INVESTIGATING THE ROLE OF BIOREFINERIES WITHIN THE CONCEPT OF CIRCULAR ECONOMY

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SOUTHEAST EUROPE'S LEADING DOWNSTREAM GROUP WITH PRESENCE ALONG THE ENERGY VALUE CHAIN

Refining, Supply & Trading

17Mtpa / 344kbpd
Refining capacity

c. 7m M³
Crude and product tank capacity

60% domestic market share

> 55%
Exports

Petrochemicals

235kt
Capacity (PP)

26kt
Capacity (BOPP)

80% vertical integration
Supply of propylene

>65%
Exports

Marketing

Domestic

1,682 petrol stations under EKO and bp brands

> 30%
market share

International

314
Petrol stations
5 countries

RES

ELPE Renewables

c. 350 MW in operation

>2GW projects in various stages of development

Power & Gas

Power (Elpedison JV)

840MW CCGT capacity

6% retail market share

Gas DEPA (35%)

Infrastructure:
In sale process

International:
Exit considered

Commercial:
- 2.1 bcm w/s
- Retail

E&P

6 Offshore early exploration blocks

Partnership with **credible IOCs**

THE ONLY CONSTANT IS CHANGE

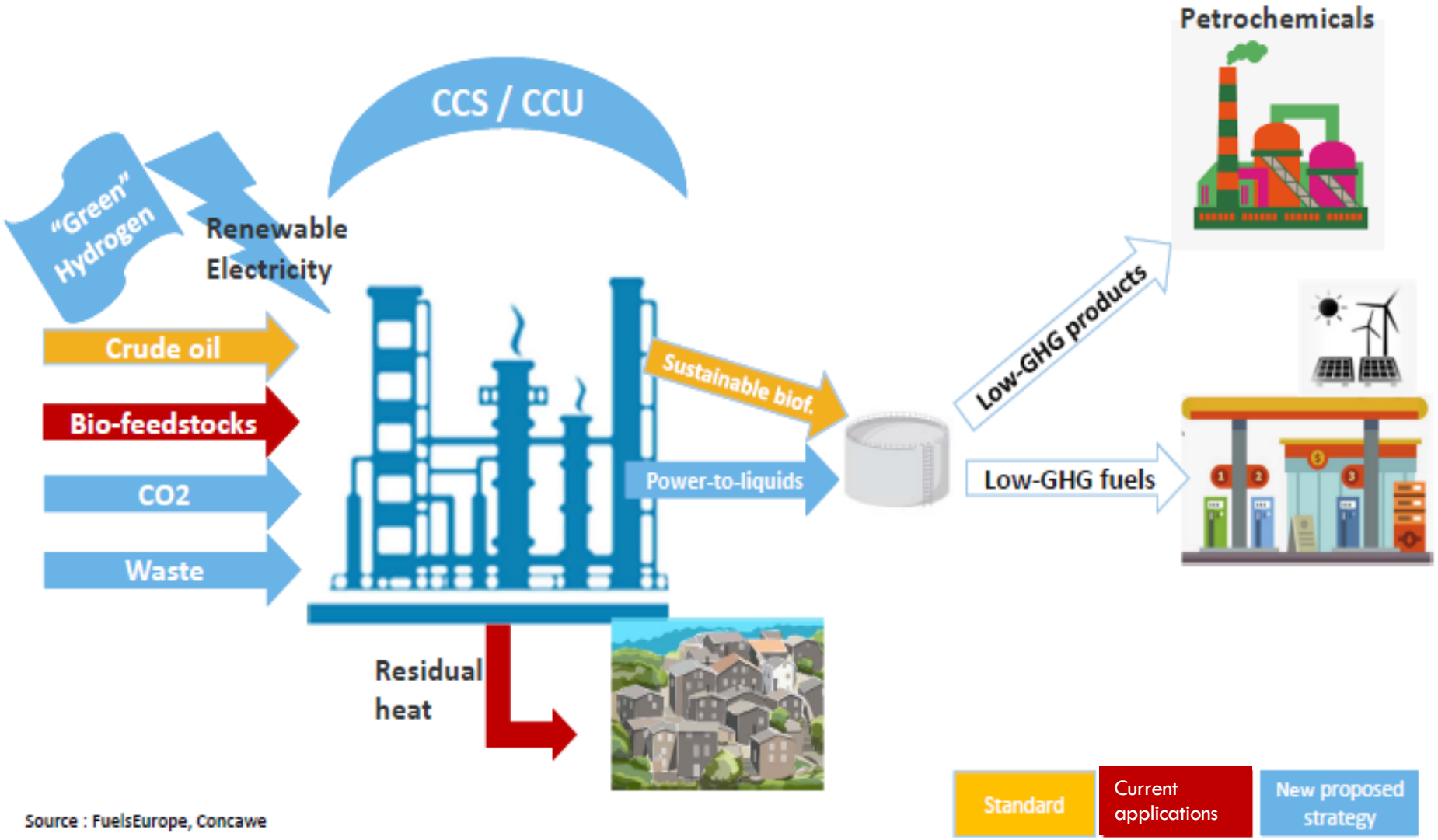
- **Electric mobility**
  - Fleet electrification is proposed as a strategy for reducing air pollutant emissions and improving air quality in urban areas
  - New storage technologies and electric vehicles are leading towards a new system in which consumers can produce, use and sell their electricity
  - Electricity produced from RES

Aligned with EU strategies such as European Green Deal, REPOWER etc

- **Renewable fuels**
  - Advanced biofuels can serve all different transport modes (road, rail, marine and air)
  - Waste, non-food biomass as a feedstock
  - Hydrotreated Vegetable Oil attracts investments (e.g. Neste, ENI, Total, UPM, Preem)

- **Green Hydrogen**
  - Integrating renewable electricity with electrolysers and desalination plants
  - Fuel cell vehicles

THE REFINING OF THE FUTURE: AN ENERGY HUB WITHIN AN INDUSTRIAL CLUSTER



Source : FuelsEurope, Concawe

Strategic Research and Innovation at HELLENiQ ENERGY

- **Started** as participants in proposed research projects related to energy issues.
- **Continue** in targeted participation in projects relevant to the Group's activities, enhancing collaborations with the academic community in Greece and abroad.
- **Evolve** into a team that defines and proposes research projects according to the strategic visions of HELLENiQ Energy.

✓ *Areas of Interest*

- **Reduction of CO2 emissions**
- **Digitalization in refining**
- **Low GHG fuels**
- **Energy storage**
- **Renewable energy sources**
- **E-Mobility**

INNOVATION AND RESEARCH OVERVIEW

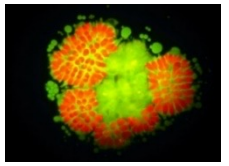
Biofuels

LIFE Biomass C+

HyCon

Beet2Bioref

SUSTAIN Diesel



ALGEA Biofuels

Lipid4Fuels

MIDAS

Marginal lands, industrial crops and innovative bio-based value chains

CIRCforBIO

ALGAFUELS

BREW2BIO

Refineries

ZEOCAT-3D

ProMethEUS
Protons for Methanol and EU Sustainability

deSulfur

PROOFF

Green H2

HYDROSOL

CCS

Novel CO2-based electrothermal energy and geological storage system

CEEGS

Bio-refineries

BIOFIT
Bioenergy Retrofits for Europe's Industry

ACTOIL

Energy efficiency & Digitalization

Esthisis

ARIS 4.0

Electric Vehicles and Charging

RE cognition

RESEARCH PROGRAM: ACTOIL (KMP6-0283869)

Utilization of plastic and rubber waste for the production of alternative liquid fuels and adsorbent materials with innovative processes within the framework of the circular economy and industrial symbiosis model - ACTOIL

ESPA 2014-2020 abt 450.000 eur

GOALS

Pyrolysis of PP waste from HELLENiQ Energy – which can be use as feedstock for a pyrolysis plant.

Pyrolysis of synthetic rubber

Investigation of the conceptual plastic waste pyrolysis in a circular economy and industrial symbiosis model. focused on the development of a PP waste pyrolysis plant in Greece, within the context of circular economy and industrial symbiosis.

Partners

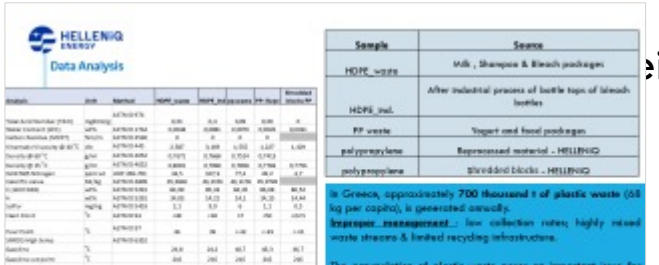
- CaO Hellas Natural Chemicals
- HelleniQ Energy
- Center for Research & Technology
- Aristotle University of Thessaloniki

Plastic Waste Treatment via Pyrolysis

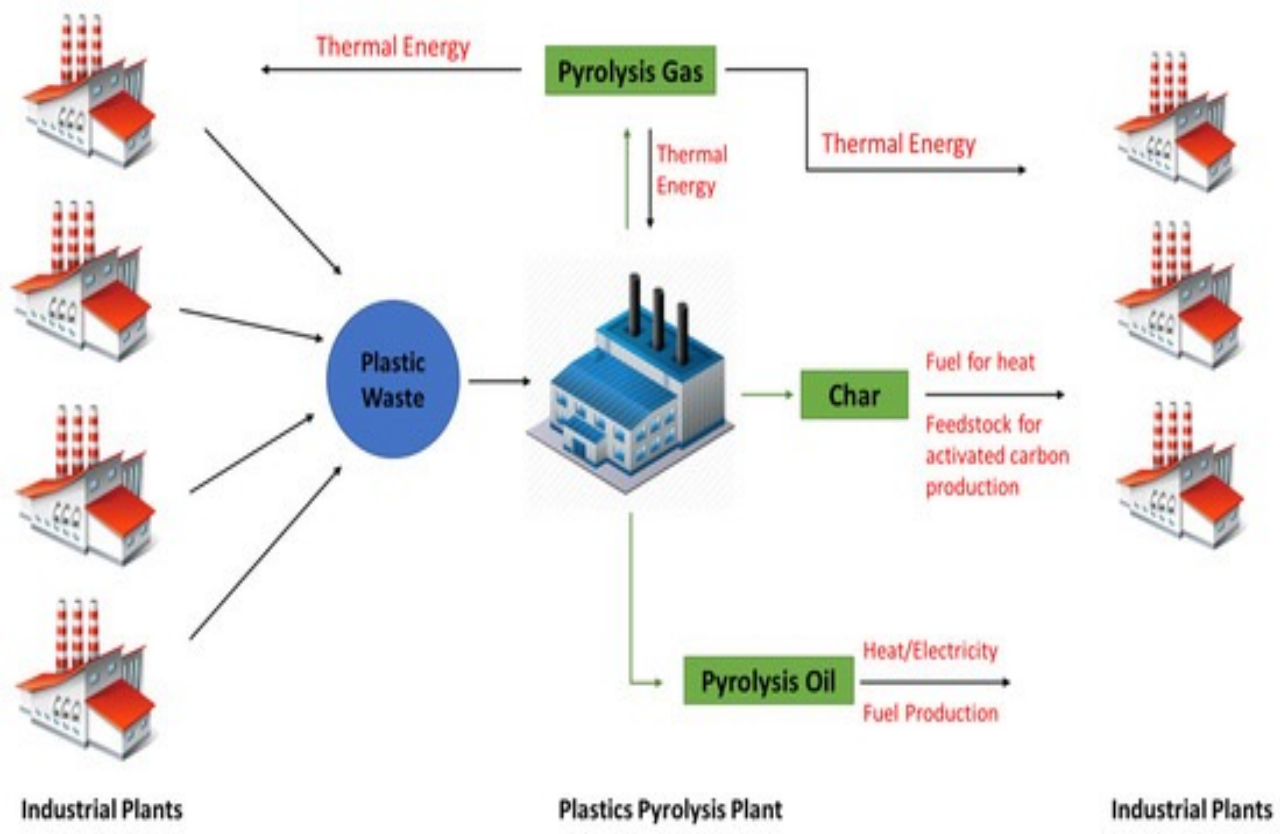
- Pyrolysis oil : can be sold, providing a source of revenue for the pyrolysis plant. It can be used to generate heat and electricity, or it can be upgraded to produce fuels.

- Two additional products can be used efficiently within the concept of industrial symbiosis :

  - The gaseous product can be utilized to cover the energy demands of the pyrolysis plant. It can also be used by neighboring industrial plants as a source of thermal energy, thus reducing their operating costs and dependence on fossil fuels, such as natural gas.



eighboring plants and used feedstock in a plant that



Several industrial plants that produce plastic waste can offer their waste as feedstock to a pyrolysis plant, ensuring an efficient and environmentally safe utilization route for their waste.

Reference:

A. Zabaniotou & I.Vaskalis (2023), Economic Assessment of Polypropylene Waste (PP) Pyrolysis in Circular Economy and Industrial Symbiosis Energies, MDPI *16*(2), 593

HELLENiQ ENERGY

Data Analysis

Analysis	Unit	Method	HDPE_waste	HDPE_ind	pp waste	PP- Repr.	Shredded blocks PP
Total Acid Number (TAN)	mgKOH/g	ASTM D 974	0,01	0,3	0,09	0,09	0
Water Content (WC)	wt%	ASTM D 1744	0,0048	0,0081	0,0079	0,0026	0,0031
Carbon Residue (MCRT)	%m/m	ASTM D 4530	0	0	0	0	
Kinematic Viscosity @ 40 °C	cSt	ASTM D 445	2,587	3,169	1,555	1,227	1,429
Density @ 60 °C	g/ml	ASTM D 4052	0,7671	0,7668	0,7514	0,7413	
Density @ 15 °C	g/ml	ASTM D 4052	0,8001	0,7998	0,7858	0,7783	0,7756
ISO17025 Nitrogen	ppm wt	UOP 269-701	43,5	107,9	77,4	49,2	3,7
Calorific value	MJ/kg	ASTM D 4809	45,6946	46,2156	46,1178	45,9728	
C (LECO 628)	wt%	ASTM D 5291	84,99	85,33	84,35	86,08	86,52
H	wt%	ASTM D 5291	14,03	14,21	14,1	14,15	14,44
Sulfur	mg/kg	ASTM D 5453	2,1	9,9	6	1,1	0,5
Flash Point	°C	ASTM D 93	<40	<40	17	<50	<22.5
Pour Point	°C	ASTM D 97	33	39	<-42	<-39	<-41
SIMDIS High temp		ASTM D 6352					
Gasoline	°C		24,8	24,2	40,7	46,3	46,7
Gasoline cut point	°C		216	216	216	216	216
Diesel	°C		36,3	30,2	37	34,6	35,1
Diesel cut point	°C		343	343	343	343	343
Residue	°C		38,9	45,6	22,3	19,1	18,2
mass%_98	°C		507,8	550	511,8	486,4	479,6
mass%_99	°C		541	587,8	561,6	517,4	508,4
mass%_FBP	°C		592,6	638,4	619,2	552,6	536,6

Sampling & Analysis: M.Bampaou & K.Panopoulos at Chemical Process and Energy Resources Institute (CPERI), Centre for Research & Technology Hellas (CERTH), 6th km. Charilaou-Thermi Road, 57001, Thessaloniki, Greece

Sample	Source
HDPE_waste	Milk , Shampoo & Bleach packages
HDPE_ind.	After industrial process of bottle tops of bleach bottles
PP waste	Yogurt and food packages
polypropylene	Reprocessed material - HELLENiQ
polypropylene	Shredded blocks - HELLENiQ

In Greece, approximately **700 thousand t of plastic waste** (68 kg per capita), is generated annually.
Improper management : low collection rates; highly mixed waste streams & limited recycling infrastructure.

The accumulation of plastic waste poses an important issue for the country, as **more than 40 thousand t of plastic leaks** into nature and local ecosystems each year.

Negative implications on the national economy, **with annual losses amassing to 26 M€**, affecting the tourism, shipping, and fishing sectors.

HELLENiQ ENERGY

The potential of utilizing waste and feeding it into a forward supply chain, within the model of circular economy, is of great significance for the energy transition to a low carbon economy.

A circular economy model focuses on waste management and resource recovery, through reuse, recycling, and energy utilization.

Emission reduction and promotion of the efficient use of resources

Can you help us to transform the energy future?