Energy in Transition: 
How New Technologies Enhance Energy Security 

Dr. Spyros Kiartzis 
Manager New Technologies & Alternative Energy Sources 

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

State of the Art Li-ion battery for 500 mile range 40 ton HGV would weigh 23 tons*

**Energy density**

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
## Assets overview

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

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>METRICS</th>
</tr>
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<tbody>
<tr>
<td><strong>Exploration &amp; Production</strong></td>
<td>• Exploration assets in Greece</td>
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<tr>
<td></td>
<td>• Complex (recently upgraded) refining system:</td>
</tr>
<tr>
<td></td>
<td>– Aspropyrgos (FCC, 148kbpd)</td>
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<tr>
<td></td>
<td>– Elefsina (HDC, 100kbpd)</td>
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<td></td>
<td>– Thessaloniki (HS, 93kbpd)</td>
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<td></td>
<td>• Pipeline fed refinery/terminal in FYROM</td>
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<td><strong>Refining, Supply &amp; Trading</strong></td>
<td>• 50% (operator) in W. Patraikos Gulf</td>
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<td></td>
<td>• Exploration rights in 2 more areas</td>
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<tr>
<td></td>
<td>• Capacity: 16MT</td>
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<tr>
<td></td>
<td>• NCI: 9.6</td>
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<tr>
<td></td>
<td>• Market share: 65%</td>
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<td>• Tankage: 7m M³</td>
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<tr>
<td><strong>Petrochemicals</strong></td>
<td>• Leading position in all market channels (Retail, Commercial, Aviation, Bunkering) through EKO and HF (BP branded network)</td>
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<tr>
<td></td>
<td>• Basel technology PP production (integrated with refining) and trading</td>
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<td></td>
<td>• &gt; 60% exports in the Med basin</td>
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<tr>
<td></td>
<td>• Capacity (PP): 220 kt</td>
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<tr>
<td><strong>Domestic Marketing</strong></td>
<td>• c.1,700 petrol stations</td>
</tr>
<tr>
<td></td>
<td>• 30% market share</td>
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<tr>
<td></td>
<td>• Sales volumes: 3.5MT</td>
</tr>
<tr>
<td><strong>International Marketing</strong></td>
<td>• c.290 petrol stations</td>
</tr>
<tr>
<td></td>
<td>• Sales volumes: 1.2MT</td>
</tr>
<tr>
<td><strong>Power &amp; Gas</strong></td>
<td>• ELPEDISON: Second largest IPP in Greece (JV with Edison/EdF)</td>
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<td></td>
<td>• DEPA/DESFA GROUP: 35% in Greece’s incumbent NatGas supply company (DESFA in sale process)</td>
</tr>
<tr>
<td></td>
<td>• Capacity: 810 MW (CCGT)</td>
</tr>
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<td>• Volumes (2015): 3.0bcm</td>
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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**

**GREEN MEOH**

**Green MEOH project - CAPITA**

**Innovation Clusters**

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