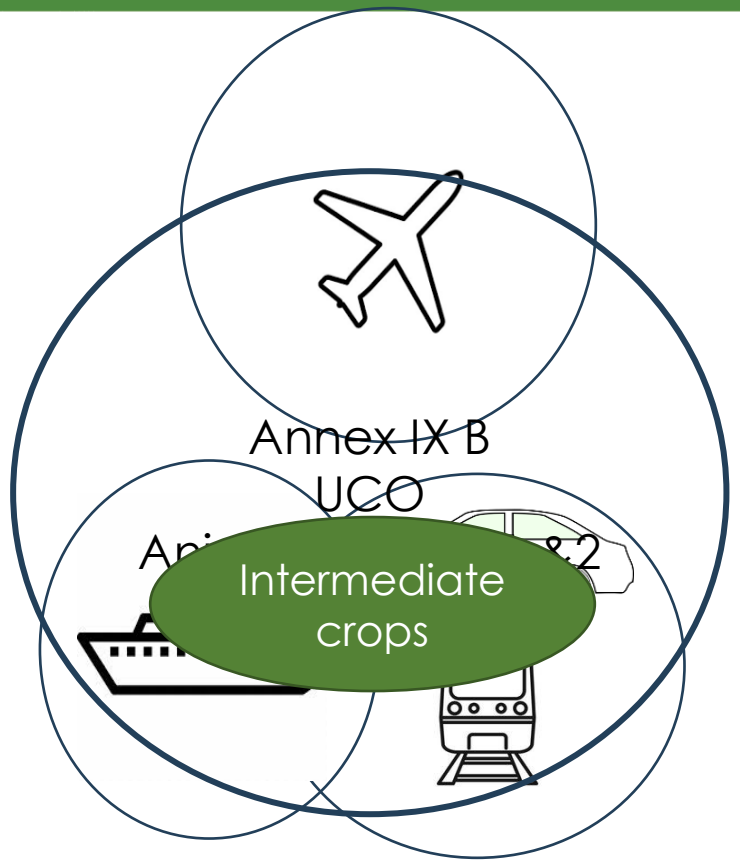
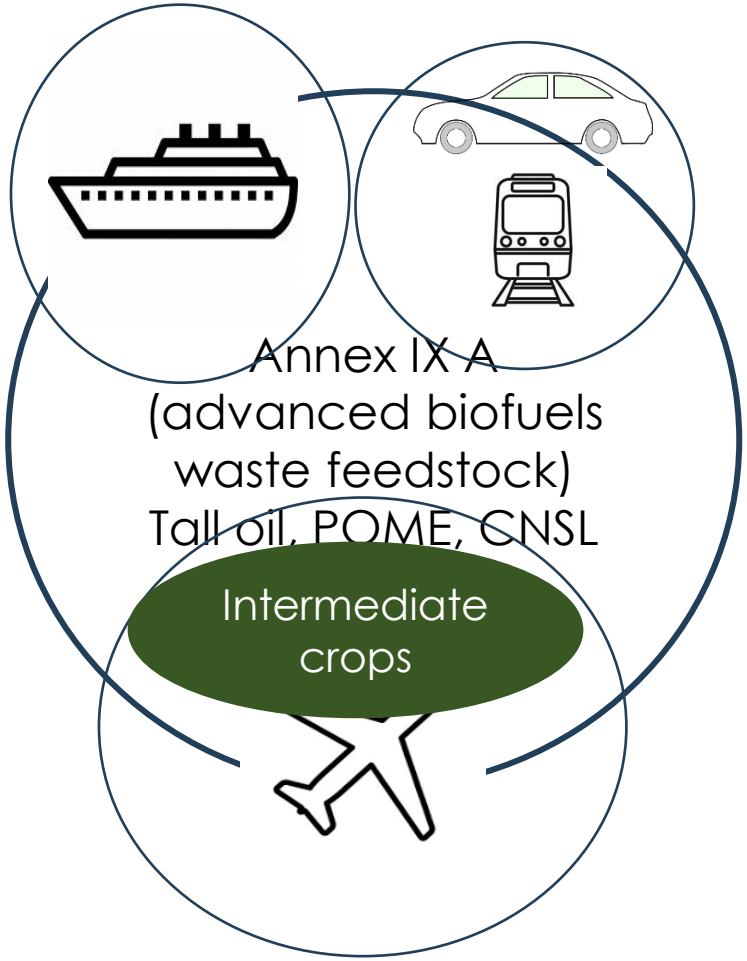
Annex IX Double counting feedstock





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Prasino Ladi S.A. UCO collection and trading

Verd S.A.

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The factory in a nutshell

2007 Original Factory

- Built based on basic engineering plans designed by **PETROTEC**, who supervised the construction and performed the commissioning.
- Production capacity of 240 m^3/day first generation biodiesel, using up to 40% of Used Cooking Oil as raw material

2013 Retrofit

- An Acid Esterification Unit and a Distillation Unit were added before and after the main transesterification unit
- Both with a capacity of 100 m^3/day
- Fully designed, supervised and commissioned by **BDI**
- Construction management performed entirely by VERD staff

Today

- **100 m^3/ day** for 100% UCOME/AF 3, or **240 m^3/day** for first generation biodiesel

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Production

Fully automated production process is performed by a turn-key SCADA system provided by Siemens

The process is continuous and comprises of the following stages:

- Purification of raw materials
- Acid esterification
- Transesterification
- Distillation
- By-products recovery and purification

Purification of used cooking oil and fats

Before being used in the production of biodiesel, the **feedstock**, (used cooking oil and animal fats), **undergoes** a **purification** process in order to **enhance** its **quality** to the specifications of the production process.

Fats & used cooking oils are washed with a **water - acid solution**.

The oil-water mixture then goes through a **centrifuge 3 phase decanter** to minimise the water soluble impurities and is finally **vacuum dried**.

The purification process allows the use of bellow average quality UCO and Animal fat

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Acid Esterification Unit

The high acidity oil coming out from the purification unit, with an FFA content up to **15%** is treated in the Acid Esterification unit in the presence of excess methanol and an acid catalyst, under high pressure and temperature, to reach **< 2% FFA** content before being used as input stream into the main transesterification unit.

Transesterification Unit

The esterified low acidity oil, undergoes a transesterification reaction under the presence of excess methanol and a basic catalyst, (potassium methoxide), towards the production of fatty acid methyl esters (biodiesel).

The product of this unit contains numerous compounds (such as methanol, soaps, catalyst, water) that are regarded as contaminants and need to be washed (3 steps), centrifugally separated and finally vacuum dried, so that the levels of water, methanol and remaining catalyst **fulfill the EN14214 specifications**.

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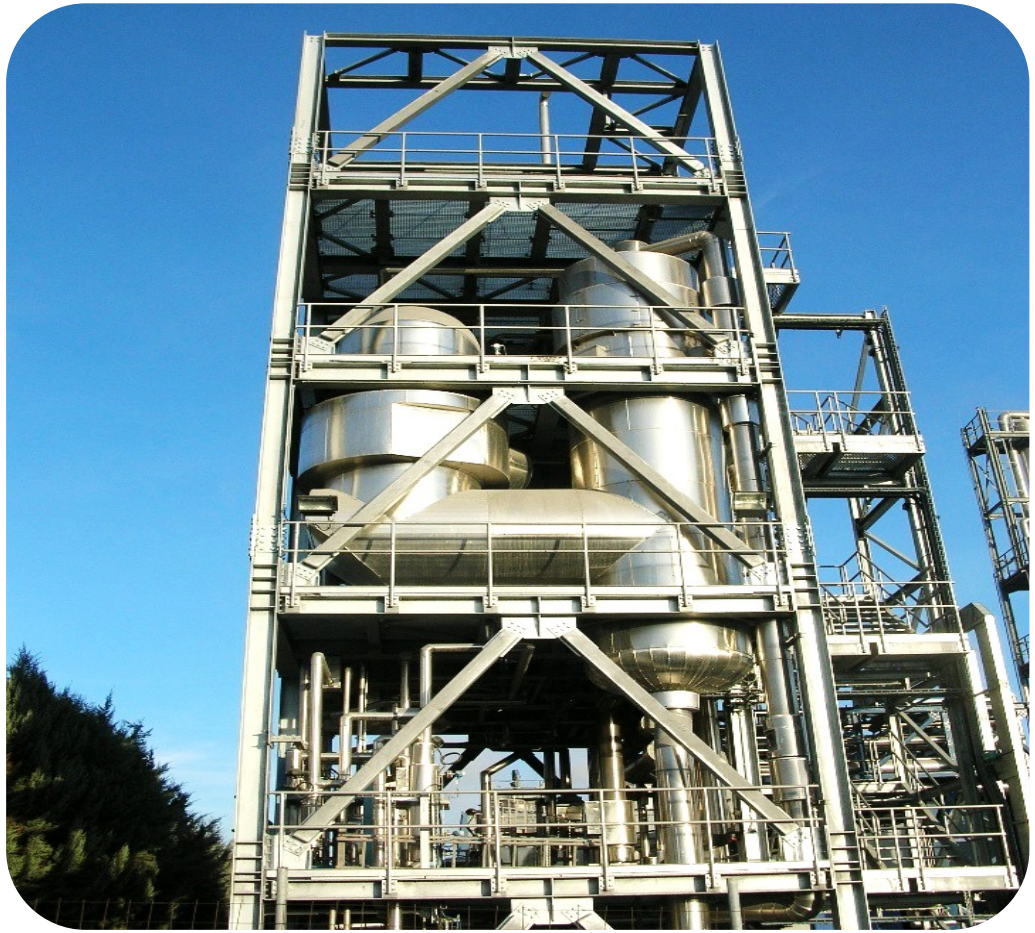
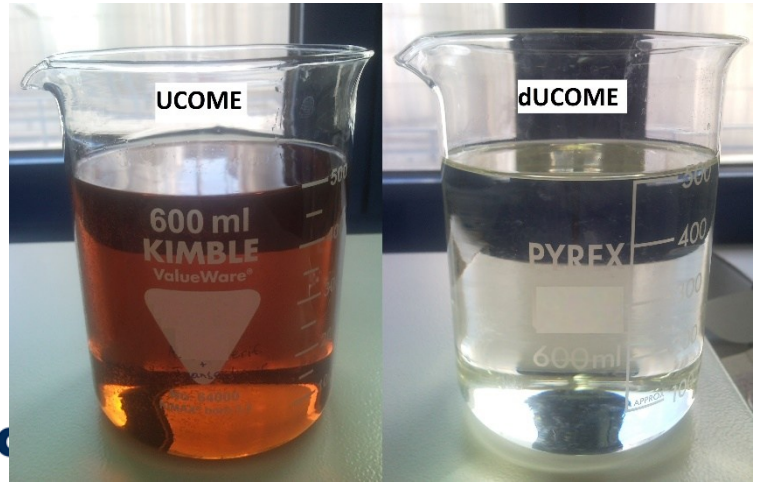
Biodiesel Distillation Unit

Biodiesel produced from waste material is further processed to the biodiesel vacuum distillation unit, so that any heavy components, (such as polymerized fatty acid methyl esters), or traces of sulfur are removed.

As a result, the final product, exceeds the EN14214 specifications, in critical parameters such as saturated mono-glycerides, etc, resulting in **excellent cold start qualities of B07 – B10 mixtures.**



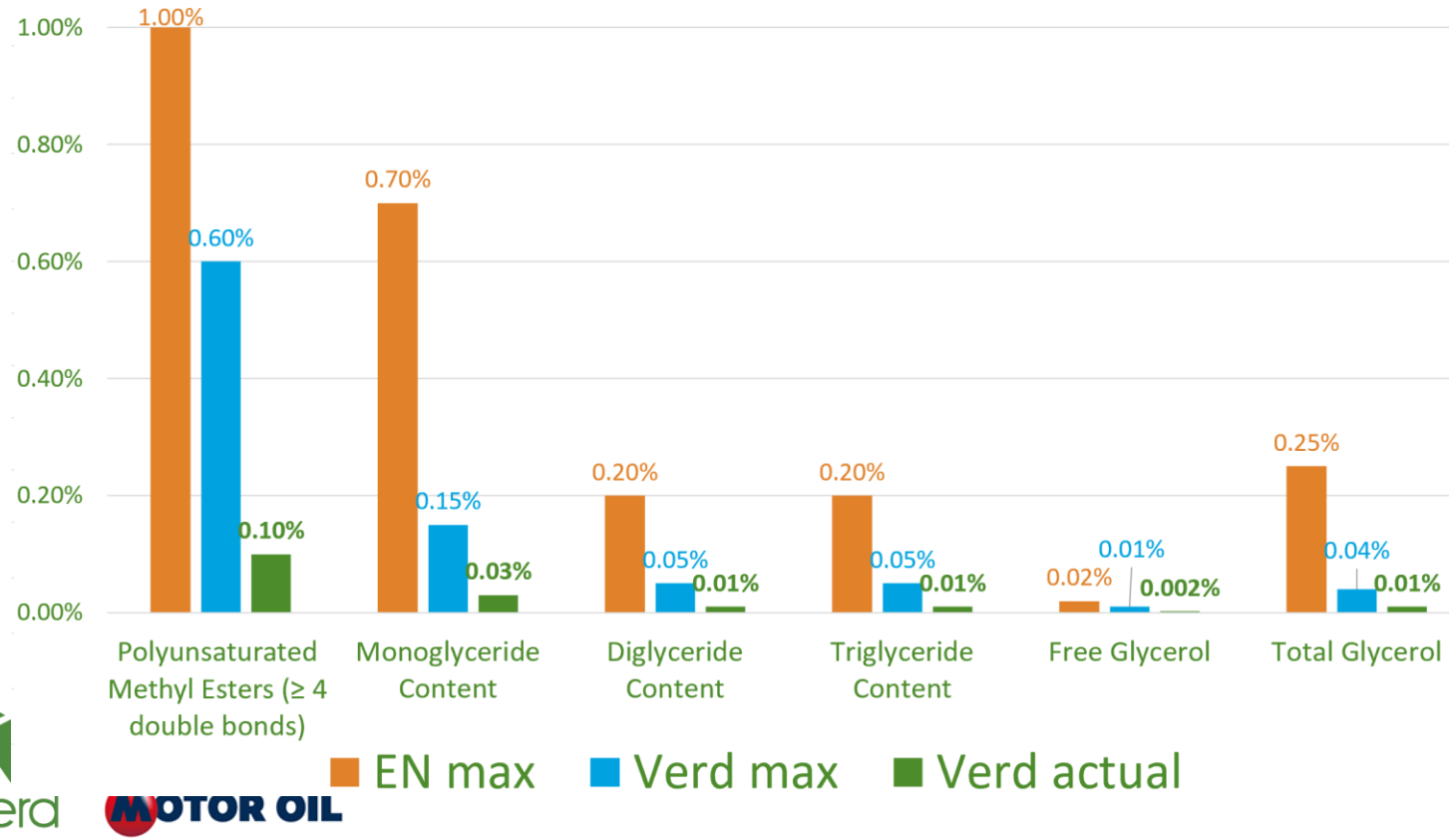
UCOME before and after distillation



Distilled biodiesel

Product

EN 14214 standard max values, vs Verd max and Verd actual values of main parameters affecting cold start properties



Verd has the reputation of the best quality biodiesel producer in Greece

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Thank You