refining & marketing

Green Refinery

Ecofining™ & Green Diesel

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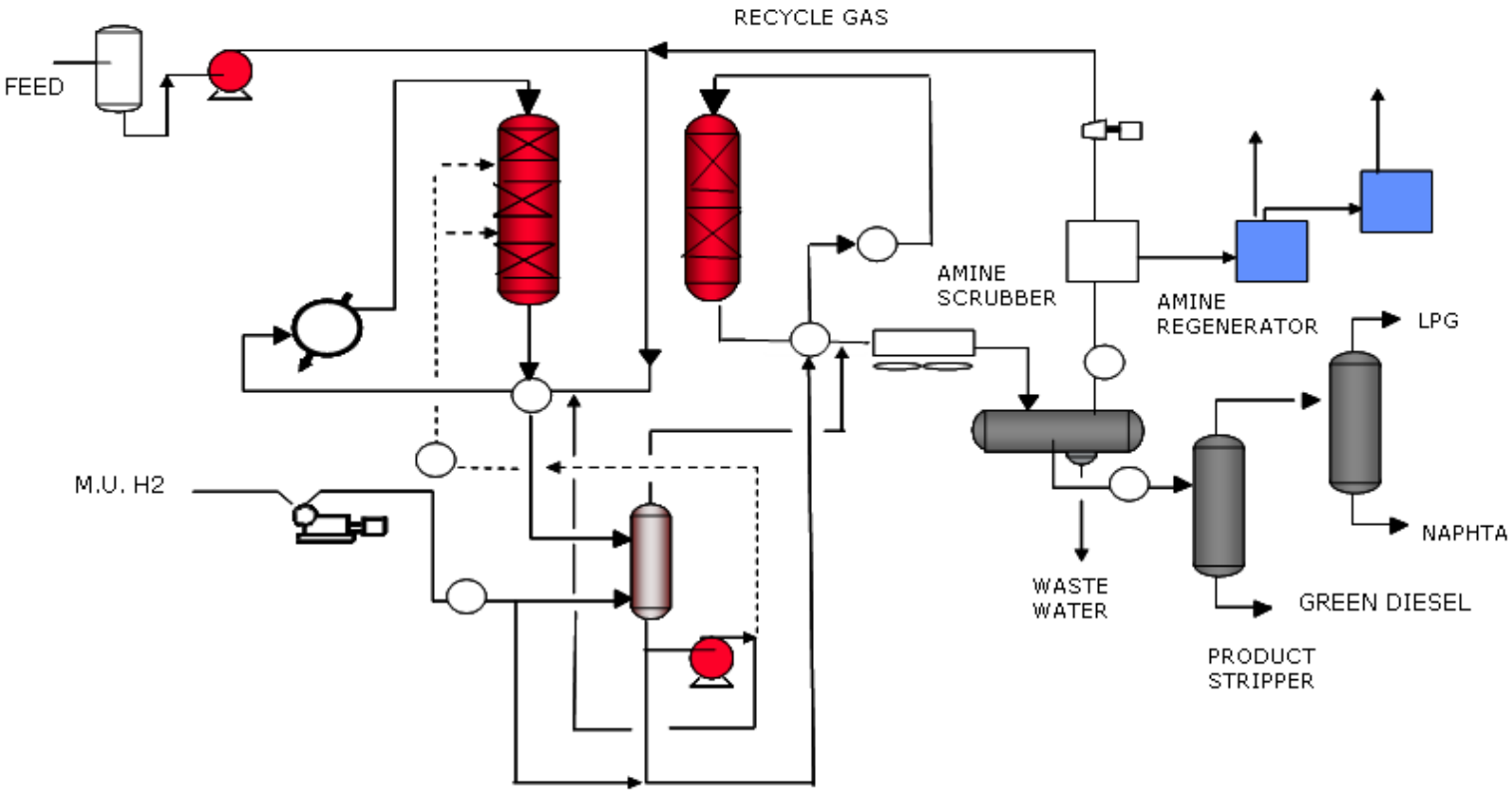
Ecofining™ Process Scheme

Biologically derived feedstock

Hydro-deoxygenation

Isomerization



De-Oxy Oil

Ecofining™

EcofiningTM is a stand-alone two-stages process

First stage
Hydrodeoxygenation

Reactions
- cracking the triglyceride structure
- oil deoxygenation
- saturation of double bonds

Product
completely deoxygenated paraffin-based hydrocarbon with high cetane number and poor cold properties (Č.P.>20°C)

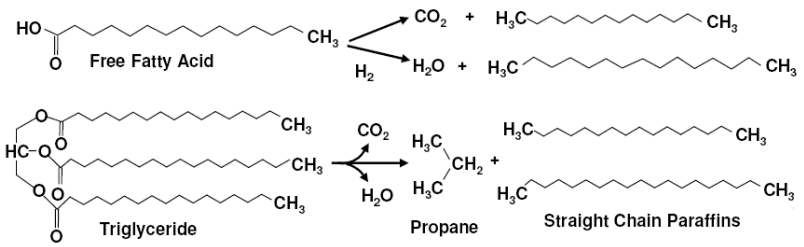
By-product: propane

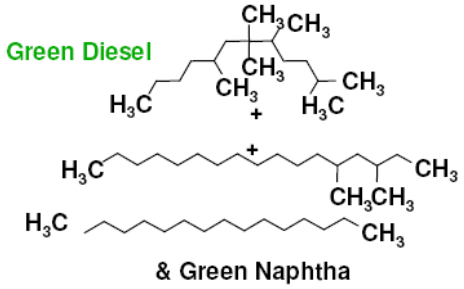
Second stage
Isomerization

Reactions
- cracking of paraffins
- isomerization of paraffins

Main product
Green Diesel, paraffin-based component with isomerization level able to meet cold property

By-products: bionaphtha & bioLPG





Ecofining™ produces Green Diesel

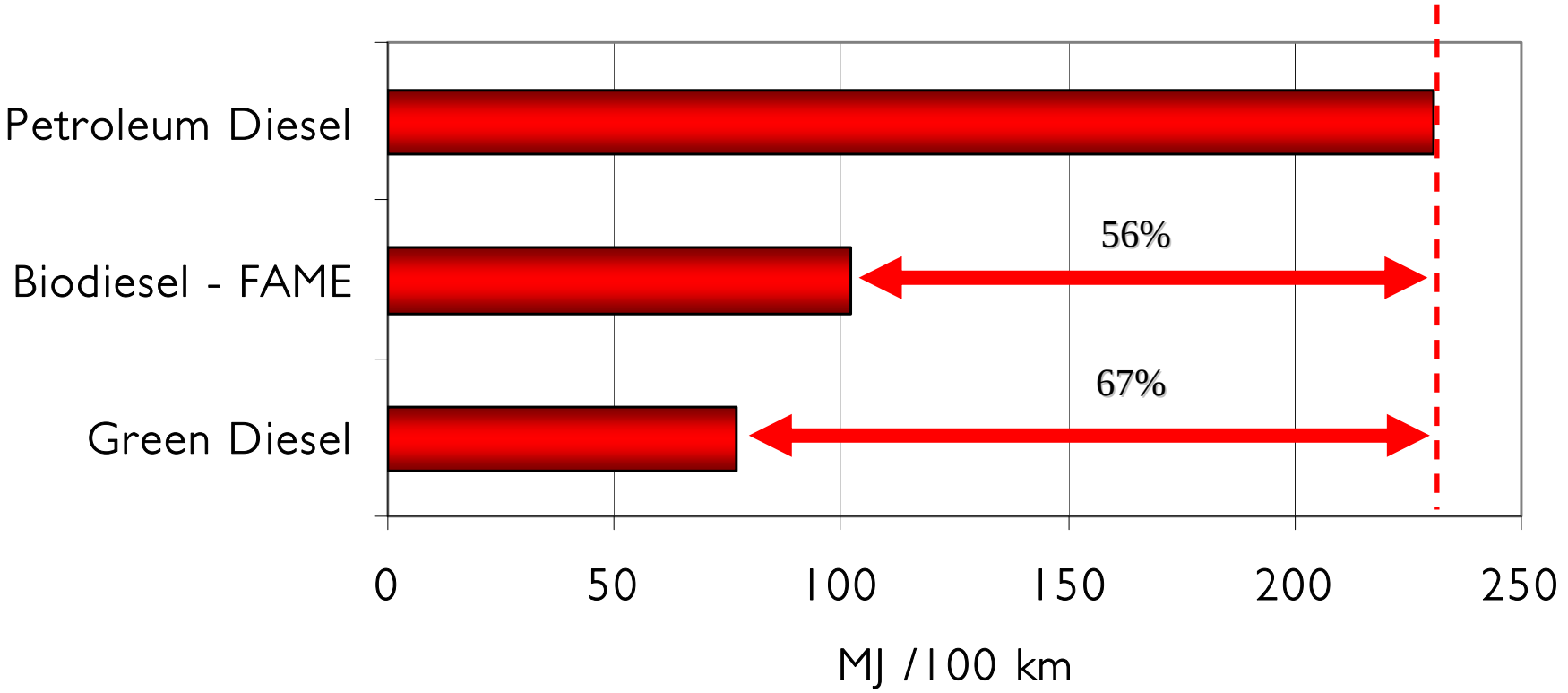
- Product is a high quality cetane component (CN>80).
- No oxygenated compounds in the diesel product (higher energy density).
- No low value liquid by-product.
- Can process low-cost refined vegetable oils, tallow, waste cooking oil .
- Product quality not affected by feedstock origin.
- Stable blending component (no problem for handling and transportation).
- Co-production of propane and naphtha (available to produce H_2 for the process).
- Low density, so it can be used to upgrade high density refinery streams.
- Produced in a "refinery" type unit adopting existing fuel quality control and handling system.

Properties of Green Diesel

- Superior fuel properties relative to FAME.
- Compatible with mineral diesel.
- Compatible with conventional diesel engines

	Ultra Low Sulphur Diesel	Biodiesel FAME	Green Diesel Ecofining™
Bio content	**0**	**100**	**100**
Oxygen Content, %	0	11	0
Specific Gravity	0.840	0.88	0.78
Sulfur content, ppm	<10	<1	<1
Heating Value MJ/kg	43	38	44
Cloud Point, °C	-5	-5 to +15	-10 to +20
CFPP additive sens.	Baseline	Baseline	Excellent
Distillation, °C	200 to 350	340 to 355	200 to 320
Polyaromatics, %w	11	0	0
NOx Emission	Baseline	+ 10%	-10%
Cetane	51	50-65	70-90
Oxidation Stability	Baseline	Poor	Excellent

LCA: Fossil Energy Consumption



LCA: Greenhouse Effect