



How Technology is Innovating the Oil & Gas Sector

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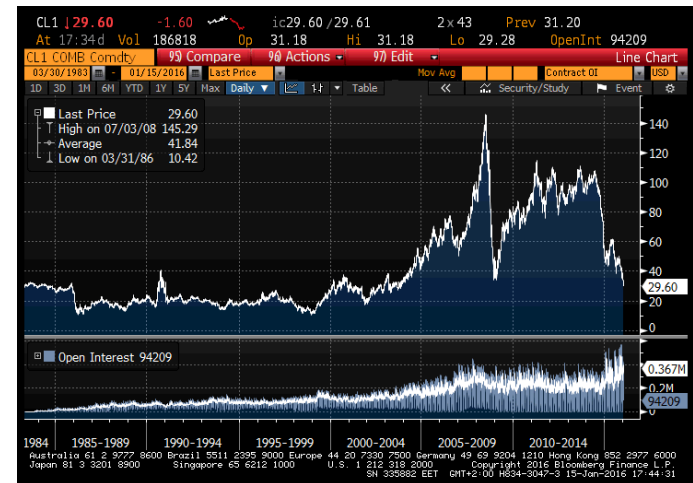


- Current transport challenges

- The future of transport
- Hellenic Petroleum overview
- Investing in new technologies in energy and transport

Oil and Gas markets have changed radically over the past 5 years

- **Demand is complicated**
 - Request for new fuels and energy products
 - Product demand is more important than crude demand
 - Price elasticity increase as subsidies are removed
- **Supply is challenged**
 - The shale oil and gas new reality
 - Investment financing limitations – capital shortage
 - Supply driven investments are slow to respond
- **Energy markets are evolving**
 - Consumer - oriented world
 - Hedging energy markets – a new price setting mechanism
- **Policy and regulations are dominating**
 - Low carbon footprint policies and climate debate
 - Environmental regulations imbalance the market
 - Create unequal cost burdens
- **Geopolitical frameworks are rethought**
 - Pipelines chess game
 - Economies in stress forced to structural reforms
 - The “energy-water-food” nexus

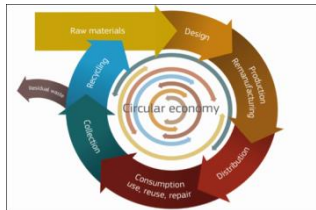


Policy limitations step up actions



- **COP21 meeting: The Paris Agreement (Dec. 2015)**
 - Transformation will need to be implemented in all economies to reduce energy demand and the use of fossil fuels.
 - In EU, the drive for efficiency will reduce the general demand trajectory for oil.

- **The EU Action Plan for the Circular Economy (Dec. 2015)**



- Transition to a more circular economy, is an essential contribution to the EU's efforts to develop a sustainable, low carbon and competitive economy.
- The bioeconomy hence provides alternatives to fossil-based products and energy.

- **European Strategy for Low-Emission Mobility (July 2016)**

- Low-emission mobility is an essential component of the broader shift to the low-carbon, circular economy needed for Europe to stay competitive and be able to cater to the mobility needs of people and goods.
- The Commission already indicated that food-based biofuels have a limited role in decarbonizing the transport sector and should not receive public support after 2020. Food-based biofuels will gradually phase out and be replaced by more advanced biofuels.



Moving away from fossil fuels?

Not so easy, not that quick!

- ✓ Low-cost renewables are required
- ✓ Volatility in CO₂ markets
- ✓ Infrastructure bottleneck (the chicken – egg dilemma)
- ✓ Not enough money for investments
- ✓ Technology issues to be resolved

New challenges for energy players

- ✓ Balancing the fuel mix
- ✓ Reliability of fuel quality
- ✓ Knowledge capture
- ✓ Technology integration
- ✓ Identifying new energy sources
- ✓ New business models to capture value



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- Current transport challenges



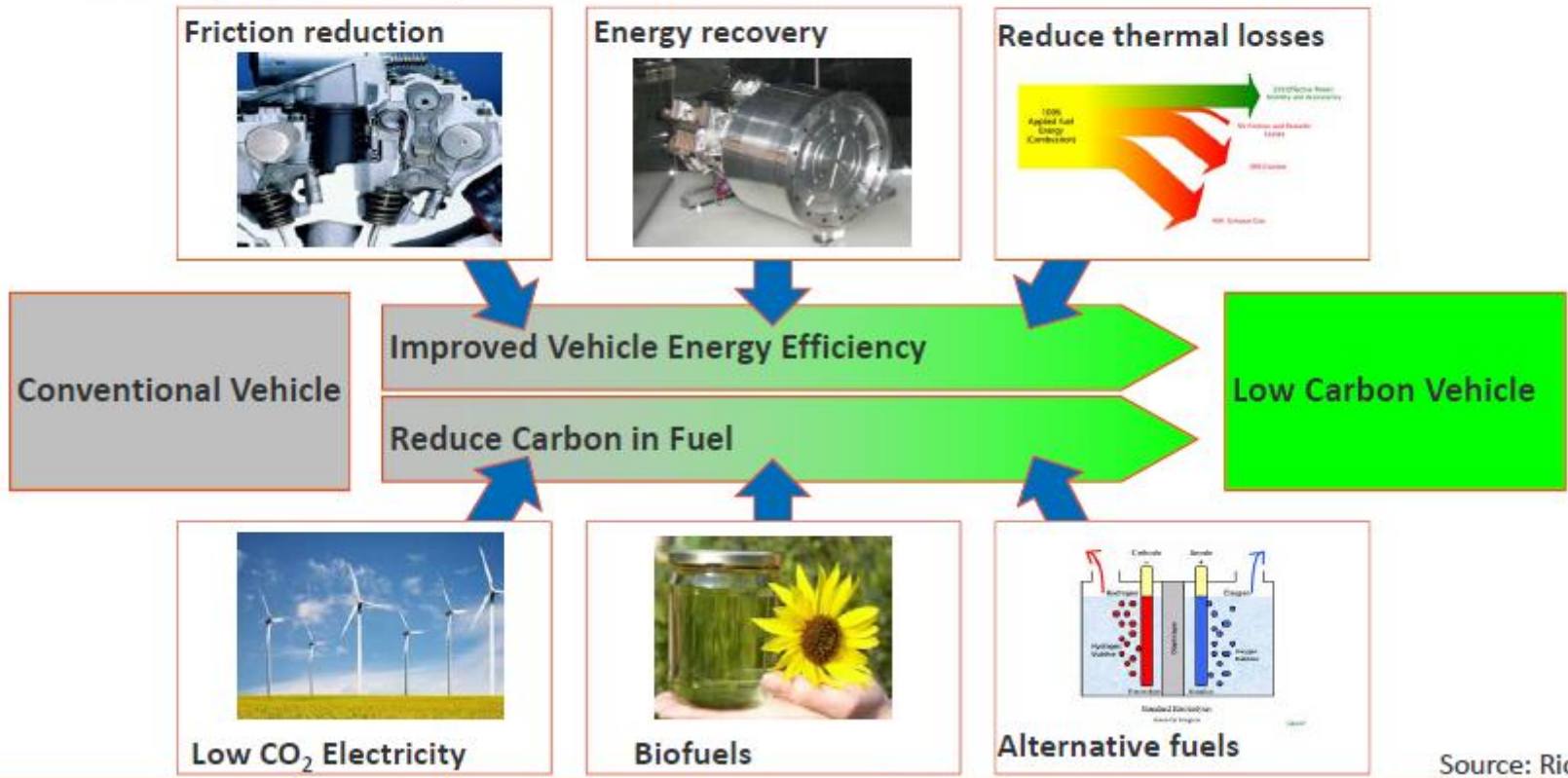
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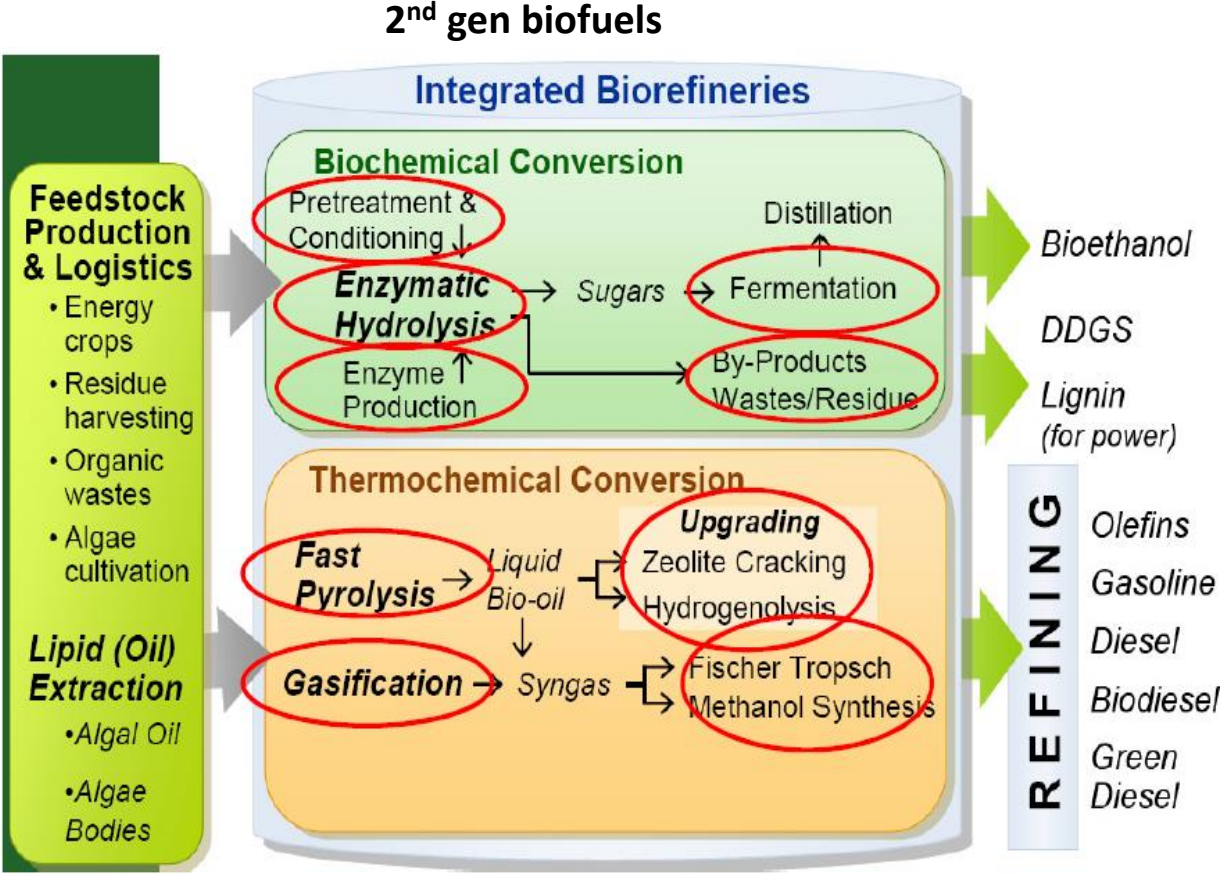
Transport Focus has been on Energy/GHG Reduction

- Options broadly fall into two categories:
 - Improve vehicle efficiency.
 - Reduce carbon footprint of fuel.
- Both pathways result in reduced CO₂ emissions for a specific vehicle/condition.



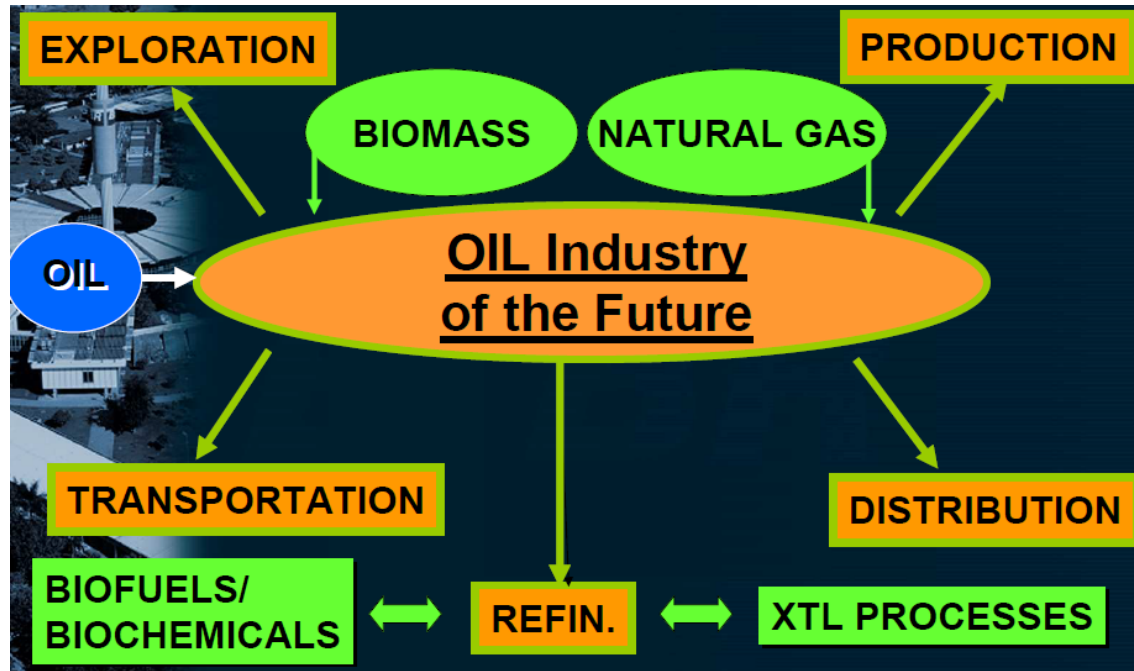
Source: Ricardo

Advanced biofuels can be an alternative



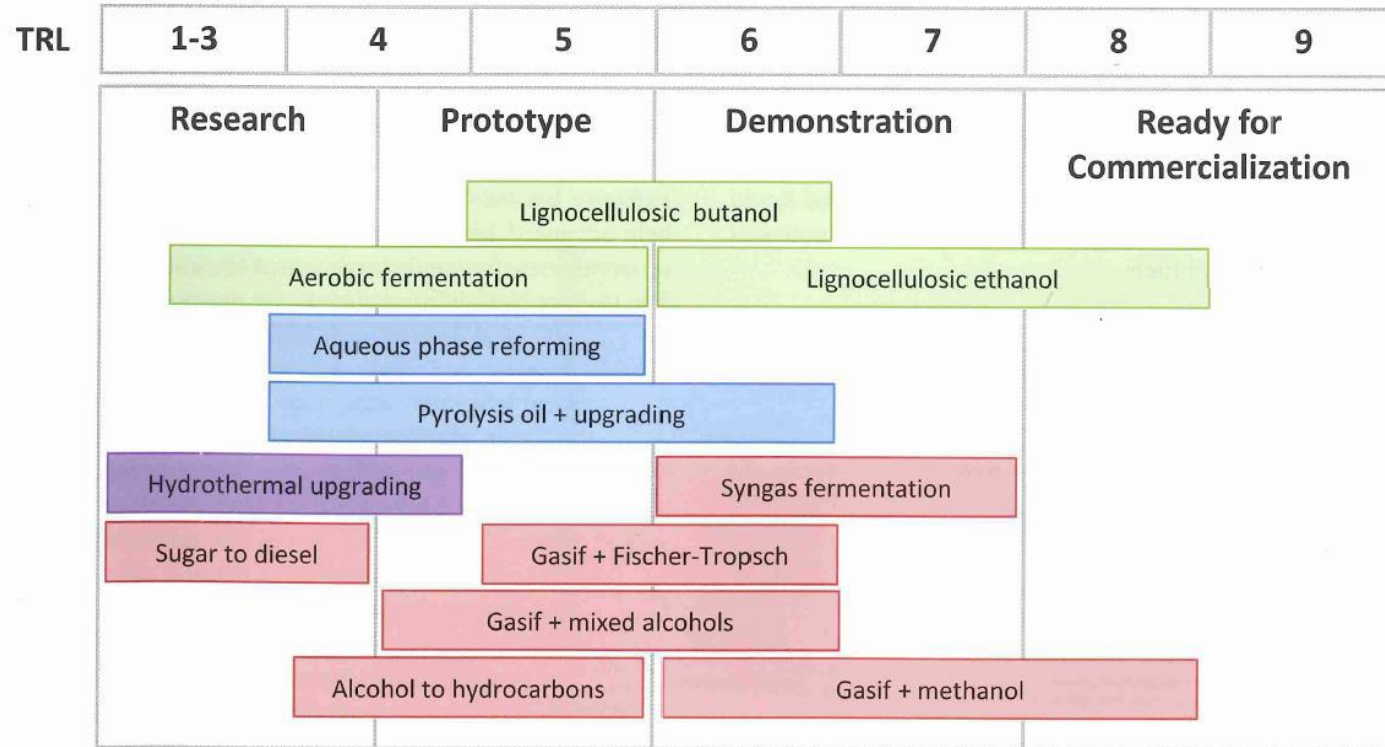
Source: IEA - Bioenergy

Biorefinery – oil industry’s next step?



- ✓ Increasing stringent environmental regulation
- ✓ Growing demand for cleaner fuels
- ✓ Increase in the production of derivatives from declining quality oil
- ✓ Growing pressure of several segments of the society aiming at the reduction of GHG
- ✓ Search for alternative raw materials such as biomass, NG and coal
- ✓ Profitability maintenance - Survival

Advanced Biofuels: Technology Readiness Levels



Source: IEA Bioenergy Task42 Biorefining

- ✓ **Main technological issues still remain to be resolved**
- ✓ **Advanced biofuels not yet market competitive**
- ✓ **Co-producing fuels and added-value bio-based products will optimize full chain**

Advanced biofuels: Misconceptions and Reality

- **Cheap oil halts renewables**
 - Capital markets are thirsty for new sections to invest
 - Renewables attract money due to shrinking investments in the oil sector
- **Biofuels is an energy security issue**
 - One single energy carrier can not meet all needs
 - Can serve all modes of transport (road, rail, marine, air)
- **Climate change debate**
 - Policies impact heavily biofuel industry and profitability
 - Stable and predictable policy framework is required to enable long-term investment planning
- **Technology barriers postpone biofuel evolution**
 - Technology revolution and breakthroughs
 - A variety of alternative processing routes are available
- **The biomass quest crossroad**
 - Many alternative feedstocks
 - In the end of the day it is a commodity market



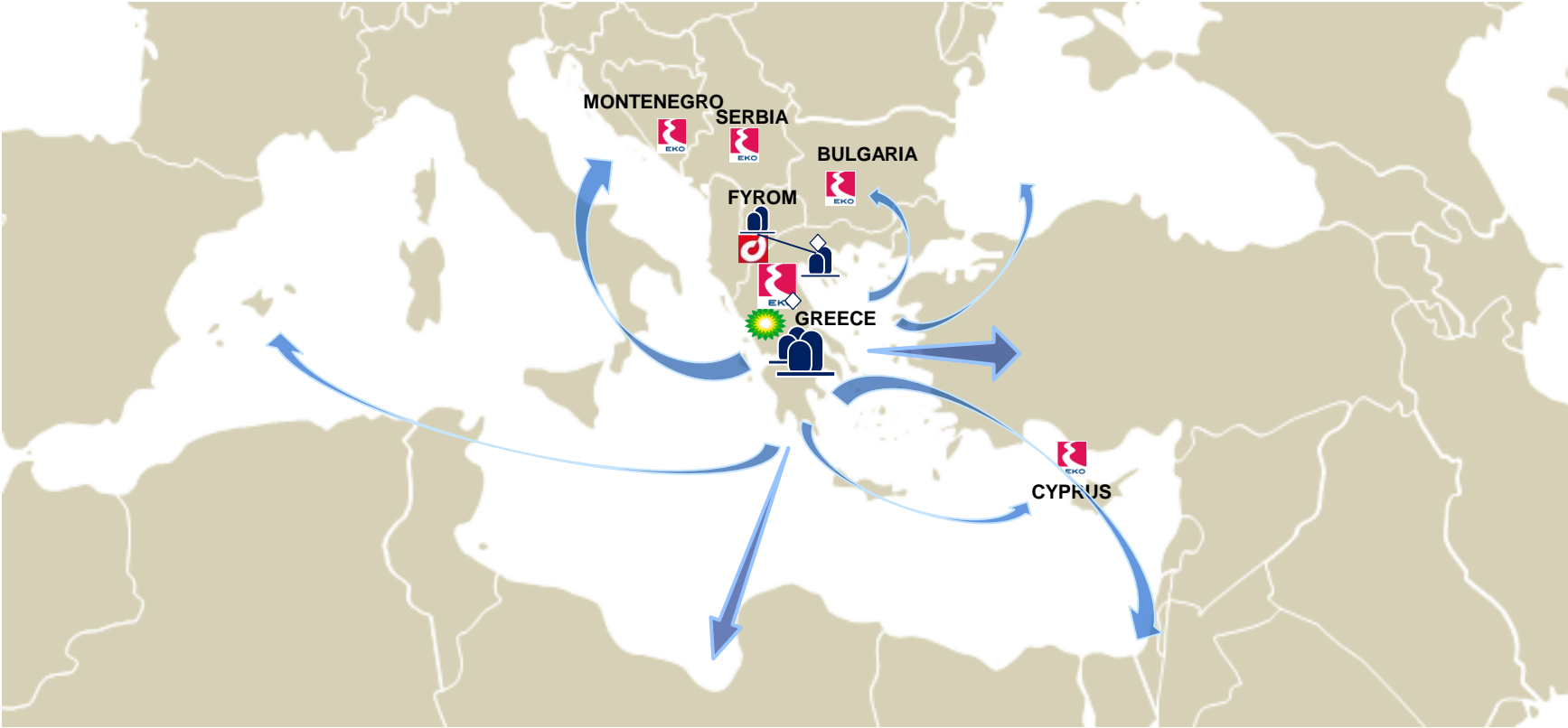
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Current position

Leading domestic market position; major middle distillates and naphtha/gasoline exporter in the East Med market

Group operational footprint and Sales



◇ Power & Gas

Assets overview

Core business around downstream assets with activities across the energy value chain

		DESCRIPTION	METRICS
Exploration & Production		<ul style="list-style-type: none"> Exploration assets in Greece 	<ul style="list-style-type: none"> 50% (operator) in W. Patraikos Gulf Exploration rights in 2 more areas
Refining, Supply & Trading		<ul style="list-style-type: none"> Complex (recently upgraded) refining system: <ul style="list-style-type: none"> Aspropyrgos (FCC, 148kbpd) Elefsina (HDC, 100kbpd) Thessaloniki (HS, 93kbpd) Pipeline fed refinery/terminal in FYROM 	<ul style="list-style-type: none"> Capacity: 16MT NCI: 9.6 Market share: 65% Tankage: 7m M³
Petrochemicals		<ul style="list-style-type: none"> Basel technology PP production (integrated with refining) and trading > 60% exports in the Med basin 	<ul style="list-style-type: none"> Capacity (PP): 220 kt
Domestic Marketing		<ul style="list-style-type: none"> Leading position in all market channels (Retail, Commercial, Aviation, Bunkering) through EKO and HF (BP branded network) 	<ul style="list-style-type: none"> c.1,700 petrol stations 30% market share Sales volumes: 3.5MT
International Marketing		<ul style="list-style-type: none"> Strong position in Cyprus, Montenegro, Serbia, Bulgaria, FYROM Advantage on supply chain/vertical integration 	<ul style="list-style-type: none"> c.290 petrol stations Sales volumes: 1.2MT
Power & Gas		<ul style="list-style-type: none"> ELPEDISON: Second largest IPP in Greece (JV with Edison/EdF) 	<ul style="list-style-type: none"> Capacity: 810 MW (CCGT)
		<ul style="list-style-type: none"> DEPA/DESFA GROUP: 35% in Greece's incumbent NatGas supply company (DESFA in sale process) 	<ul style="list-style-type: none"> Volumes (2015): 3.0bcm

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Investing in Renewable Energy Sources

- Developing renewable electricity to diversify Group's energy portfolio. Also offsetting part of CO₂ emissions due to refining and power generation.
 - Wind and PV assets in operation
 - Developing a 200 MW portfolio (in various maturity stages)
- Expanding in biofuels
 - 2nd and 3rd generation biofuels



Supporting new technologies in energy and transport

- Supporting R&D projects with various academic institutions :
 - ✓ “Sustain-Diesel”: hybrid diesel from used cooking oils
 - ✓ “Sustainable use of marine microalgae for the production of biofuels and high-added value biochemicals”: 3rd gen biofuels
- Pilot applications of alternative technologies in transport
 - ✓ Electric vehicle charging points in selected petrol stations
- Corporate Venture Capital - under consideration



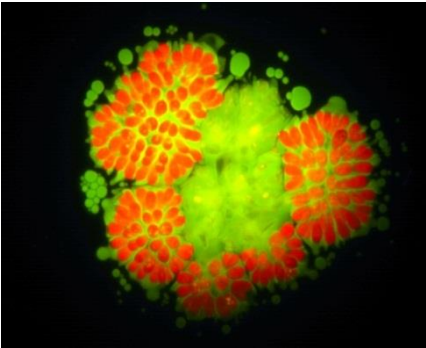
Participating in R&D projects ...



Sustain-Diesel



Hydrosol Plant project - FCH JU



Sustainable use of marine microalgae for the production of biofuels and high-added value bio-chemicals

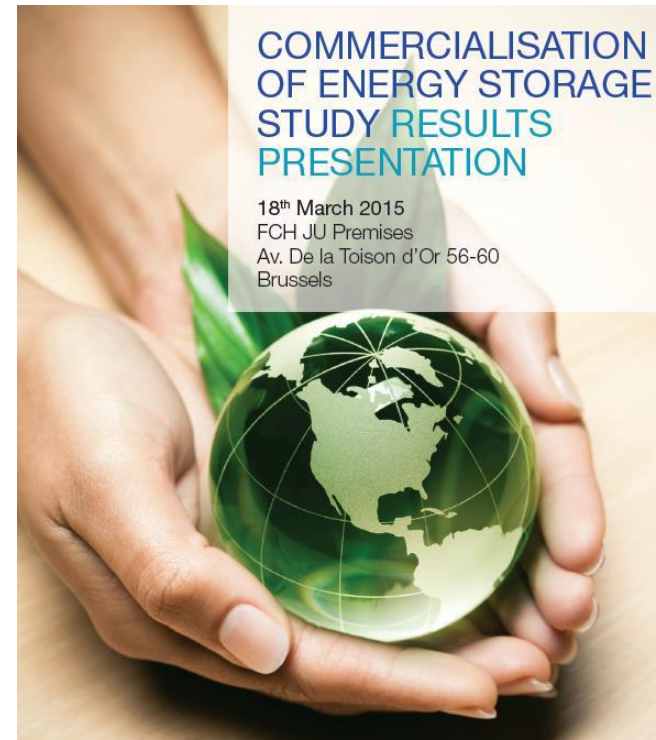


GREEN MEOH
Green MEOH project - CAPITA



Innovation Clusters

... and European Union initiatives



Our vision: Sustainable transport & Clean energy

- Gaining know-how in future energy technologies
- Developing new business
- Converting R&D outputs in production

Evolving to an innovative, reliable and competitive energy supplier in the future



Hellenic Petroleum: Energy for life

