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"New Business Opportunities for the Gas and the Shipping Industry in Greece"

The role of the small & mid scale LNG/CNG technology

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Public Gas Corporation of Greece (DEPA) S.A.

- The main player in the Greek gas market and one of the most successful business stories in Greece the last 25 years
- DEPA enjoys an extremely healthy financial position and offers strong profitability to its shareholders
- At a corporate level, DEPA's Group has a turnover of about 2 billion Euros and EBITDA exceeding 200 mio Euros
- The Group plays a key role towards:

✓ the development of the Greek gas infrastructure/market and
✓ the diversification of SE Europe's gas supply sources and transport routes

- Company's privatization process is now at its final stage

DEPA's Strategic Objectives

Ensure long-term leadership in a competitive market and capture growth both in Greece and the region

- √ Achieve competitive well-diversified and flexible supply
- √ Remain the market leader and maximize growth in the domestic market
- √ Play a key role in the region in infrastructure development and supply
- √ Optimize wholesale margins

- Contribute to the creation of a green and efficient domestic energy market (infrastructure, energy mix and market)
- Build a fit-for-purpose organization to win in a competitive gas market

SOURCE: DEPA's 2012-2016 Business Plan

Strategic Choices & Key Success Factors

DEPA's business model is premised on key strategic choices and success factors:

- ✓ Continuous gas network expansion in Greece
- ✓ Direct marketing in large consumer market segments; and through local distributors (EPAs) in residential, commercial and small industrial
- ✓ Effective commercial, contracting, and pricing policies
- ✓ Value-created relationships with customers
- ✓ Systematic monitoring and deep understanding of the international and domestic energy markets; excellent knowledge of gas markets
- ✓ Flexibility to explore market opportunities, mainly in the supply side
- ✓ Trans-border interconnections in partnership with international players
- ✓ A fit-for-purpose organization
- ✓ Knowledgeable, skilful and experienced personnel
- ✓ Business- and action-oriented culture

Looking for New Growth Opportunities

- Current business growth levers, although still valid, seem inadequate to ensure success going forward because:
  a) Traditional sources of gas demand growth either have already reached - or are about to reach - their limits and
  b) Domestic market liberalization and also regional market integration threaten DEPA's market share and profitability
- DEPA should timely adapt to the new market context and, simultaneously, exploit new and innovative sources of growth
- Before I enter in more details about these new sources of growth, let's have a quick look to the wider business context and gas market fundamentals

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A new "Golden Age" for Gas?

- Natural gas is clean, plentiful and competitive, that's why became the fuel of choice worldwide, especially for power generation purposes
- It perfect fits in a context with an increasing focus on substitution of expensive oil, energy efficiency, and lower carbon emissions
- The "shale gas revolution" has given birth to a new market context as well as opportunities for the gas industry in the US, expected to spread to Canada and even Asia and Europe
- These new supply realities have also alleviated some of the previous years concerns about the long-term availability of gas and gave rise to new hopes for the gas industry
- Two years ago IEA mentioned the possibility the world to enter into a new "golden era" of gas, although there are completely opposite views at least for gas in Europe

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The Rising Role of LNG

- Besides shale gas, the other fundamental change in the gas market in recent years has been the strong LNG demand growth
- This success of LNG can be attributed to its inherent geographic and supply flexibility as well as to significant reduction of its costs across the value chain thanks to the tremendous technological progress
- After all LNG seems to be well-placed to address the mosaic of needs of an increasingly global and flexible energy market
- LNG accounts for approximately 32% of the global gas trade, and its role has never been so important as it is today

The Emergence of Small & Mid Scale LNG/CNG Technology

- Small & mid scale LNG and CNG technology offers substantial new business opportunities for the gas, the shipping and other industries.
- The technology is already proven and available on a commercial basis, increasing the accessibility of gas to geographically isolated areas (including coastal areas and/or islands) as well as to locations that are far away from the gas network
- Small-scale LNG solutions can also be employed in the transport sector. LNG can fuel cars, buses, heavy trucks, sea and river ships and boats, rail locomotives and even aircrafts
- Mercedes-Benz Trucks calls LNG “the champagne of fuels”
- Similarly, although with a much narrower scope, CNG technology can be employed for the same purposes

(Source of next images: Gas LNG Europe, IGU, NGVA Europe, DNV, CRYONORM)

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Proven Technology, Already in the Agenda of many Governments and Businesses

LNG powered offshore supply vessel, Norway

LNG powered vessel design (Source: DNV)

Locomotive converted to LNG, US

LNG trailer 50 m^3, China

LNG bus, Poland

LNG truck, Netherlands

NG and LCNG station, US

Source: IGU/NGVA Europe/DNV

LNG/CNG Technology and Business Opportunities in Greece

- Small & mid scale LNG/CNG technology can be employed in Greece and create new business opportunities not only for the gas but also for other industries (i.e. shipping industry)
- DEPA in cooperation with its subsidiaries EPA, other entities and local authorities is currently studying such opportunities
- The strategic objective is to use LNG/CNG technology for gas supplies to islands, cities, industrial areas and big individual consumers which cannot be easily linked with Greece's natural gas grid, at affordable prices

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DEPA's CNG Filling Station for Buses and other Public Vehicles

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CNG-Fuelled Garbage Truck in Athens

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An LNG-fuelled City Logistic Truck

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An LNG-fuelled Long-vechicle

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A Simple CNG & LNG Refueling Station in Spain

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Small-Scale LNG/CNG for Gas Distribution in Cities/Areas not Connected to the Network

- Depending on the geographic location, DEPA plans either push forward alone or through its subsidiaries EPAs distribution of gas to areas and/or industrial consumers not connected to the network
- Gas could be transported by trucks from a satellite LNG or CNG filling station and delivered to certain consuming centers in an economically feasible manner
- We firstly plan to supply gas to certain cities and industrial areas and/or isolated consumers in Northern Greece, which are not connected yet to the gas network
- And indeed, there are many similar niche gas markets around Greece

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An LNG Satellite Plant

(for local distribution or for CNG trucks loading)

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LNG Transportation Truck with a 40 m³ Tank

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LNG Container

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1.500 Nm3/hr@6 bar Re-gas Facility

(for gas supply to an industrial customer)

Small-scale LNG for Gas Supply to Islands and New Regions

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Loading LNG on Small Vessel and a Truck in Norway

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A Five Tank LNG Row in Norway
(5x683=3415 m3 LNG)

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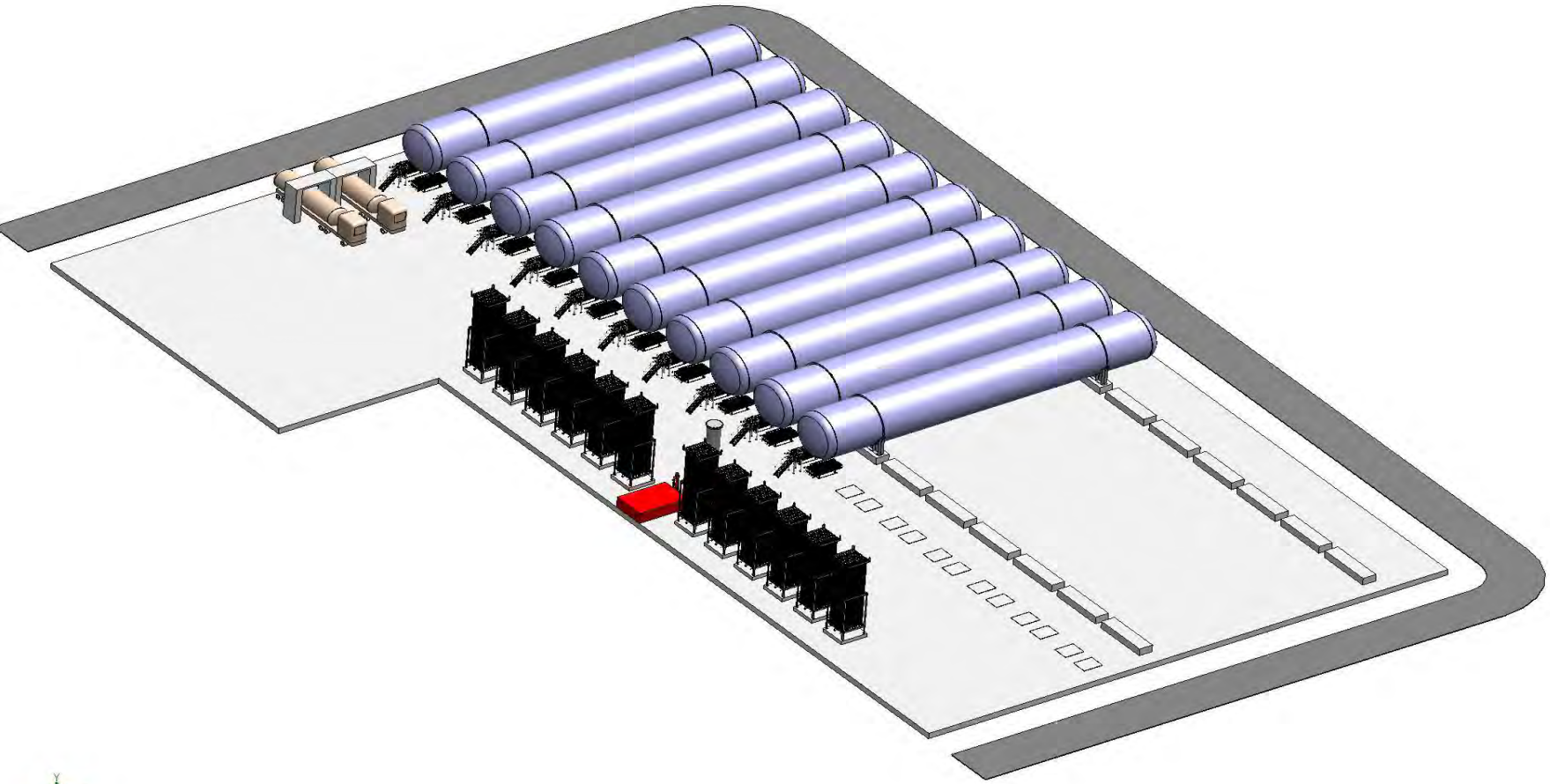
Figure of a Ten Tank LNG Row

(1000 m3 each, capable to fully cover demand of the city of Patras)



LNG Supplies to Crete

- The following concept has officially been proposed to PPC, jointly by DEPA, SBM & LINDE
  - ✓ LNG will be shipped and unloaded to an 130.000 m³ capacity central Floating Storage and Re-gasification Unit (FSRU), which will be anchored offshore in the vicinity of one of PPC's power plants
  - ✓ Part of the LNG stored in the FSRU will be re-gasified and sent to the nearby power plant via a subsea (and thence an onshore) natural gas pipeline
  - ✓ The rest will be trans-loaded onto smaller LNG ships in the order of 8-15,000 m³ capacity for delivery either to other PPC's power stations, or to a small-scale satellite LNG plant for further distribution to residential, commercial and industrial consumers in Crete
- Similarly, LNG could be also transported from the above FSRU to a number of big islands in the Aegean sea (i.e. Rhodes, Kos)

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An LNG Vessel while Unloads into a Peer FSRU

Aegean LNG

- Finally, DEPA's strategic agenda includes a green-field LNG re-gas facility in Northern Greece **(Aegean LNG)**
- The terminal, with a proposed capacity of about 6 bcm/y will be export-oriented and target the wider SE European gas market
- Its strategic importance has exponentially increased following the significant gas discoveries offshore Israel and Cyprus and the high possibility these reserves to be monetized through LNG
- Aegean LNG is better positioned than other proposed LNG terminals in the region and indeed, combined with IGB and South Kavala UGS, could consist a credible entry point for the Balkan gas market and potentially even to become the region's first gas hub
- Switching to an FSRU (a feasibility study is currently under execution) could also reduce project risk by lowering costs and by offering capacity flexibility

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A Floating Storage & Re-gas Unit

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Environmental Challenges for the Shipping Industry

- The shipping industry is facing the challenge of 'going green' in the years to come due to tighter environmental restrictions imposed by IMO regulations, EU Directives, MARPOL Annex VI., SECAs etc.

- The adjustment to new regulatory conditions/requirements is far from being easy, especially under the current economic conditions

- Apart from the substantial capital requirements there are also a number of operational, logistical, commercial, social and safety concerns and obstacles directly related to switching to greener fuels which must be timely overcome

- Lets have a deeper view to these issues

New Regulations Force the Shipping Industry to Adjust…

- Stringent regulations aiming at the reduction of CO2, NOX, SOX and particulate matter emission levels, increase the necessity for the shipping industry to adjust, especially for the owners of passengers ferries, support vessels and cargoes carriers operated in rivers, lakes and “closed seas” (i.e. Baltic Sea, Black Sea, Mediterranean etc.)
- Already, from 1 January 2015 the limits on sulfur content in marine fuels will be decreased from 1.0 % to 0.1 %, in the Baltic Sea, the North Sea, and the English Channel
- In the rest parts of the EU (i.e. in the Mediterranean) the sulfur cup has been set at 0.5% by 2020 onwards and it is expected to be reduced further in a longer horizon
- The shipping industry studies and should make choices among four options:

  1) Burning marine gas oil with lower sulfur
  2) Fitting abatement technologies i.e. exhaust gas scrubbers
  3) Converting to LNG or building new LNG-fuelled ships
  4) Adopting a hybrid solution of dual-fuelled ships

...and Create New Business Opportunities

- But where there are challenges and a need for radical adjustment there are also business opportunities

- Since the environmental performance of LNG is by far better compared with the other conventional bunker fuels (i.e. much lower SOx, NOx, CO2 and particulate matter emissions, lower noise & vibration as well as lower maintenance and consumables costs) it will become more competitive compare with other conventional fuels and very likely the preferred option for the shipping industry thus signaling a new era in bunkering

- On the other hand, transportation of LNG by small vessels from a main import LNG terminal to smaller LNG re-gas facilities of local nature and/or to costal satellite stations it is obvious that will create new business opportunities for the shipping industry

...But Create New Business Opportunities (cont.)

- Additionally, business opportunities could be also for the shipbuilders and the LNG construction industry which should prepare themselves to build/construct new small-scale LNG vessels, storage and re-gas facilities in ports, islands and isolated costal areas

- Finally, the use of LNG as marine fuel would also offer business opportunities to gas and bunkering providers, to classification societies and to ports owners

DNV's Forecasts for LNG Fuelled Ships and LNG Demand as Marine Fuel in 2020

Issues for consideration

- According to Gas LNG Europe ***"Small-scale LNG technology offers an excellent opportunity for improving the environmental footprint and will be key in meeting the increasingly strict environmental requirements for the transport sector (including bunkering)"***
- However, there are still many issues for consideration towards the massive use of LNG as marine fuel

- Such issues are mainly connected to a number of regulatory, logistical and technical issues i.e. :

- Establishment of the appropriate regulatory framework (for ship design, ship engine conversions, for emissions control, for training and licenses granting and for HSE)
- Development of the necessary logistical framework for the supply of LNG to marine customers
- Creation of a consistent and reliable access/partnership to the entire LNG supply chain
- Development of the necessary bunkering infrastructure and the adoption of a number of best practices

Issues for consideration (cont.)

- But also to commercial issues i.e. energy & bunkering costs
- Cost of LNG supply = Market based gas price + Cost of supply logistics
- Cost of supply logistics includes:
  - ✓ Loading from a small-scale LNG facility (unless loading from a large LNG terminal is available i.e. Revithoysa Terminal)
  - ✓ transportation freight to a bunkering port (i.e Piraeus or Patras Port)
  - ✓ bunkering operation in the port area directly to marine customers (ship to ship bunkering) or through a small-scale LNG terminal at the port
- In all cases, LNG supply to ships should be at competitive prices compare with other conventional fuels

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Staten Island Ferry Fueled by LNG

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ARGONON is the First LNG Fueled Chemical Tanker in the World

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LNG Fueled Ro-Ro Ship

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Bunkering from a Small-scale LNG Ship

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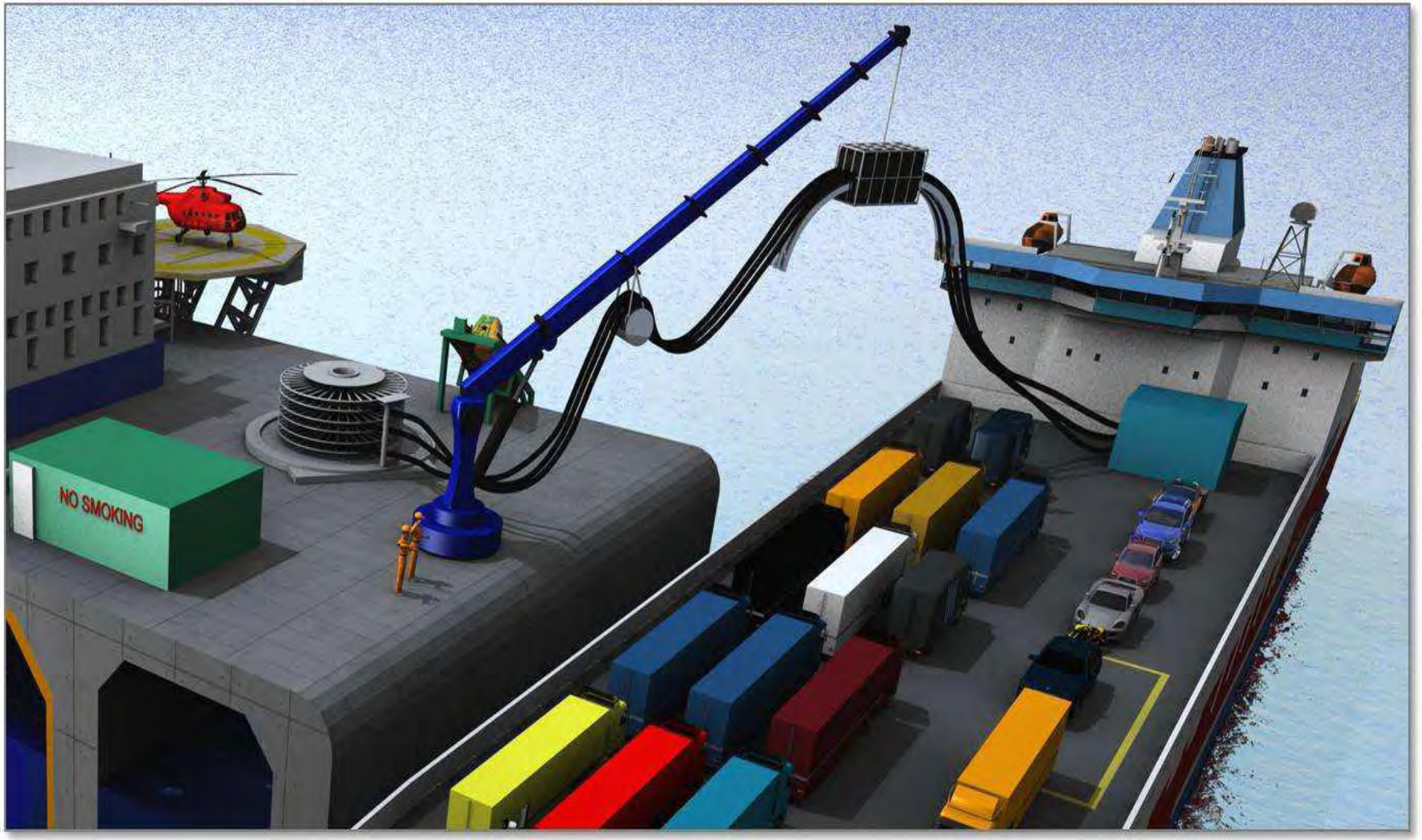
Bunkering from a Dockside Facility



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Bunkering by an LNG Truck

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Bunkering by LNG Tank Truck

The Greek Reality

- Generally speaking there is insufficient preparation/action
- Greece has only limited participation in certain EU co-financed research/pilot projects, which directly refer to Mediterranean countries (i.e. the COSTA Action for CO2 and Shipping Emission Abatement by LNG, funding by TEN or the North-South Blue Corridor).
- However this is not enough
- A national strategy is urgently needed towards the adjustment of the Greek shipping industry to comply with the international regulations in the years to come
- A road-map which should describe/specify roles and actions to be taken by the Greek State, the local and port authorities, the shipping, gas, shipyard and other industries, as well as by other scientific and classification societies and/or interested parties
- Ministry of Shipping should take the lead in this effort
- Starting from the Port of Piraeus the Ministry in close cooperation with the Port Management must coordinate all the involved parties in order to prepare a Master Plan for transforming 'green' the first port of the country

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Conclusions

- Small & mid scale LNG/CNG technology could offer new business opportunities and sources of growth to the gas industry, by increasing gas accessibility to isolated areas (including islands) and by unlocking new market segments
- Small-scale LNG/CNG technology can be also employed in the transport sector, allowing fueling of cars, vehicles, buses, heavy trucks, ships and rail locomotives.
- Similarly, small and mid-scale LNG technology could offer business opportunities to the shipping industry, the shipbuilders and the LNG construction industry, while the use of LNG as marine fuel would also offer opportunities to bunkering providers, to classification societies and to ports owners
- After all. the development of local gas infrastructure and the use of LNG/CNG will create new jobs, reduce CO2 emissions, and foster social and economic development at a regional level

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Thank you for your attention

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