



PHIL FATHERS
VICE CHAIRPERSON
NGV GLOBAL

UNECE



Jan 2013

Geneva, Switzerland

NGV Global

- ❑ Formerly International Association for Natural Gas Vehicles (IANGV)
- ❑ Established 1986 (formation meeting in Vancouver)
- ❑ Based in New Zealand
- ❑ Representing worldwide
 - ▣ 4 Affiliated Associations
 - ▣ 7 Allied Associations
 - ▣ 26 Members
 - ▣ 239 Associate Members



Activities

- Special Consultative Status with the United Nations
- Engaged in development of UN ECE regulations
- Liaison status with several ISO and OIML committees
- Liaison with IGU Working Committee 5.3 (Utilization – Natural Gas Vehicles)
- Harmonization of standards big part of focus
- Information gathering and dissemination
- Weekly industry news via NGV Global News – www.ngvglobal.com.



Secretariat

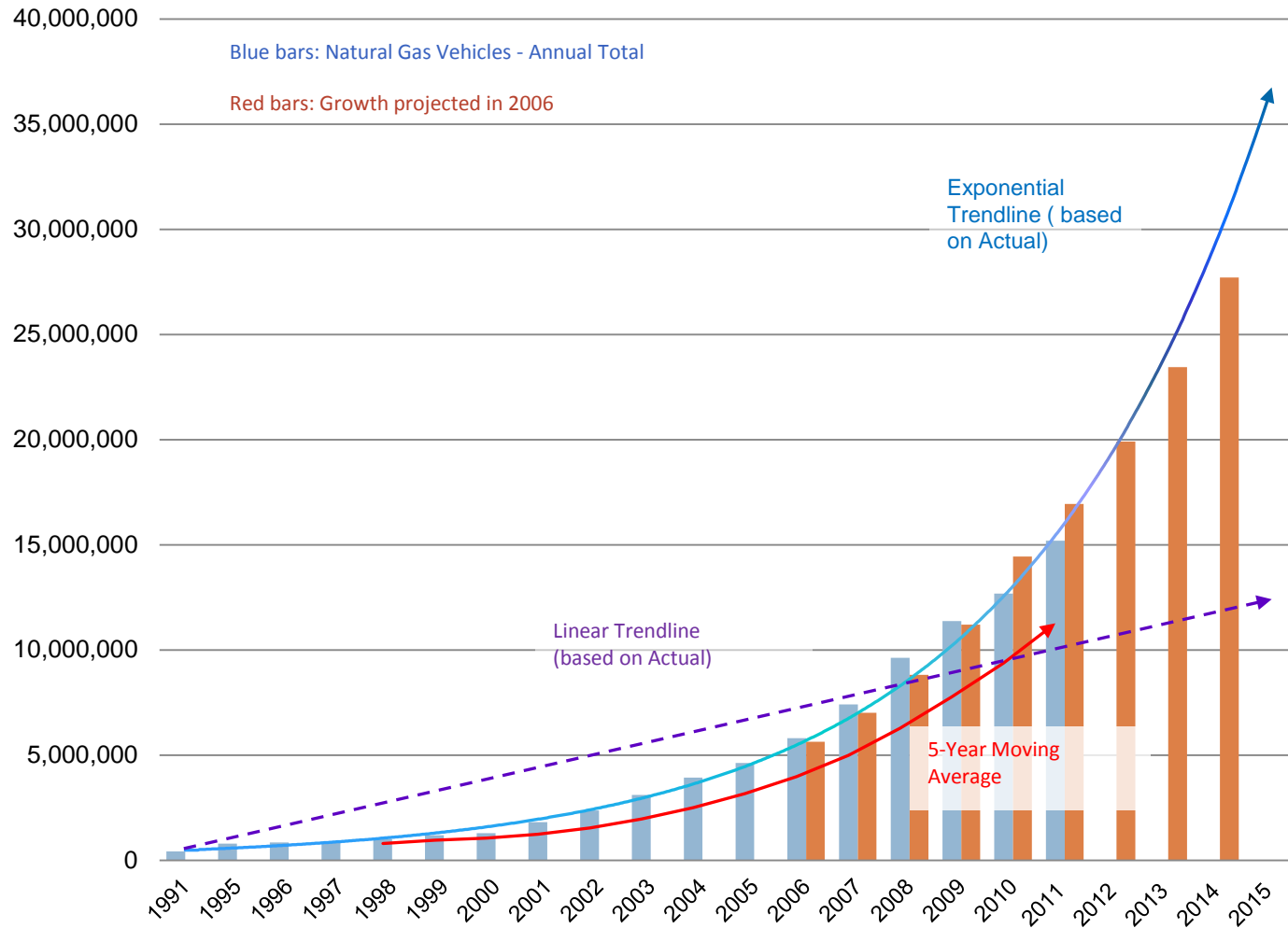
NGV Global's participation in UN ECE activities:

- ❑ Co-Secretariat with AEGPL of the UN Gaseous Fuel Vehicles (GFV) group.
- ❑ Secretariat of GFV Task Force on Heavy Duty Dual-Fuel (HDDF)
- ❑ Co-Secretariat with NGVA Europe of the Task Force on Liquefied Natural Gas vehicles (TF-LNG)
- ❑ Both Task Forces are working on regulations to allow Dual-Fuel and LNG vehicles to operate in UNECE areas.



Status and Growth

**Natural Gas Vehicle Growth Worldwide
Actual with Projections and Trendlines to 2015**



Recent OEM Contributions



More OEMs and Retrofits



Heavy-duty sector

- On-road and off-road (mining, rail)
- No job too big or small for natural gas
- Natural gas the only **real** alternative to diesel
- Does the 'heavy lifting' in displacing oil
- Major source of growth in OECD countries



2012 : Year of HD NGV Engines

- ❑ Cummins Westport Commences Development of Mid-Range Natural Gas Engine (Oct 2012)
- ❑ Peterbilt Adds Westport ISX12 G to Natural Gas Engine Range (Jun 2012)
- ❑ Mack Commits to 2013 Natural Gas Pinnacle and Granite Models (Jun 2012)
- ❑ Volvo Trucks North America Unveils 13L Natural Gas Engine with Westport HPDI Technology (May 2012)
- ❑ Cascadia 113 Joins Freightliner's Natural Gas Vehicle Portfolio (Apr 2012)
- ❑ Volvo Trucks North America Adds Natural Gas 12 Litre VNL Daycab (Mar 2012)
- ❑ Kenworth to Harness Cummins Westport ISX12 G Natural Gas Power (Mar 2012)
- ❑ Cummins Commences Development of 15L On-Highway Natural Gas Engine
- ❑ Navistar's New International Loadstar Work-Truck Includes Natural Gas Version (Mar 2012)
- ❑ China's First Engine with Westport HPDI Technology Unveiled during China National People's Congress
- ❑ Westport Signs HD Supply Agreement with Cummins for Westport HD 15 Litre Engine (Feb 2012)
- ❑ Cummins Westport 12-Liter Natural Gas Engine Undergoes Field Trials (Feb 2012)



Rail

- World record (Russia)
 - ▣ Largest load by a single locomotive of **any** fuel type
 - ▣ 16,000 tonnes, 170 rail cars
- Potential fuel savings of millions of dollars for operators

LNG-Powered GT1 Locomotive Sets New World Record

September 14, 2011 – 9:15 am | Russia, Moscow



LNG-powered GT1 sets new world record.

The Russian-developed GT1-001 gas turbine-electric locomotive has successfully undergone further field tests in Moscow, in readiness for deployment on non-electrified freight-intensive areas of the railways. Hauling 16,000 tonnes in 170 rail cars, a new world record for a single prime mover with an internal combustion engine, the 300 tonne two-section GT1 combines a turbine and power unit with a separate section containing the 17 tonne liquefied natural gas (LNG) fuel tank. The engine can develop 8300 kW of power and when fully fuelled can drive the train 750 kms with a top speed of 100 km per hour.

Canadian National Railway Co. Tests Dual-Fuel Locomotives

September 28, 2012 | Canada, Edmonton AB



Canadian National Railway's locomotive set for testing natural gas fuel operations.

Canadian National Railway Company (CN) is testing two mainline diesel-electric locomotives fuelled principally by natural gas in revenue service in northern Alberta. Keith Creel, executive vice-president and chief operating officer, said, "CN launched this locomotive test to explore the use of natural gas as a potential alternative to conventional diesel fuel. This reflects CN's continuing drive to look for ways to improve operating efficiency and advance the company's sustainability agenda."

"Natural gas has a lower carbon content compared with diesel



CNG Hybrids

- Best of both worlds, natural gas **and** hybrid
- Weight and cost premium vs diesel hybrids reduced due to reduced on-board fuel needs

First BRT Solution for Sweden Uses Gas Hybrid Buses

November 24, 2012 | Sweden, Malmö



A joint venture between the City of Malmö, bus passenger transport company Nobina Sweden and Skånetrafiken, part of a regional public body responsible for public transport on city and region buses and trains in Skåne, will see 15 new gas hybrid buses commence operation in Malmö in June 2014. The new concept is a gas hybrid premiere for Skånetrafiken, since the buses will run on a combination of biomethane and rechargeable batteries that charge when braking. The Euro 6 classification of the buses means a much lower environmental impact.

Tata CNG-Electric Hybrid Buses Trialled by BEST

February 3, 2011 – 1:28 pm | Source: The Times of India | India, Mumbai



Tata CNG-electric hybrid

The city of Mumbai will have two Tata Motors CNG-electric hybrid buses on its streets this week, trialled by public transport provider Brihanmumbai Electric Supply and Transport Undertaking (BEST), reports [The Times of India](#). BEST will conduct a month-long trial and later order more depending on the feedback. The 35-seater low-floor buses, featuring wheelchair access and accommodation, are expected to be well received by commuters. [Read More »](#)

Print PDF

Barcelona Trials CNG Hybrid Prototype Bus; Builds CNG Fleet

April 7, 2011 | Spain, Barcelona



Almost 50% of TMB's fleet of 1,080 buses will be CNG-powered by 2015

Transports Metropolitans de Barcelona (TMB) and Gas Natural Fenosa are trialling a new hybrid bus prototype with electric and natural gas engines, a pilot scheme under an agreement signed last April between TMB and Gas Natural Fenosa to reduce emissions from buses, with the aim of improving air quality in Barcelona and the metropolitan area. The prototype is to be incorporated provisionally into the



Off Road

- Very heavy fuel use
- Fewer weight restrictions
- Potential fuel savings of millions of dollars for operators

Westport and Caterpillar Will Develop Natural Gas Technology for Off-Road Equipment

June 5, 2012 | Canada, Vancouver BC

Initial focus on mining trucks and locomotives

Westport Innovations Inc., a company that designs and builds an array of natural gas engines, has signed agreements with Caterpillar Inc. to co-develop natural gas technology for off-road equipment, including mining trucks and locomotives. Caterpillar and Westport will combine technologies and expertise, including Westport High Pressure Direct Injection (HPDI) technology and Caterpillar's off-road engine and machine product technology, to develop the natural gas fuel system.

Dual-Fuel Mining Truck Demonstrated in U.S.

October 22, 2010 – 6:44 pm | USA, Harlan County



CAT 777

GFS Corp. Converts CAT 777C to 60% Liquefied Natural Gas

Gaseous Fuel Systems, Corporation (GFS), a manufacturer and seller of equipment that enables diesel engines to operate on both diesel and natural gas, has successfully demonstrated its dual-fuel conversion system for mining vehicles in the United States. The CAT 777 operating at a commercial coal production facility in Harlan County, Kentucky operates with more than 60% gas substitution for diesel without loss of performance. [Read More »](#)

XGMA Produces CNG-Powered Wheeled Front Loader

November 18, 2010 – 6:37 am | Source: KHL News | China



XGMA will be exhibiting a new wheeled loader powered by compressed natural gas (CNG), according to a low-detail report by [KHL News](#) that does not specify which locations. XGMA's CNG machine will apparently reduce fuel costs by about 50% compared with a similar diesel machine, and the company says it is also 40% quieter.

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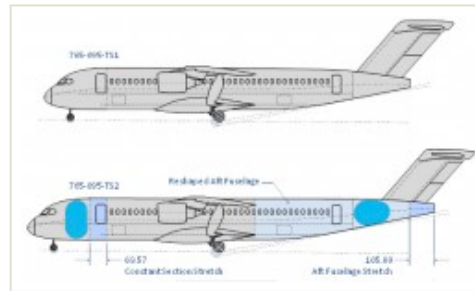


Aviation

- NASA N+4
- 2040-2050 timeframe

Boeing Delivers LNG-Fuelled Aircraft Concept to NASA

March 22, 2012 | Source: Aviation Week | USA



Boeing elongated design concept featuring possible LNG accommodation (in blue).

Will technological advances enable liquefied natural gas powered (LNG) aircraft to take to the skies by mid century, asked the US National Aeronautics and Space Administration (NASA). Boeing has addressed this question by submitting a concept study in February under NASA's N+4 generation airliners program for 2040-2050, reports [Aviation Week](#). Considered too immature a technology for the N+3 program, NASA believed LNG to be worthy of further investigation. Boeing's study says it can be done.

The LNG project is named 'SUGAR Freeze' – SUGAR is NASA's acronym for Subsonic Ultra Green Aircraft Research, a term inclusive of eco-fuel, fuel efficiency, reduced emissions and more efficient design. 'Freeze' refers to the cryogenic fuel storage.



Natural Gas has diverse applications

Steyr Presents Dedicated Natural Gas Tractor

November 30, 2011 | Austria



Steyr Profi 4135 operates on CNG or biomethane.

Under the 'Steyr' brand, CNH Global N.V., a worldwide manufacturer of agricultural and construction machinery majority-owned by Fiat S.p.A., has presented what they say is the first production tractor powered by natural gas, at the recent Agritechnica 2011 exhibition. Based on the Profi 6125 model, the new Steyr Profi 4135 Natural Power is equipped with a turbocharged dedicated (mono-fuel) compressed natural gas (CNG) engine, made by Fiat Powertrain Technologies (FPT), another Fiat group company.

The engine is a 3.0 litre, four-cylinder unit, producing 100 kW/136 hp rated – 105 kW/143 hp max power and a maximum torque of 542 Nm at transmission input shaft.

District of Columbia to Get a Clean Sweep

April 12, 2012 | USA, Washington DC



The Pelican Sweeper can be powered by CNG or LNG.

The U.S. District of Columbia (DC) has added two compressed natural gas (CNG)-powered sweepers and two CNG refuse trucks to its maintenance fleet. The alternative-fueled, single-engine Elgin Pelican Sweeper is powered by the ultra-low emissions Cummins B5.9-195G engine that is certified to U.S. EPA and CARB standards and Euro V and EEV. The engine offers low emissions without sacrificing performance and efficiency.

Elgin Sweeper is a manufacturer of street sweepers for general street maintenance, special industrial and airport applications. The company offers the Pelican, its flagship product, with CNG and liquefied natural gas (LNG) options, also LPG.

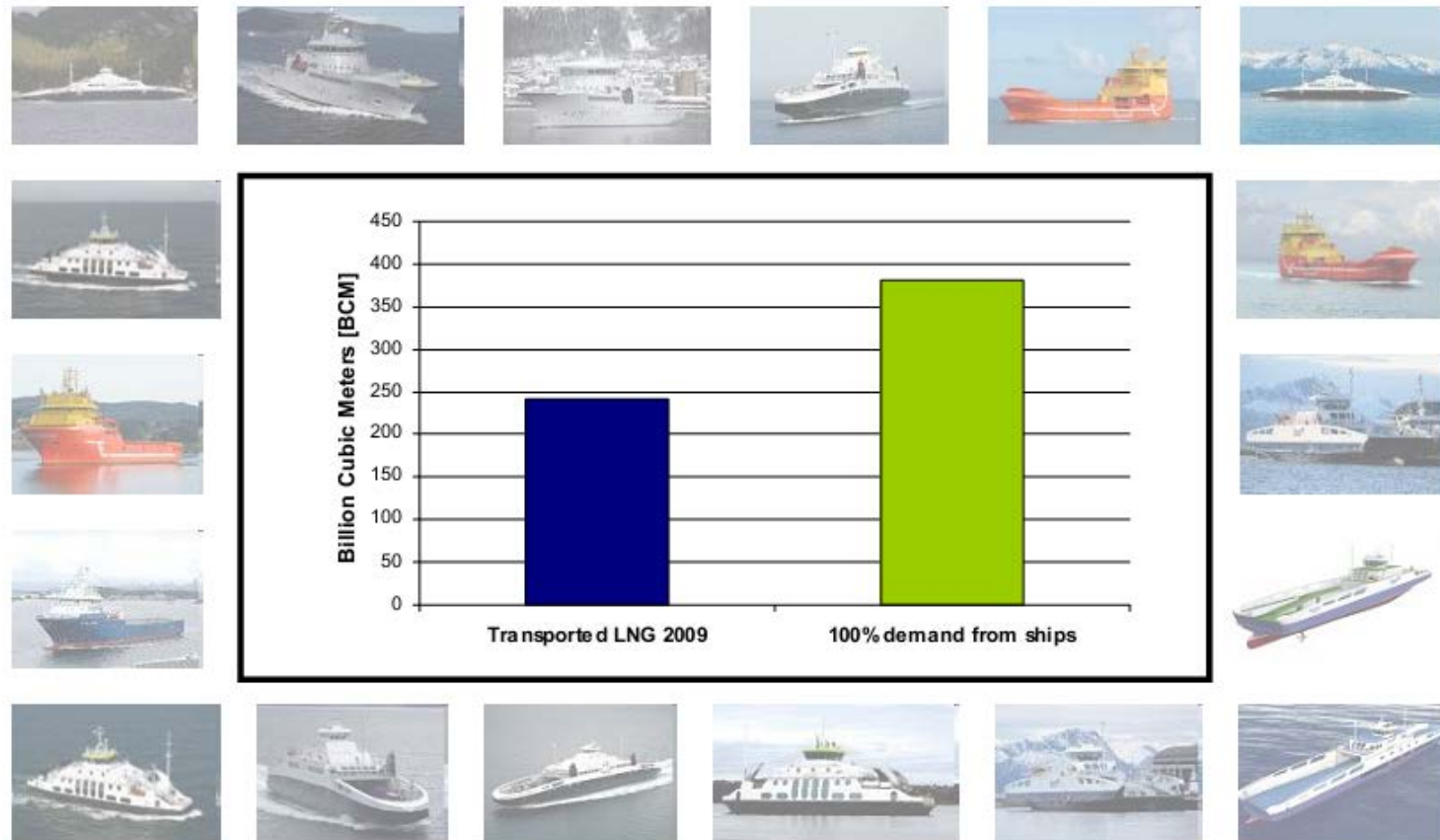


Piaggio CNG Ape



Marine Sector

- Consumes 50% more energy than all LNG shipped internationally in 2009



Marine - LNG Shipping

LNG-Powered M/S Viking Grace Ready for Operations

January 11, 2013 | Finland



STX Finland Oy's Turku shipyard has delivered a next-generation cruise ferry to Viking Line ABP. M/S Viking Grace, described by STX as the most environmentally friendly large cruise vessel ever built, uses Liquefied Natural Gas (LNG) as fuel. Building started at the STX Turku shipyard in September 2011 and the ship was floated out in August 2012, providing some 2,600 man-years of labour to the shipyard.

The ship's emissions into the sea have been eliminated, and

Wartsilä to Supply Dual-fuel LNG Propulsion Package for Dutch Tankers

December 31, 2012 | Finland, Helsinki



Wärtsilä, a marine industry solutions and services provider, has been contracted to supply the complete LNG-powered dual-fuel propulsion package for two new Liquefied Ethylene Gas (LEG)/Liquefied Petroleum Gas (LPG) tankers being built for Anthony Veder, the Netherlands based shipping company specialised in gas transportation. The contract was signed with AVIC-International Shanghai and Avic-Dingheng Shipbuilding Co. Ltd yard in September 2012. The ships are being built at the yard and they will operate in the North Sea area.

Hyundai Heavy Industries Wins Orders for 5 Dual-fuel LNG Carriers

December 31, 2012 | Source: E2News | South Korea

Hyundai Heavy Industries Group (HHI) and its affiliated shipyard Hyundai Samho Heavy Industries (HSHI) have won contracts to build five membrane-type liquefied natural gas (LNG) carriers, all powered by dual-fuel engines, which allows the ships to run either on marine diesel or natural gas. Reported by Korea's **Energy and Environment News**, the sum of orders exceeds \$1 billion.

'Clean Sky' Design for Bulk Carrier Vessels Incorporates LNG Fuel System

December 21, 2012 | United Kingdom, London



"LNG may be the ideal solution for meeting increased environmental performance without losing competitiveness." (Golden Union)

Lloyd's Register, international assurance provider, has provided approval in principle (AIP) for a new 'Clean Sky' bulk carrier design incorporating an LNG-as-fuel system. COSCO, Golden Union and Lloyd's Register started the project in June 2011 to investigate the potential to develop a commercially viable bulk

Caterpillar Extends Focus on LNG Marine Engines

December 19, 2012 | USA, Houston TX



Caterpillar, Inc. is developing a liquefied natural gas (LNG)-fueled, high-speed engine below 2 MW that will be designed primarily for electric propulsion with specific focus on offshore and ferry applications. The new project runs concurrent with the development the company's MaK M 46 DF, a **dual-fuel engine platform** for the commercial marine industry, introduced December 2011 and available in 1st quarter 2014.

Caterpillar says this focus on LNG engine technology demonstrates its ongoing commitment to develop

Contracts Finalised to Build LNG-Powered Containerships

December 7, 2012 | USA, San Diego CA



General Dynamics NASSCO, a wholly owned subsidiary of General Dynamics, has finalized a contract with TOTE, Inc., for the design and construction of two 3,100 TEU Liquefied Natural Gas (LNG)-powered containerships, setting a new benchmark in green ship technology. When completed the 764-foot-long containerships are expected to be the largest ships of any type in the world primarily powered by LNG. Construction of the first



Marine - LNG Bunkering

TEN-T Project Supports Swedish LNG Floating-Bunker Feasibility Trial

January 11, 2013 – 11:00 pm | Sweden



The European Union will co-finance with €261,000 from the TEN-T Programme, a project to convert an existing vessel into a Liquefied Natural Gas (LNG) bunkering ship so that it may be used to refuel other ships. The project, which takes place in the Port of Stockholm and contributes to the realisation of the Motorways of the Sea (TEN-T Priority Project 21), aims to demonstrate the feasibility of using alternative fuels in shipping.

[Read More »](#)

Zeebrugge Port Prepares for Small-Scale LNG Fuel Demand

December 20, 2012 | Belgium, Brussels



New terminal users have booked capacity at the Zeebrugge liquefied natural gas (LNG) terminal to load more than 200 small ships. This is a new step for the terminal in its development into a hub for supplying LNG as a ship fuel. The LNG terminal's ambitions are based on the benefits of using LNG as a reduced-emissions fuel for ships and long-haul trucks.

Last month Fluxys LNG gave potential customers the option to book long-term capacity at the second jetty currently under

Waller Initiates LNG Facility for Marine Fuel

November 17, 2012 | USA, Houston TX



Waller LNG articulated tug barge (ATB) Concept

Waller Marine, Inc., through its LNG development subsidiaries, Waller Energy Holdings, LLC and Waller LNG Services, LLC, (the Company) has initiated activities on its first natural gas liquefaction (LNG) facility to be constructed on a 175 acre site the Company has acquired at the entrance point of the Calcasieu Ship Channel in Cameron Parish in Southwest Louisiana. Using small-scale liquefaction technology, the Company plans to install nominal 500,000 gallon per day LNG

Gazprom and Gasunie to Cooperate on Small Scale LNG

October 24, 2012 | Russia, Moscow and Netherlands, Groningen



Following discussions during the St. Petersburg Economic Forum in June 2012 Gazprom Export (Russia) and Gasunie (the Netherlands) signed a Memorandum of Understanding on cooperation in the field of development of small scale LNG. The Memorandum was signed by Alexander Medvedev, General Director of Gazprom Export LLC and Paul van Gelder, Chairman of the Executive Board, CEO of Gasunie. The purpose is to make LNG available for distribution to marine bunkering and truck fuelling stations. In this way LNG can be used as a clean

Rotterdam-Gothenburg Port Alliance to Accelerate LNG for Marine Fuel

October 18, 2012 | The Netherlands, Rotterdam and Sweden, Gothenburg



The largest port in Europe, the Port of Rotterdam, and the largest port in Scandinavia, the Port of Gothenburg, have entered a new alliance. The aim is to speed up the establishment of liquefied natural gas (LNG) as a maritime fuel. A memorandum of understanding will be signed between the Port of Rotterdam and the Port of Gothenburg. Both ports are located within the Sulphur Emission Control Area (SECA) in northern Europe where stricter rules governing sulphur in maritime fuel are due to be introduced in 2015. The aim is to

Joint Industry Project on Assessing Requirements for LNG Bunkering in Australia

October 16, 2012 | Australia



Det Norske Veritas (DNV) and nine key members of the Australian maritime, port and energy sectors have established a four-month study organized as a Joint Industry Project (JIP). This JIP's intention is to facilitate the adoption of LNG fuelled vessels in Australian waters. Using LNG as marine fuel eliminates SOx and particulate matter emissions, nets a 15% reduction in GHG emissions and diminishes that of NOx by 85-90%. This addresses both local and global pollution issues.



Energy Security

Oil Supply Vulnerability Highlights Need to Step Up Natural Gas Vehicles Programs

July 1, 2011 – 7:51 pm | Source: Brett Jarman - NGV Global executive director



"The cost of an NGV program is small compared to the cost of propping up the oil economy with 'emergency reserves'."

The uncertainty surrounding oil markets has been demonstrated by an intervention last week from the International Energy Agency (IEA) calling for the release of 60 million barrels of oil from emergency reserves of its member nations. The intervention is only the third in the 35 year history of the IEA and is intended to ameliorate oil supply after disruption caused by events in Libya. While some analysts have questioned the need for the stock release at this time, it reminds us that oil supplies, the lifeblood of most economies, are a fragile balancing act. The

release also follows a [report issued by the IEA](#) suggesting that we are entering a 'golden age' of natural gas. From an overall fuel supply perspective it highlights what the IEA refers to as "[oil's twilight](#)" and the need for new mainstream alternatives.

[Read More »](#)



Current Issues (Gas industry related)

- Gas quality & composition
 - ▣ NGVs have more particular needs than most natural gas users
- Vehicle and station safety
 - ▣ Very high standards in place and very good safety record but growing opportunities for 'abuse' as NGV population grows. We need to be pre-emptive.
- Engaging with the opportunity
 - ▣ Oil reserves declining, gas reserves increasing
 - ▣ Transport consumes more than 25% of world energy
 - ▣ Gas industry yet to grasp the scale of the opportunity



Information Flow



NGV GLOBAL
2012
MEXICO CITY, MEXICO

- A global thirst for information about natural gas vehicles and implementation
- More conferences on annual calendar

Date	Event
28/01/2013 - 29/01/2013	<u>Gas Transport and Storage Forum 2013</u> <i>Hotel Palace berlin, Berlin</i>
28/01/2013 - 30/01/2013	<u>LNG Bunkering Summit 2013</u> <i>The Manhattan Hotel Rotterdam, Rotterdam</i>
31/01/2013 - 01/02/2013	<u>7th Natural Gas Vehicles & Infrastructure Indonesia Forum and Exhibition</u> <i>Darmawangsa Hotel, Kebayoran Baru, Jakarta</i>
31/01/2013 - 01/02/2013	<u>Green Gas for Transport</u> <i>Kulturcenter Limfjord, Skive</i>
19/02/2013 - 22/02/2013	<u>ExpoBioqaz</u> <i>EUREXPO, Lyon</i>
19/02/2013 - 20/02/2013	<u>Prospects for the Development and Use of CNG in Transport</u> <i>Prague Congress Centre (U Hajku), Prague</i>
24/02/2013 - 26/02/2013	<u>Natural Gas Vehicle Infrastructure Conference & Exhibition (2nd Annual)</u>

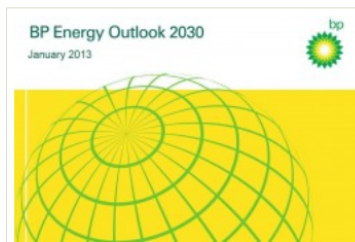
- More reports and research



Reports and reports

BP Publishes Energy Outlook 2030 — Natural Gas Grows as Transportation Fuel

January 17, 2013



Strong growth in production from unconventional sources of gas and oil will have a major impact on global energy markets to 2030, redefining expectations for major economies and rebalancing global trade flows, according to BP's latest Energy Outlook 2030. The transport sector illustrates a strengthening role for natural gas as a fuel for transportation.

The world has ample proved reserves of oil and natural gas to meet expected future demand growth. At the end of 2011, global proved reserves of oil were sufficient to meet 54 years of current

(2011) production; for natural gas that figure is 64 years.

Energy Vision Report Documents Biomethane (RNG) as Transportation Solution for USA

January 15, 2013 | USA, New York NY

A newly released publication, *Renewable Natural Gas (RNG): The Solution to a Major Transportation Challenge*, reports that the use of renewable natural gas (biomethane) as a vehicle fuel is a technologically viable alternative to relying exclusively on petroleum-based fuels for transportation. The new publication was prepared by Energy Vision, a national, New York-based energy research organization.

UK Report Identifies Natural Gas as Key Carbon Cutter for Road Freight Sector

December 3, 2012 | United Kingdom



Sainsbury's dual-fuel fleet operates with Clean Air Power technology and Gasrec biomethane.

Switching from diesel to natural gas, reducing rolling resistance and aerodynamic drag and introducing more hybrid and electric vehicles are identified as key opportunities for further cutting carbon and improving efficiency in the road freight sector according to a new report commissioned by the United Kingdom's Transport Knowledge Transfer Network (TKTN) and the Low Carbon Vehicle Partnership (LowCVP).

The report, written by Ricardo-AEA for the project partners, focuses on the key technical opportunities, but importantly identifies options to overcome the main barriers to the adoption

European Gas Forum Concludes Greater Use of NGVs Will Meet CO2 Abatement Targets

October 15, 2012 | Belgium, Brussels



Huge Cost Savings delivered by Alternative Pathway

"European policymakers need to recognise the important role that natural gas can play." Klaus Schäfer, CEO of E.ON Ruhrgas AG on behalf of EGaF

The European Gas Forum (EGaF), established by eight major European gas companies in 2010, has produced a new report — *Reducing CO2 emissions in the EU Transportation Sector to 2050 — An alternative pathway to reach 2050 abatement targets with lower costs* — to provide policy makers and industry players with descriptions of alternative decarbonisation pathways for the transport sector in order to meet abatement targets in 2050 and compares the potential cost requirements of each. The study reveals "continuing the use of [natural] gas is consistent with long term decarbonisation goals and provides economic benefits" (pg 28).

US Study Focuses of Natural Gas as Transportation Fuel for Local Distribution Companies

October 3, 2012 | USA, Washington DC



American Gas Foundation (AGF), an independent research organisation based in Washington DC, has released a study — *Natural Gas as a Transportation Fuel: Business Models for Local Distribution Companies* — written to enable local distribution companies (LDCs), and other stakeholders, to better understand the commercial and regulatory considerations involved in entering the NGV refueling market in the United States

ClassNK Issues Guidelines for Gas-Fuelled Ships

February 23, 2012 | Japan, Tokyo



Tokyo-based Nippon Kaiji Kyokai, known as ClassNK or NK, a ship classification society, has issued engineering "Guidelines for the issuance of ship fuel gas". The draft guidelines were compiled based on the IGF Code of the International Maritime Organization (IMO) — *International Code of Safety for Ships Using Gases and or Other Low Flash-Point Fuels*. The publication would appear to be in response to increasingly stringent IMO emissions controls and recognises the rapidly

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