

THE ITALIAN EXPERIENCE: SAFETY AND TECHNOLOGY



Mariarosa Baroni

NGV International Academy – President

ITALY A WORLD LEADERSHIP:

90 years of experience

1,7 Billion € Overall Turnover

983, 000 NGVs

1,170 refuelling stations

20, 000 employees



The Italian Natural Gas Industry for a sustainable mobility



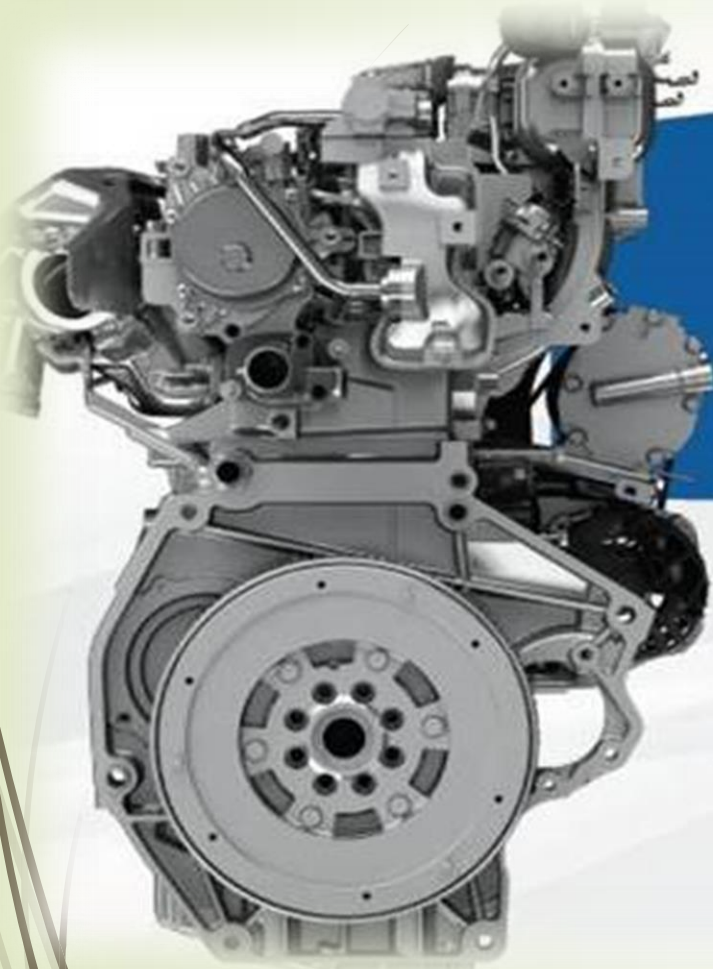
The italian natural gas Industry
for a sustainable mobility

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www.ngvitaly.com



Technology



0.9 TWINAIR
TURBO
CNG
80 HP ENGINE

■ CNG CO₂ EMISSIONS:
86 G/KM

■ CNG CONSUMPTION:
3.1 KG/100 KM
(TYPE-APPROVAL COMBINED CYCLE)

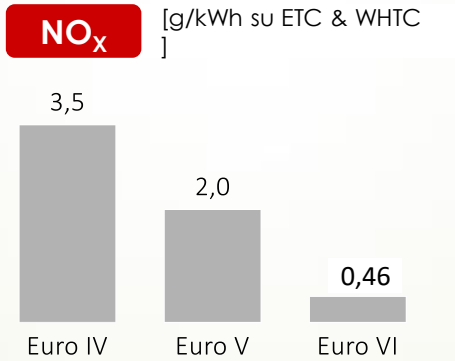
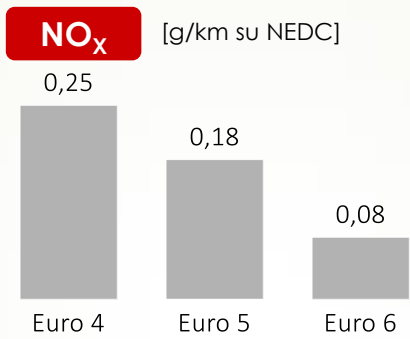
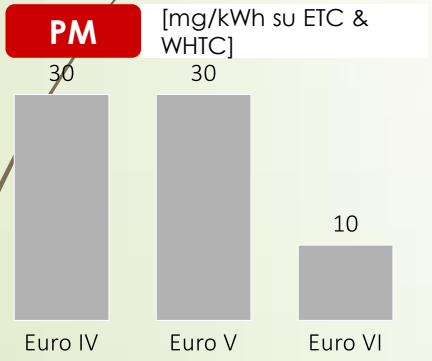
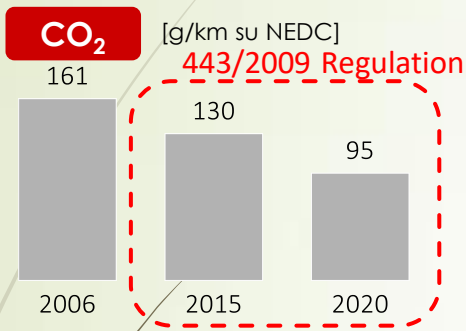
CURRENT FLEET COMPOSITION and EMISSIONS TREND



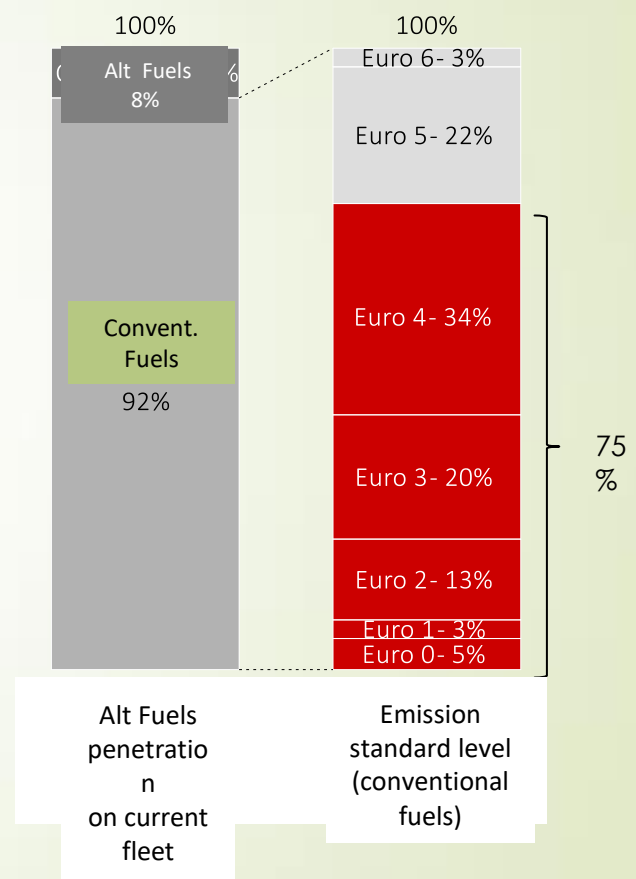
EMISSIONS STANDARD EVOLUTION

CARS

COMMERCIAL VEHICLES



FUELS AND TECHNOLOGIES TODAY



Source: Dati New European Driving Cycle (NEDC), Emissioni CO₂ (EEA), dir. 98/69 (emissioni NO_x EURO 4), limiti normativi reg(CE) n.715/2007 (emissioni NO_x EURO 5, EURO 6), penetrazioni carburanti (ACEA, 2015).

ENVIRONMENTAL +: Emissions comparison - Passengers cars

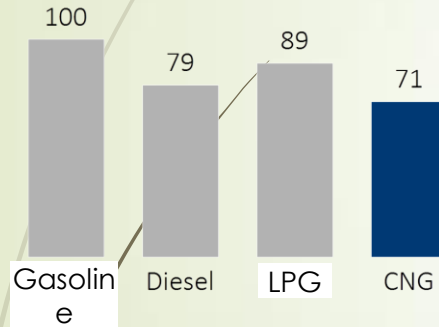
FCA
FIAT CHRYSLER AUTOMOBILES

IVECO

CNG is one of the cleanest alternative fuel available
Over the CO₂ benefits, it reduces significantly the most harmful emissions

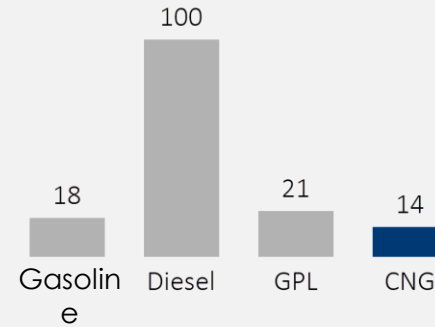
CO₂

[100 = Fuel with highest emissions
e.g.: comparison made on Fiat Panda
Euro 6b]



NO_x

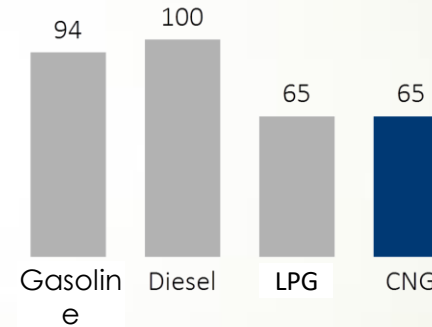
[100 = Fuel with highest emissions,
source: ISPRA 2014 Euro 6b]



Euro 6b limit:
60 mg/km – S.I.
80 mg/km - Diesel

PM

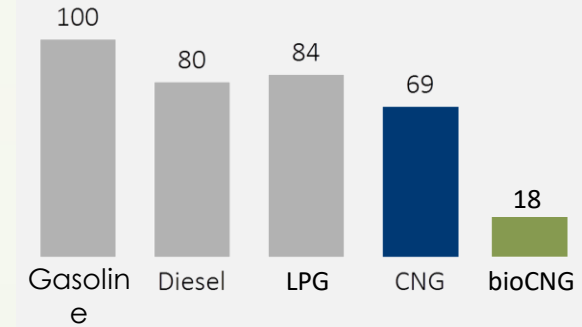
[100 = Fuel with highest emissions,
source: ISPRA 2014 Euro 6b]



Euro 6b limit:
4,5 mg/km
(both S.I. and Diesel)

WELL TO WHEEL

[100 = Fuel with highest emissions
e.g.: Panda Euro 6 b – Data Well to Tank JRC
2012]



Comparison made using CO₂ emission factor
of ADEME

<http://www.objectifco2.fr/index/documents>

ENVIRONMENTAL +: Emissions comparison – Heavy Duty



CNG is one of the cleanest alternative fuel available
Over the CO2 benefits, it reduces significantly the most harmful emissions

CO₂

100

85

Diesel

CNG

NO_x

100

62

Diesel

CNG

PM

100

1

Diesel

CNG

WELL TO WHEEL

100

22

Diesel

bioCNG

Comparison made using CO2 emission factor of ADEME

<http://www.objectifco2.fr/index/documents>

This emission comparison is based on homologated values (WHTC) of the IVECO Cursor 9 Euro VI-C 400 hp diesel and CNG

ENVIRONMENTAL +: BIOMETHANE additional benefits

FCA
FIAT CHRYSLER AUTOMOBILES

IVECO

Infrastructure and technologies developed for natural gas represent a good platform for the uptake of renewable resources such as bio-methane

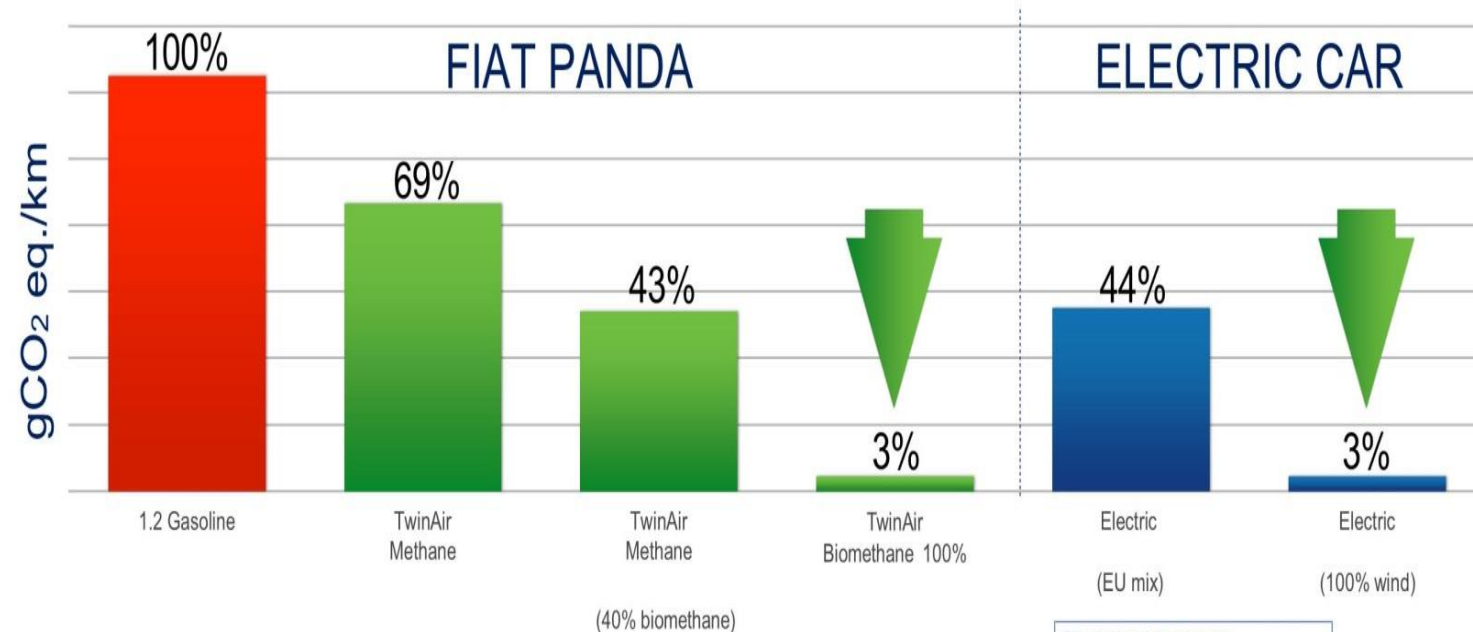
SUSTAINABILITY

Infrastructure and technologies used for the transport of natural gas allow a more extensive use of bio-methane, a renewable fuel comparable to electric

CO₂ EMISSIONS COMPARISON - WELL TO WHEEL

WTW = WTT (Well to Tank) + TTW (Tank to Wheel)
WTT including fuel production, refinement, distribution and refilling
TTW representing tailpipe emissions

CO₂ equivalent = CO₂ + 25*CH₄ + 298*N₂O
according to IPCC standards used in the JRC Study



EU mix electricity sources:
27,4% nuclear
47,7% fossil (coal, oil, natural gas)
24,9% renewables (hydropower, wind, solar)

CNG ITALIAN CASE: MoU FCA – CNG – Snam



IVECO



The natural gas sector has an annual turnover of €1.7B and employs 20,000 people in Italy



- Active role in the expansion of natural gas infrastructure and the number of stations
- **Investment of €200M over the next 5 years to foster the development of CNG infrastructure**
- Coordinate the development of service stations throughout Italy
- Customer service improvement to support the evolution of an increasing vehicles fleet



IVECO

- Promotion of the CNG broadest product offering and continuous improvement of its technology
- **Investment of €40M over 2015-2018 period to develop a complete new generation of HD gas trucks**
- Cooperation with gas supplier and transporters to create new public refueling station where most needed in Europe
- Switch IVECO and FCA logistic from diesel to gas trucks
- Active promotion and dedicated marketing campaigns to promote CNG and its advantage



CNG fleet increase to 3 million vehicles over the next 10 years

Snam, FCA and IVECO joint action to boost an effective CNG development

A EUROPEAN PERSPECTIVE: CNG Projects



Italy is a leading player in the Natural Gas industry in Europe and in the world

TECHNOLOGY FOR NATURAL GAS: AN ITALIAN EXCELLENCE

The Italian natural gas industry worth €1.7B per year and has ~20,000 employees

FCA and Iveco have been chosen as main partner of the Israel government for the co-operation in the development of natural gas-based technologies, aimed at reducing the transport industry's dependence on oil

FCA remains the only automaker to offer an OEM-built natural gas pickup in the US, the Ram 2500 Heavy Duty CNG

FCA and Iveco cooperate with Engie to spread the use of natural gas in transport in Belgium, France and Romania

FCA and GRDF collaborate to develop the natural gas transport in France



Natural Gas technology is:

- available
- environmental friendly
- safe
- reliable

SNAM, FCA and IVECO are working together to support the CNG development in Italy,
within the guidelines of the European Directive on Alternative Fuels Infrastructure (DAFI)

1st/ positive result of collaboration with Engie: Wallonia adopts a mobility plan for Alternative fuels



VERDISSEMENT DE LA FLOTTE PUBLIQUE WALLONNE: CONTENT

As from 1/1/2017, 50% of the new public fleet vehicles will be with alternative fuels (CNG, electric, hybrid, hydrogen)

As from 1/1/2030, 100% of new public fleet vehicles will be with alternative fuels (CNG, electric, hybrid, hydrogen)

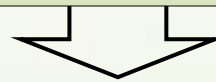
Annual fleet renewal of 10%: expectation of 250-300 vehicles/year + Expected annual fleet renewal of 20% for all semi-public entities

Specific regulatory framework to facilitate and speed for the installation of CNG filling stations, even for private use

Fiscal incentives for local authorities buying

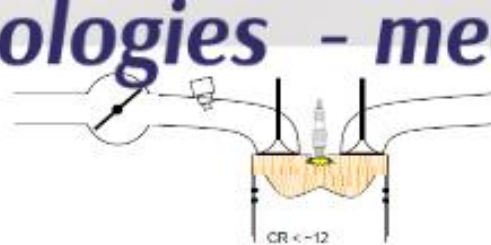
* electric or CNG vehicles below 3,5T: 20% of the price with a maximum of 6.000 €

* Non-polluting vehicles or Min EURO 5 over 3,5T: 15% of the vehicle price with a maximum of 22.500€

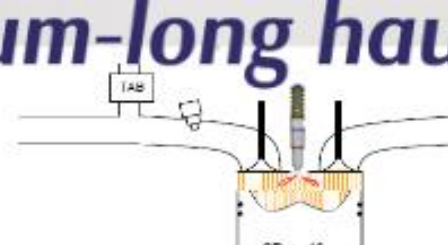


Green Public Procurement and fiscal incentives for alternative fuels are the ignition for private sector to invest in infrastructure and in Alternative Fuel fleets

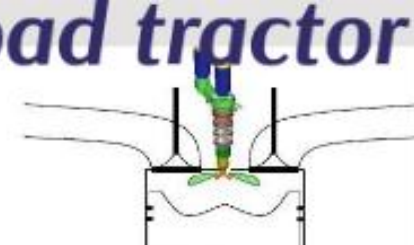
available technologies - medium-long haul road tractor



SPARK IGNITED



COMPRESSED IGNITED



	1 MONO FUEL	2 DUAL FUEL	3 HPDI
Thermodynamic cycle	Otto	Diesel	Diesel
Injection	Air inlet	Air inlet	Direct
Engine efficiency	-17%	Similar to diesel	Similar to diesel
Diesel replacement rate	100%	50-60%	90-95%
TCO estimated reduction	6%		
Work with	CNG/LNG	CNG/LNG	LNG
Can run this diesel only	NO	YES	NO
Cruise range (1000km)	700 liters	500 liters	530 liters
Euro VI emissions	compliant	compliant	Under development
After-treatment	3-way catalyst w/o urea	Diesel ATS	Diesel ATS
Retrofit opportunities	NO	YES	NO
Noise level	-5dBA	Slightly better than Diesel	Same as diesel
Braking	Weaker	Same as diesel	Same as diesel

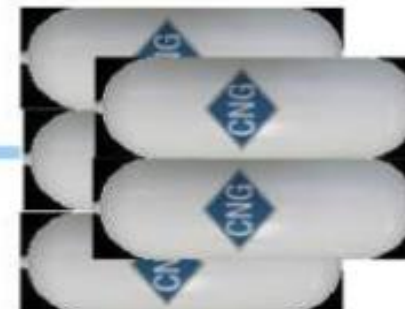
d-gid Flexible Dual Fuel LNG/CNG



Cryogenic Storage
Liquid Natural Gas
at -162°C 8 bar

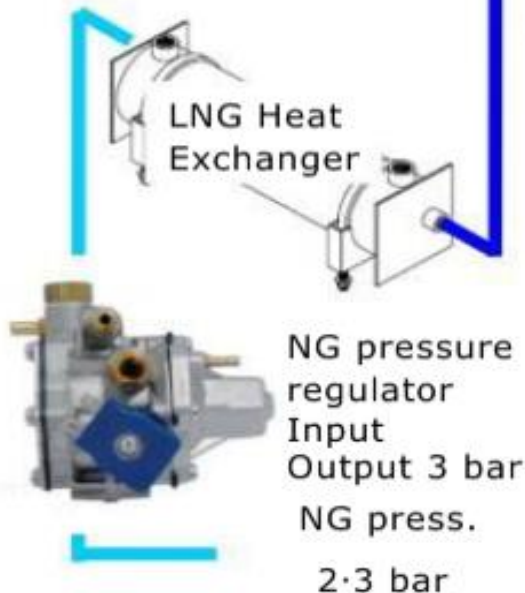
LNG
Cryogenic Tank
LNG

CNG
Hi-pressure Cylinders
CNG



Hi Pressure Storage
Natural Gas
Compressed at 220 bar

d-gid ECU can easily manage both LNG and CNG according
with desired Diesel Dual Fuel strategy



Stralis CNG / LNG

MAIN CHARACTERISTICS

Engine – Cursor 8



LNG tank with evaporator and refueling receptacle



Standard working pressure and temperature: 10 bar, -130° C

3-way passive catalyst



CNG Refueling system



Safety switch: when case open the engine cannot start

CNG receptacle: NGV1 or NGV2

CNG cylinders



Type: CNG-I (steel)
Standard working pressure: 200bar

ISO 15500
SERIES

ISO 12614
SERIES

ISO 12619
SERIES



Cooperation

Liaisons

ISO TC 22/ SC 41

CUNA

WG 3
Gaseous Fuel
Fuel system components

WG 4
Vehicles propelled by LNG
Fuel system components and
refuelling connectors

WG 5
Vehicles propelled by
gaseous Hydrogen
Fuel system components

WG 6
Fuel system components and
refuelling connector for
vehicles propelled by Liquefied
Petroleum Gas (LPG)

WG 7
General safety
requirements of vehicles
propelled by gaseous
fuels

ISO TC 58
GAS CYLINDERS

SC 3
CYLINDER DESIGN

ISO TC 70
INTERNAL COMBUSTION
ENGINES

ISO TC 193
INATURAL GAS

ISO TC 197
HYDROGEN
TECHNOLOGIES

ISO TC 220
CRYOGENIC VESSELS

ISO TC 252
NATURAL GAS FUELLING
STATIONS FOR VEHICLES

WG 1
CNG STATIONS

WG2
LNG STATIONS

UNITED NATIONS ECONOMIC
COMMISSION FOR EUROPE

CEN TC 326
GAS SUPPLY FOR NATURAL
GAS VEHICLES

WORKING PARTY ON
GENERAL SAFETY
PROVISIONS
(GRSG)

WORKING PARTY on
POLLUTION and ENERGY
GRPE

GASEOUS FUELLED
VEHICLES
(GFV)

ISO 16924

ISO 16923
based on prEN 13638

TASK FORCE ON LIQUID
NATURAL GAS VEHICLES
(TF-LNG)

World Forum for Harmonization
of Vehicle Regulations
(WP 29)

Reg. 110
Reg. 115
Reg. 67
Reg. 134

Mandatory standardization



Alternative Fuel Systems





Comitato Fondo Bombole Metano

19

- ✓ Established on 8 July 1950 by Law n. 640 for circulation and use of natural gas cylinders and for the creation of the "**Fondo Bombole Metano**". The Fund receives 0,035 € for each Sm³ sold and is administered by a committee composed of representatives of the Ministries, natural gas producers, owners of cylinders for natural gas, distributors and transporters of natural gas and two representatives of Eni.

The Committee:

- ✓ is responsible for guiding and controlling the optimal safety of operating conditions of the natural gas cylinders for road haulage
- ✓ is autonomous in terms of the assets required and accounting of activities to ensure the fulfilment of its institutional role
- ✓ administers the Fund

Fondo Bombole Metano was established on 8 July 1950. On 5 January 1998 a Decree granted Eni S.p.A. the exercise of activities relating to the Fondo Bombole Metano for twenty years, enabling Eni SpA to conduct such activities through a subsidiary company **SFBM SpA** (established in December 1999).

Technical activities

testing of cylinders using a hydraulic test presented in line with expiry dates (4 or 5 years).

- inspection by hydraulic and ultrasound tests of composite cylinders installed on public transport in line with expiry dates (four years).
- replacement of cylinders that are no longer suitable for use.
- cylinder punching activities.



L-CNG STATION



the strength of the chain is measured on the weakest link

which is the weakest chain's link?





weakness of workshop



no evidence of training



no evidence of certified competence



no evidence of application of mandatory/voluntary standards (as OEMs & System Manufacturers)

**IMPRESE CHE TRASFORMANO I VEICOLI
PER L'USO DEI GAS GNC E GPL -
QUALIFICA DEL PERSONALE TECNICO**

CUNA
NC 120-01
GIUGNO 2013

Workshops which convert road vehicles for the use of CNG and LPG – Qualification of technical personnel

SOMMARIO

La tabella definisce le competenze, le abilità e le conoscenze necessarie per la qualifica del personale tecnico delle imprese che trasformano il sistema di propulsione dei veicoli per l'uso dei gas (GNC e GPL).

RELAZIONI NAZIONALI

==

RELAZIONI INTERNAZIONALI

==

ORGANO COMPETENTE

CUNA - Commissione tecnica di Unificazione Nell'Autoveicolo

APPROVAZIONE

Ministero delle Infrastrutture e dei Trasporti
Dipartimento per i Trasporti, la Navigazione ed i Sistemi Informativi e Statistico
Direzione Generale per la Motorizzazione
(Prot. 26317 del 25/10/2013)

EDIZIONE PRECEDENTE

Ottobre 2007

CUNA
Commissione Tecnica di
Unificazione
nell'Autoveicolo
Corso Galileo Ferraris, 81
10128 TORINO, Italia


Riproduzione vietata. Tutti i diritti sono riservati. Nessuna parte del presente documento può essere riprodotta o diffusa con un mezzo qualsiasi, fotocopie, microfilm e altro, senza il consenso scritto della CUNA.

CUNA

more than 3500
technicians trained

800
technicians certified

conclusion



Installer/ workshop seems to be the weakest point of the NGV value chain mainly for the lack of certified competence

Although OEM and System Manufacturer must apply mandatory and voluntary standards, the value chain is badly effected by continuous demand of cheap products



To Do:

in order to stress the priority of safety start a massive campaign to train as much technicians as possible accordingly with the NGVs sold



To Do:

A strong action shall be implemented in order to include in regulations the requirements concerned with WORKSHOPS (the weakest part of the system)



Needs for **COMPETENT PERSONS**

Ensuring NGV safety is a critical Scope

Training Courses dedicated to:

- **Decision Makers**
to explain the high potentiality of natural gas alternative fuels and all advantages to pursue the scope fixed by UE for the next 30 years on environment policy
- **Potential investors** in the natural gas business
- **Marketing and sales manager** to deliver significant business benefits in better sales technique of alternative fuels vehicles
- **Workshop Technicians** for installation and maintenance of vehicles
- **Fuelling station manager**
- **Fleet manager**



The NGV International Academy (The NGVIA)

Ensuring NGV safety is a critical responsibility for every fleet manager operating compressed natural gas (CNG) vehicles or liquefied natural gas (LNG) vehicles. Safety is the most critical training need for NGV technicians because of their daily contact with the fuel delivery system, storage and fueling equipment



NGVIA Vehicle Training Mission Statement

NGVIA aims to provide accurate and relevant technical training to prepare technicians to safely and competently install, inspect and service NGVs by utilizing professionally facilitated instructional techniques and **certified** performance based assessment..

Certification

Will be released by a certification body accredited accordingly with ISO/IEC 17024, and member of the **International Personnel Certification Association** .



TRAINING TEAM

Our team is **well known globally as most experienced** in natural gas business: ISO Tech. Committes and Standards, OEM and CNG engine, electronic and System industry experts, natural gas companies, all with more than 25 years' experience..

Who and what facilitate

- **decision makers** to invest on NGVs: (reference can be the UE policy for the next 30 years on alternative fuels)
- **government decision makers** - Italian Case Study: legislation, rules and directives, incentives, barriers to remove - what happens in UE and in the rest of the world
- **potential investors in NG business** - new opportunities: different case studies from filling stations owners - OEMs, aftermarket workshops
- **sales technique of NGVs** - customers service skill and marketing expertise - economic advantages
- **new technology** to support the NG development: dual fuel naval and on wheel
- **installation of retrofit system, maintenance and diagnostics in workshop**
- **maintenance and diagnostic for Natural Gas Vehicles (NGVs) in workshop**
- **installation and management of a filling station**

Who should attend...

- Public and Private Decision makers
- Technicians who will perform installation of components and maintenance on NGVs
 - NGV Technician and Fleet Operations Safety
 - CNG Fuel System Inspector
 - Heavy-Duty NGV Maintenance and Diagnostics
 - Light-Duty NGV Maintenance and Diagnostics
- All employees involved in NGV fleet operations
 - Driver, Technician and Fuel Handler Safety for CNG / LNG Powered Vehicles
 - NGV Fleet Driver
- Introduction to NGVs, Fueling and Maintenance Facilities*
- Fleet managers and supervisors
- Corporate/agency safety managers
- Risk management staff

Thank you for your attention

