



# Energy in Transition: How New Technologies Enhance Energy Security

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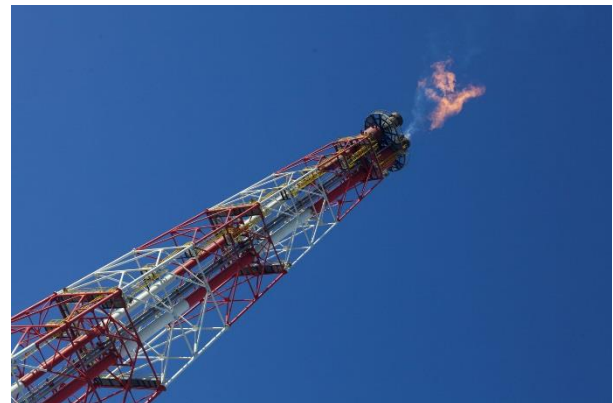


## • Energy in Transition

- A new era in transport
- Hellenic Petroleum overview
- Investing in new technologies

# Energy security

- **The uninterrupted availability of energy sources at an affordable price (IEA definition)**
  - Long-term energy security deals with timely investments to supply energy in line with economic developments and sustainable environmental needs
  - Short-term energy security focuses on the ability of the energy system to react promptly to sudden changes within the supply-demand balance
- **Is not one topic but a cluster of different problems - the core may be economic but politics and security loom large in the surrounding issues**
  - nuclear safety and the risks of nuclear proliferation
  - the safety of high dams for hydro-power in earthquake zones
  - current fears about 'fracking' (subterranean rock fragmenting) for extracting shale oil and gas
  - speculation over harmful side-effects of extracting wind and solar energy
- **Bioenergy as a valuable option for energy security may have positive synergies with other policy priorities**
  - water and food security
  - support energy access
  - economic development, growth and stability
  - climate security and other environmental goals



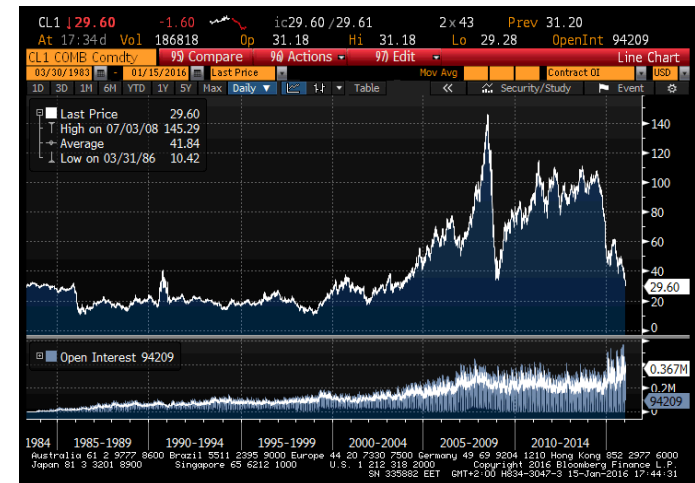
# From the shale revolution to a shift towards low-carbon fuels

- **The concept of energy security is undergoing a rapid transformation**
  - In the past: geopolitics and the supply of oil and gas were the dominant factors
  - Today: a broader and more complex spectrum of elements are interacting to both stabilize and threaten energy security
- **Strong growth in the production and integration of renewable and distributed energy**
  - diversify energy mix, reduce reliance and price exposure to only a few sources and countries
  - renewable and on-site generation, if connected to advanced microgrid and storage technology, can contribute to energy security
  - new challenges of the digital revolution improve efficiency, lower costs, creates vulnerabilities
- **Supply is as important and as vulnerable as is transmission and distribution of energy**
  - Regardless of climate policy, timely investment into oil and gas supply remains a cornerstone of energy security



# Oil and Gas markets have changed radically over the past 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



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# Moving away from fossil fuels?

## Not so easy, not that quick!

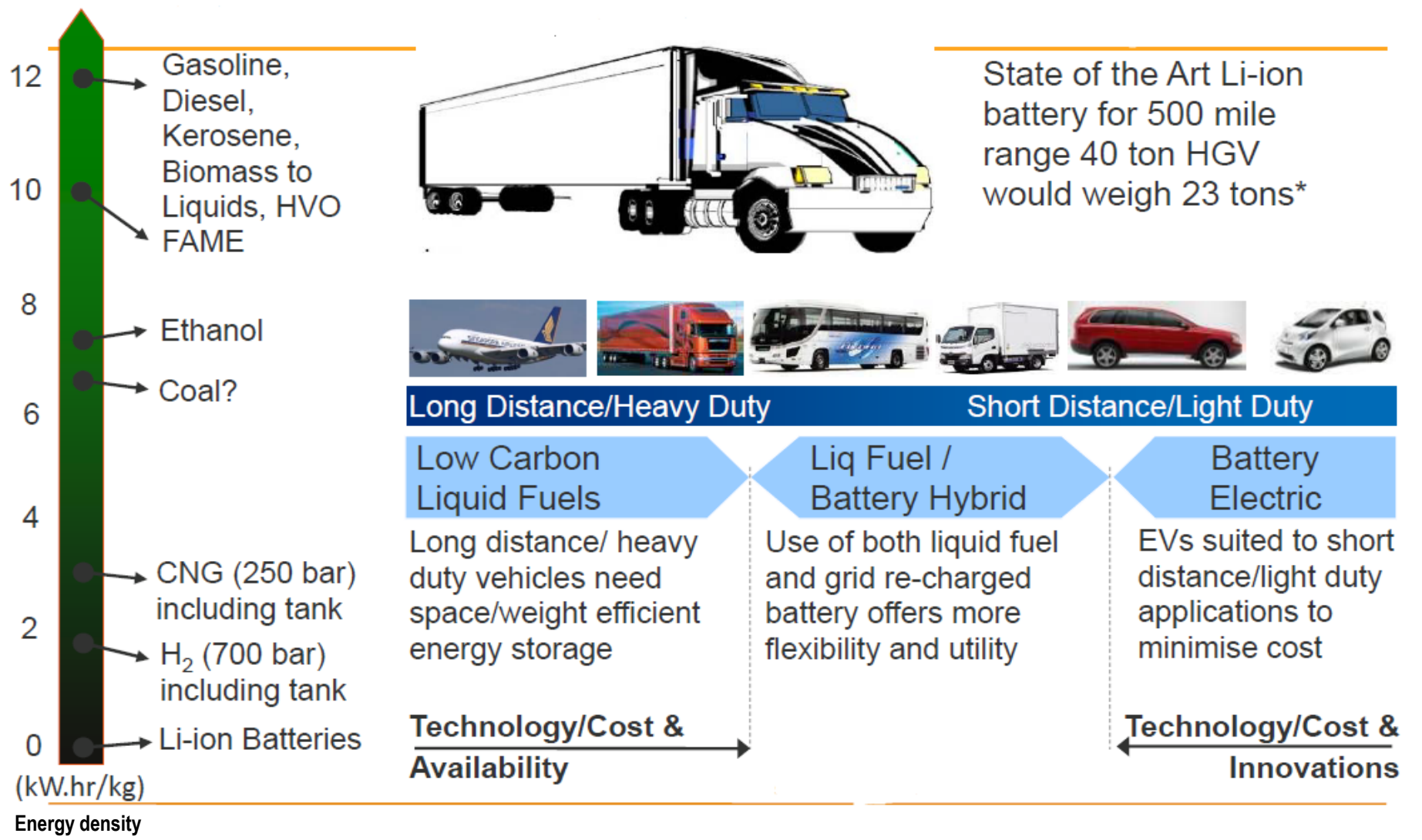
- ✓ Low-cost renewables are required
- ✓ Volatility in CO<sub>2</sub> markets
- ✓ Infrastructure bottleneck (the chicken – egg dilemma)
- ✓ Not enough money for investments
- ✓ Technology issues to be resolved

## 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



# Electric Vehicles likely attractive for some light duty applications but long haul will need low carbon fuels



Source: Ricardo research & US DoE




# 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



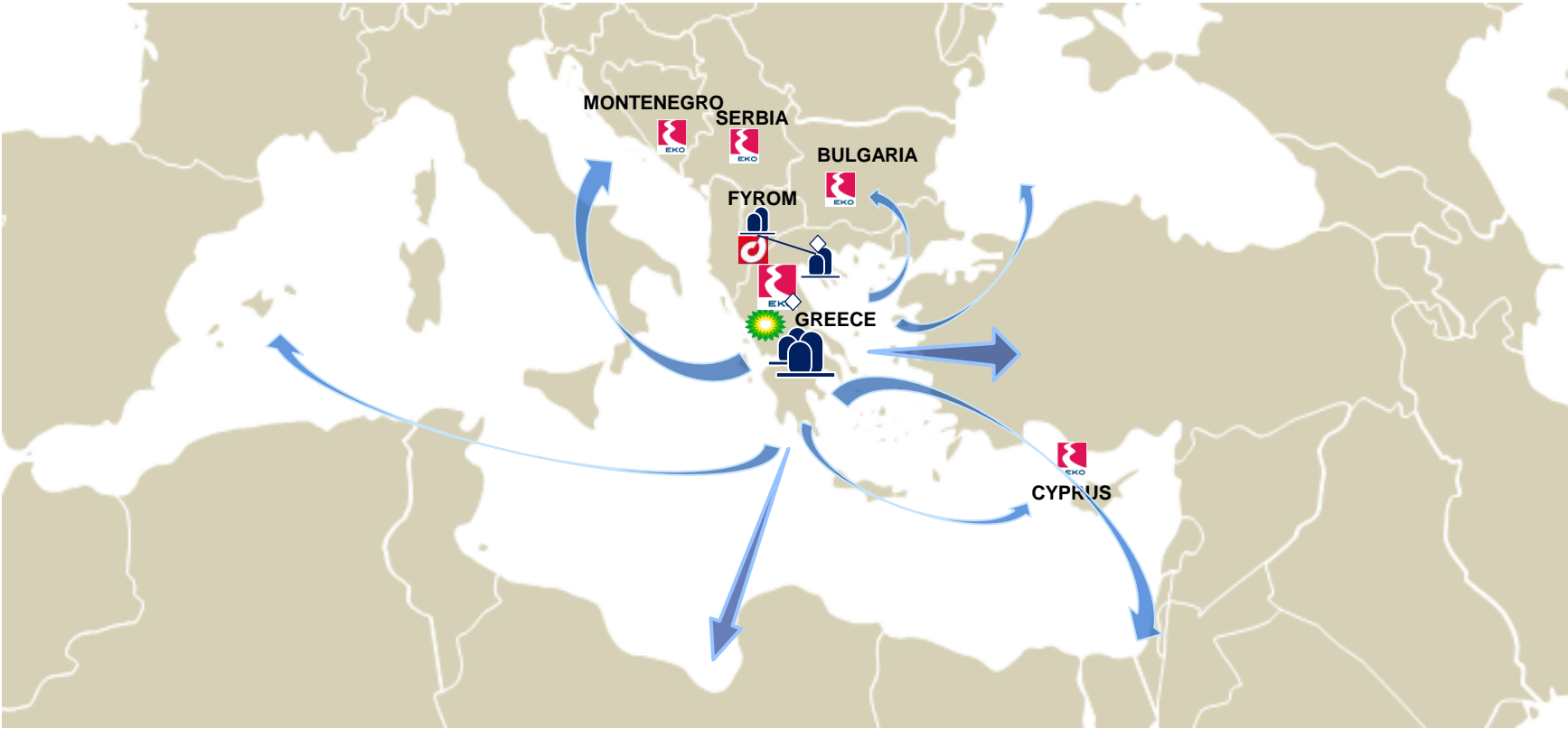
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# Current position

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"> <li>Exploration assets in Greece</li> </ul>	<ul style="list-style-type: none"> <li>50% (operator) in W. Patraikos Gulf</li> <li>Exploration rights in 2 more areas</li> </ul>
Refining, Supply & Trading		<ul style="list-style-type: none"> <li>Complex (recently upgraded) refining system: <ul style="list-style-type: none"> <li>Aspropyrgos (FCC, 148kbpd)</li> <li>Elefsina (HDC, 100kbpd)</li> <li>Thessaloniki (HS, 93kbpd)</li> </ul> </li> <li>Pipeline fed refinery/terminal in FYROM</li> </ul>	<ul style="list-style-type: none"> <li>Capacity: 16MT</li> <li>NCI: 9.6</li> <li>Market share: 65%</li> <li>Tankage: 7m M<sup>3</sup></li> </ul>
Petrochemicals		<ul style="list-style-type: none"> <li>Basel technology PP production (integrated with refining) and trading</li> <li>&gt; 60% exports in the Med basin</li> </ul>	<ul style="list-style-type: none"> <li>Capacity (PP): 220 kt</li> </ul>
Domestic Marketing		<ul style="list-style-type: none"> <li>Leading position in all market channels (Retail, Commercial, Aviation, Bunkering) through EKO and HF (BP branded network)</li> </ul>	<ul style="list-style-type: none"> <li>c.1,700 petrol stations</li> <li>30% market share</li> <li>Sales volumes: 3.5MT</li> </ul>
International Marketing		<ul style="list-style-type: none"> <li>Strong position in Cyprus, Montenegro, Serbia, Bulgaria, FYROM</li> <li>Advantage on supply chain/vertical integration</li> </ul>	<ul style="list-style-type: none"> <li>c.290 petrol stations</li> <li>Sales volumes: 1.2MT</li> </ul>
Power & Gas		<ul style="list-style-type: none"> <li>ELPEDISON: Second largest IPP in Greece (JV with Edison/EdF)</li> <li>DEPA/DESFA GROUP: 35% in Greece's incumbent NatGas supply company (DESFA in sale process)</li> </ul>	<ul style="list-style-type: none"> <li>Capacity: 810 MW (CCGT)</li> <li>Volumes (2015): 3.0bcm</li> </ul>

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# Investing in Renewable Energy Sources

- Developing renewable electricity to diversify Group's energy portfolio. Also offsetting part of CO<sub>2</sub> 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
  - 2<sup>nd</sup> and 3<sup>rd</sup> 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”: 3<sup>rd</sup> gen biofuels
- Pilot applications of alternative technologies in transport
  - ✓ Electric vehicle charging points in selected petrol stations
- Corporate Venture Capital - under consideration



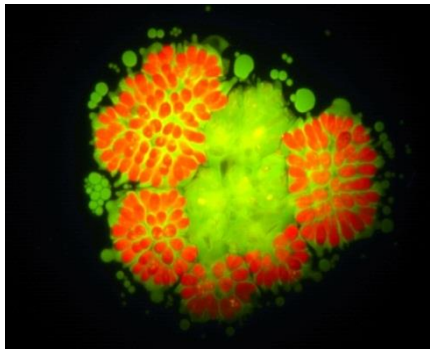
# Participating in R&D projects ...



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

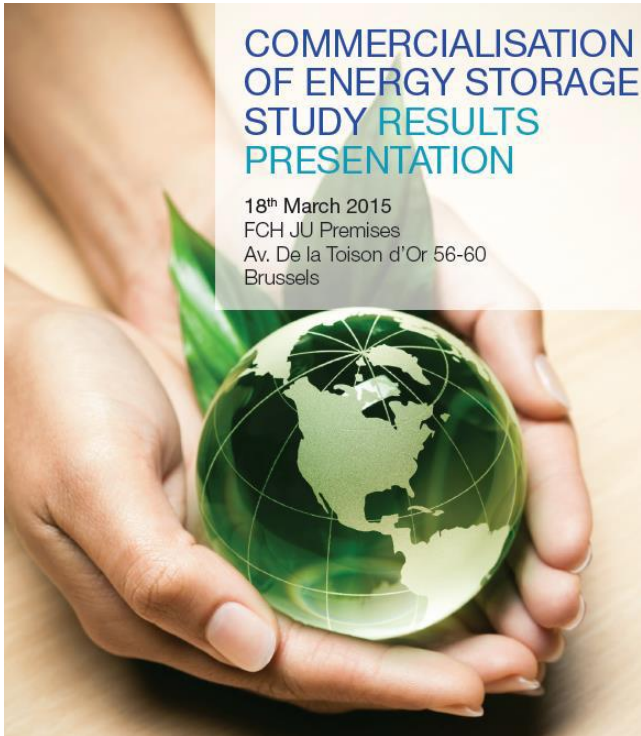
Green MEOH project - CAPITA



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

