



# Advancing the Vehicular Natural Gas Market

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## Current Status of Vehicular Natural Gas Market

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- As we have heard and seen today, substantive growth in the vehicular natural gas (VNG) market is being driven by several factors, including:
  - Economics
  - Emissions
  - Fuel Security
- Vehicle manufacturers are responding with a wide range of light duty (LD), medium duty (MD) and, increasingly, heavy duty (HD) natural gas vehicles
- Suppliers of fueling infrastructure are advancing design and operational functionality while reducing system costs
- Finally, in yesterday's sessions, we learned of the anticipated growth and strategic importance of LNG as a component of global gas supplies

## The Path Forward

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- Pace Global’s analysis of fuel consumption across the various classes of natural gas vehicles operating in the EU reveals the following “representative” rates of annual fuel consumption

| Class of NGV | mmBtu consumed/year |
|--------------|---------------------|
| Light Duty   | 150                 |
| Medium Duty  | 800                 |
| Heavy Duty   | 1500+               |

Derived from both published and private data

- Given the above data, it may be reasoned that centrally organized, fueled, and operated fleets of commercial MD and HD vehicles will drive vehicular natural gas-related fuel consumption across Europe
- In fact, Pace Global believes that consumption of natural gas by HD vehicles could overtake the combined consumption of LD & MD vehicles.

## The Role of LNG in Developing the NGV Sector

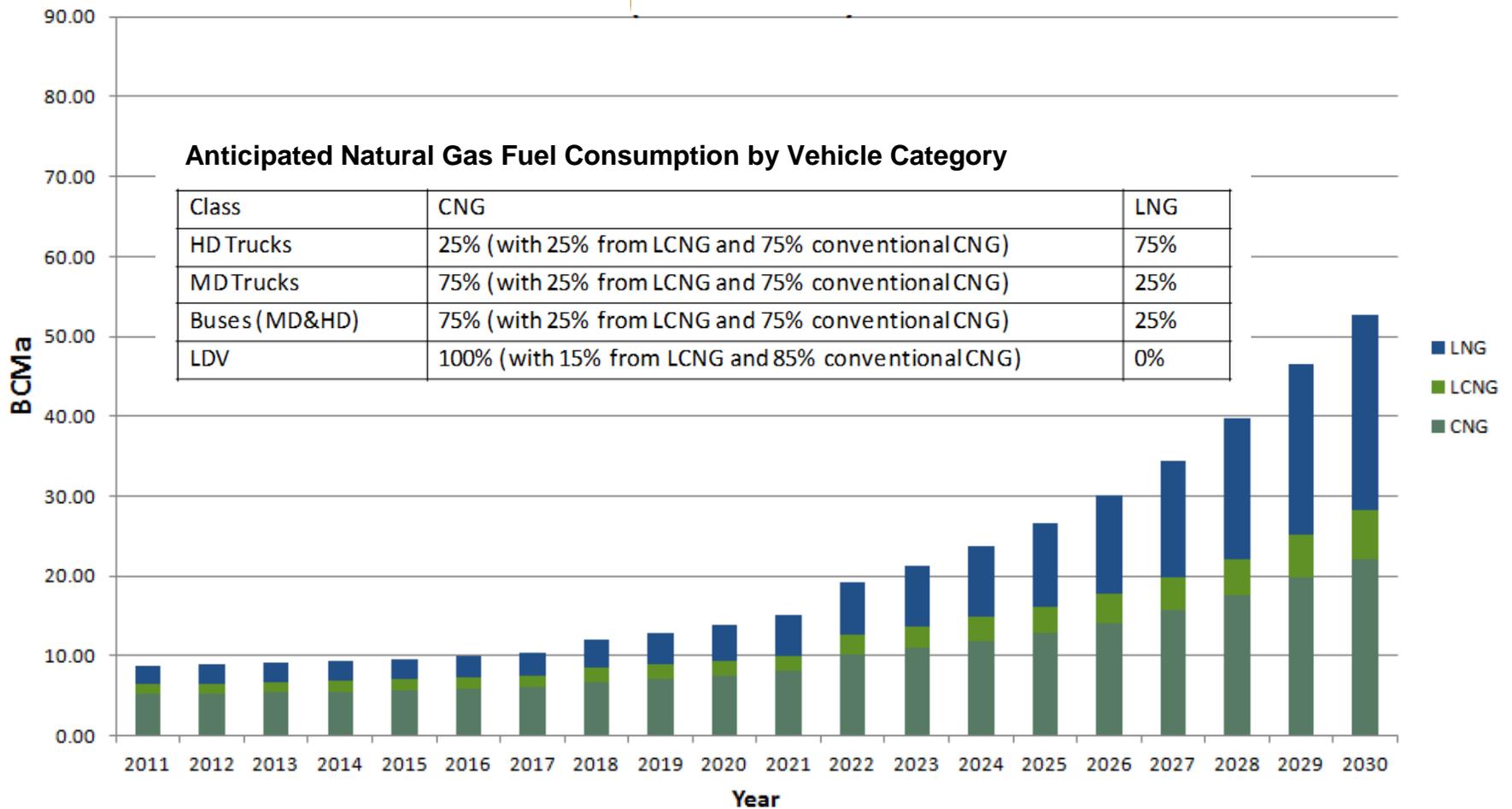
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- Liquefied Natural Gas should be expected to fulfill a significant percentage of natural gas vehicle fuel demand over the coming years.
- LNG offers -
  - Effective fuel density (~21,000 Btu/l or roughly 60% that of diesel fuel) necessary for heavy duty vehicle operational needs
  - The potential to extend fueling infrastructure beyond the geographical presence of the conventional pipeline gas distribution network
  - The capability to supply both LNG and LCNG forms of fuel from a single source
  - An efficient means of supplying large volumes of fuel (LNG and LCNG) with minimal on-site power requirements

On the whole, natural gas vehicle growth rates will be largely dependent on the availability of cost-effective fuel, adequate vehicle fueling infrastructure, and task appropriate vehicles

# The Potential Impact of LNG on Natural Gas Fueling

## Projected 2030 European Natural Gas Fuel Consumption By Fuel Type



Note: Estimations of Consumption by Fuel Type developed by Pace Global

# Market Growth Requires Coordinated Growth of Downstream Segments

1. Interested Customers
2. Heavy Duty Vehicles
3. Fueling Technologies
4. LNG Fuel



LNG is the only readily available, plentiful, cost-effective, and environmentally-friendly alternative to diesel in the heavy duty sector

## Market Entry Strategy “Takeaways”

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- The end-user business case is paramount and will be optimized by –
  - Minimizing premiums paid for NGV technology (cars, trucks, buses)
  - Employing relatively longer periods for end user return on investments (ROI)
  - Careful targeting of fleets that consume larger volumes of fuel (distance, duty, etc.)
  - Creating cost-competitive LNG supply chains
- Focusing marketing and sales efforts on the best end-user business cases. All prospective NGV projects must be carefully targeted, screened, and developed
- Identifying, developing, and nurturing partners with coincident business goals and objectives in the transportation and logistics sectors
- Considering synergies with other industry sectors such as marine bunkering, off-grid supply, and pipeline balancing/storage
- Natural gas industry stakeholders must work with EU regulators to develop internationally harmonized standards and protocols for certification/registration of HD LNGV vehicles and fueling systems

THANK YOU FOR YOUR ATTENTION