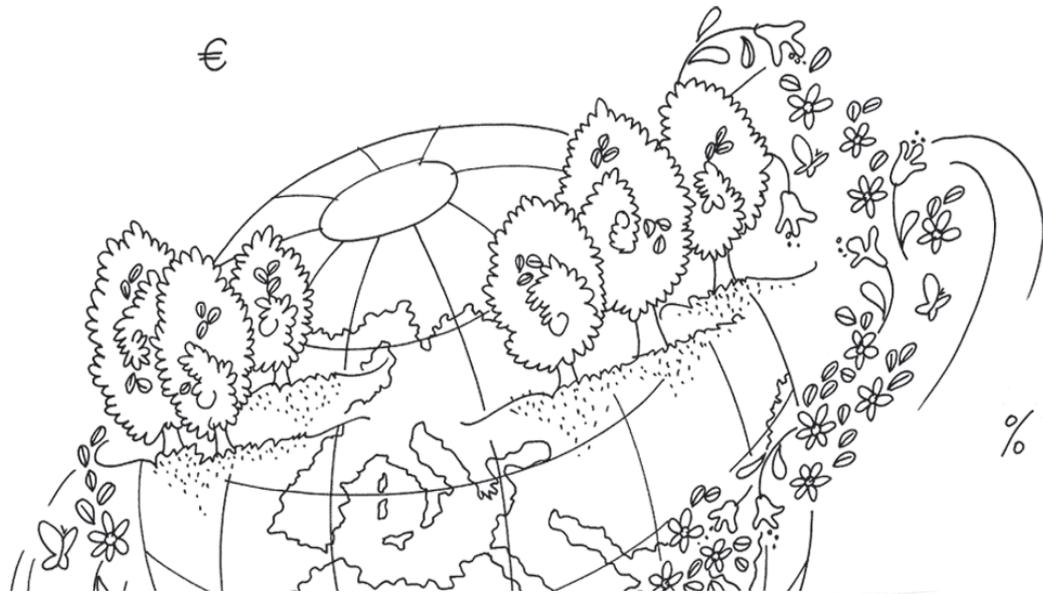




**LANDIRENZO®**



# Clean Cities Transportation

March 30-31, 2011

**Workshop for Almaty**

**LANDI RENZO GROUP**  
**Solution for transportation energy**

**Gert-Jan Rap**



# Agenda



- **Landi Renzo Introduction**
- **OEM Projects**
- **R&D Highlights**
- **Gas Systems Trends**
- **Typical CNG System**
- **New Technologies**



# History of the Group


**1954**

- ❑ Renzo Landi, father of the current owner, founds "Officine Meccaniche Renzo Landi", producing systems for conversion of vehicles to run on gas

**1960s**

- ❑ Sells products directly to *installers* and establishes a sales network in Italy

**1963–64**

- ❑ International expansion as products are exported to Europe and Asia, and subsequently to South America

**1965**

- ❑ Begins to outsource manufacturing, but *retains R&D activities and assembly*

**1968**

- ❑ Introduction of Renzomatic, a pressure reducer for LPG conversion. First product in the market to electronically control the "idle speed" condition

**1978**

- ❑ Corporate reorganisation as Landi Renzo S.r.L, which controls the company's subsidiaries, is formed

**1980s**

- ❑ Further evolution of business model as company uses distributors to deal with end-market installers
- ❑ Introduction of TN1, the first pressure reducer operated electronically

**1990s**

- ❑ Acquired 70% of *Eurogas Holding BV* in 1995, a Dutch company operating in the same sector. Then in 1999 it formed a Polish subsidiary, Landi Renzo *Polska*

- ❑ Acquisition of *MED S.p.A.*, a specialist in gas valves and car alarm systems to improve electronic capabilities

**2001**

- ❑ After receiving **ISO 9001** certification (1996), the Company was the first in the industry to obtain **ISO/TS 16949** certification for automotive high quality standards
- ❑ Production facility opened in *Brazil*

- ❑ Subsidiary opened in *China*

**2003**

- ❑ Subsidiary opened in *Pakistan* (includes production facility)

**2005**

- ❑ Subsidiary opened in *Iran*

**2007**

- ❑ *Stock Exchange quotation*

**2008**

- ❑ ***Lovato Acquisition***

**2009**

- ❑ Subsidiary opened in *Romania*

**2010**

- ❑ Subsidiary opened in *India* and *USA*,

- ❑ ***Acquisition of AEB***

# Highligts

- **World leader** in **CNG** and **LPG** fuel systems for Cars – LCV - Buses
- Presence in more than **50 countries**
- **14** Subsidiaries
- Two main business channels: **Aftermarket & OEM**
- **1040** Employees
- **Stock exchange** Quotation (2007)
- Landi Renzo focussed on **R&D** and **Distribution**



## Complete System



## Components

### CNG Reducers



### Electronic Control Unit



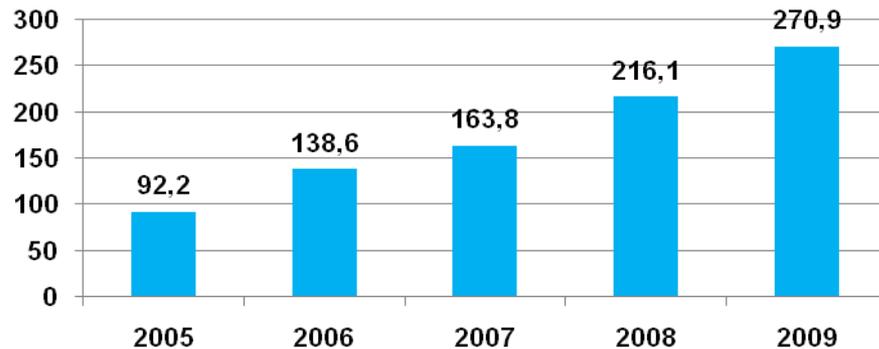
### LPG Reducers



### LPG / CNG Injectors



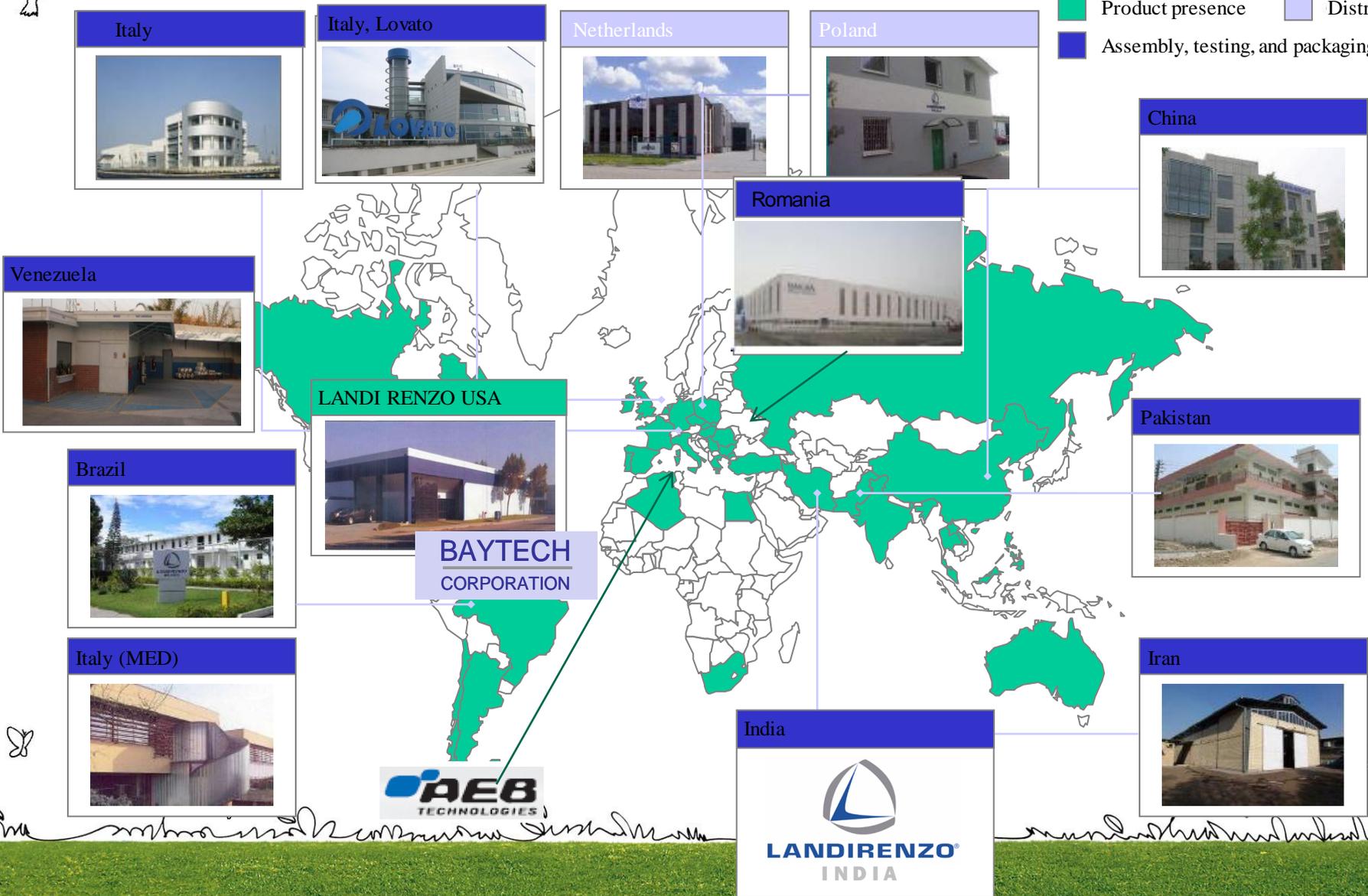
## TURNOVER(M€)



# Geographical footprint



- Product presence
- Distribution
- Assembly, testing, and packaging



# Lovato Company Profile: Overview

- **LPG & CNG systems & Components**
- **Active worldwide**
- **Since October 2008 Lovato is part of the LANDI RENZO GROUP**



# Agenda



- Landi Renzo Introduction

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- New Technologies





**1 Turnkey projects ready to run**



**2 Industrial approach**



**3 High quality solutions offered to competitive price**



**4 After-sales**



# OEM Alternative Fuel Vehicle Partnerships

## Developed Markets

## Emerging Markets

Cars



LCVs



# Focus on main project



	Italy	Europe	Asia	South America
<b>Fiat</b>	LPG			
<b>Renault</b>	LPG		CNG	CNG
<b>Dacia</b>	LPG		CNG	
<b>GM (Opel)</b>	LPG	LPG / CNG	CNG	
<b>VW - Seat - Skoda</b>	LPG			
<b>Nissan</b>	LPG			
<b>Toyota</b>	LPG		CNG	CNG
<b>Dahiatsu</b>	LPG			CNG
<b>Suzuky</b>	LPG		CNG	
<b>PSA - CITROEN</b>	LPG / CNG			
<b>CHRYSLER</b>				CNG
<b>BMW</b>	LPG			
<b>Daimler</b>	CNG			



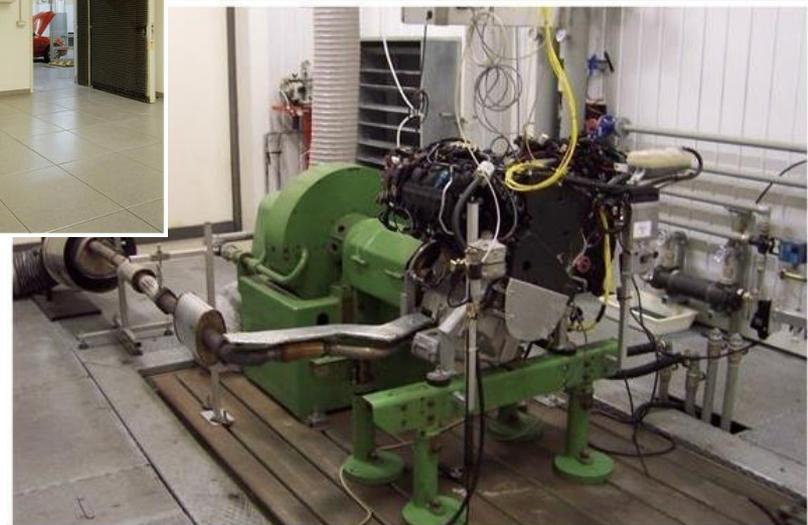
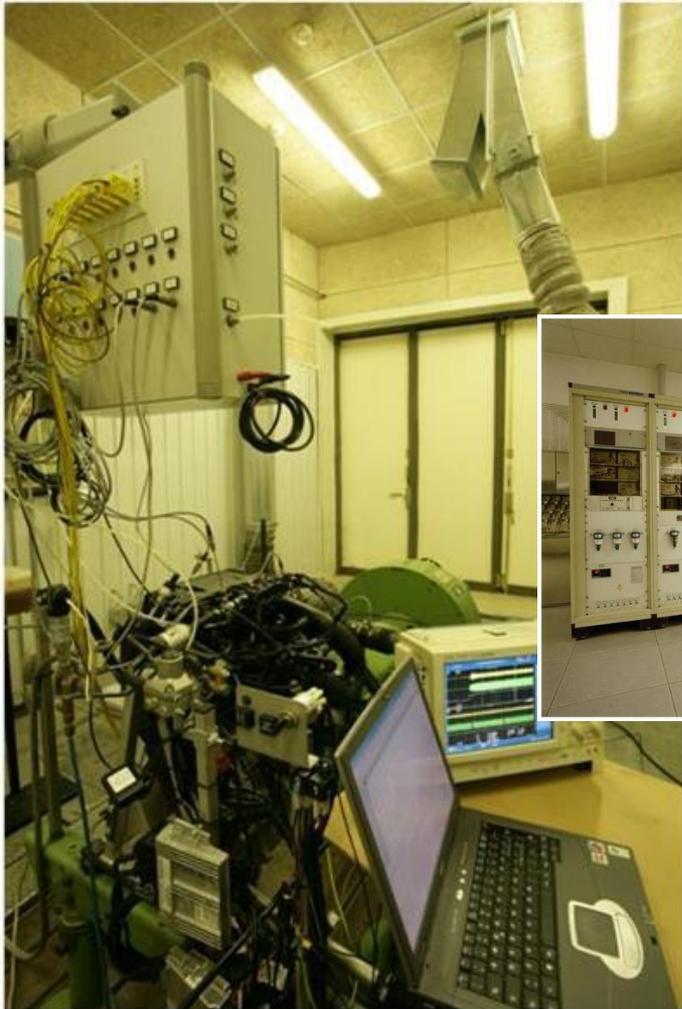
# Agenda



- Landi Renzo Introduction
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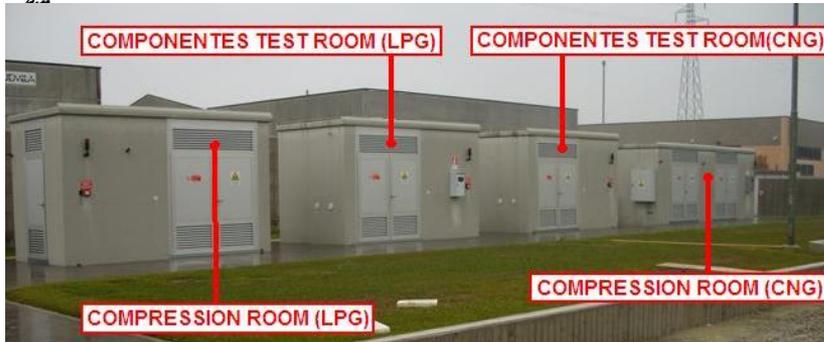


# Emissions & Performance LABS



**Top level Testing facilities at three sites in Italy**

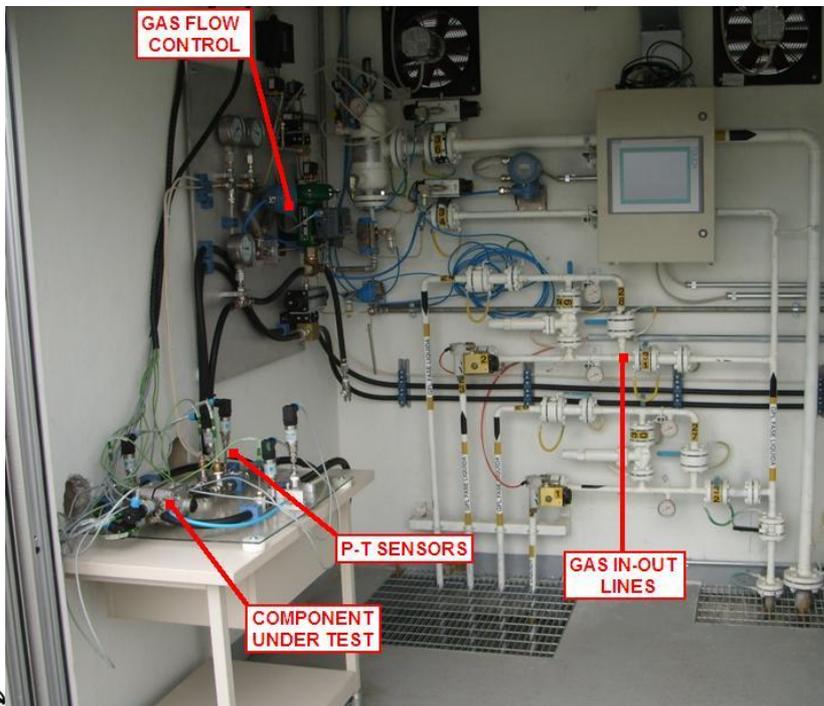
# Components Testing Facilities with real-gas



## CNG / LPG COMPONENTS TEST BENCH

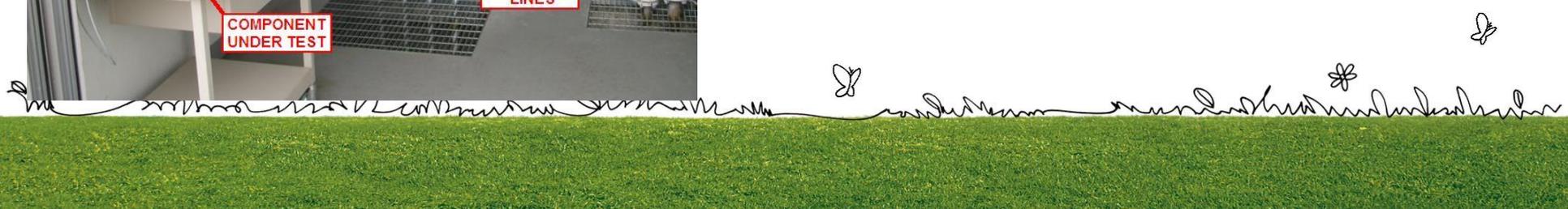
### Advanced Testing Facilities:

- Components tested with real gas
- Different gas blends and gas conditioning



## H2 COMPONENTS TEST BENCH:

- Available in new technical centre



# New R&D Center



- 4 Dynamic Engine test cell
- 2 Climatic/Emission Roller Benches
- 1 Chassis Dynamometer

- Mechanical Proto Lab
- Electronic Lab



# Injectors Assembly Line



Highly automated production lines



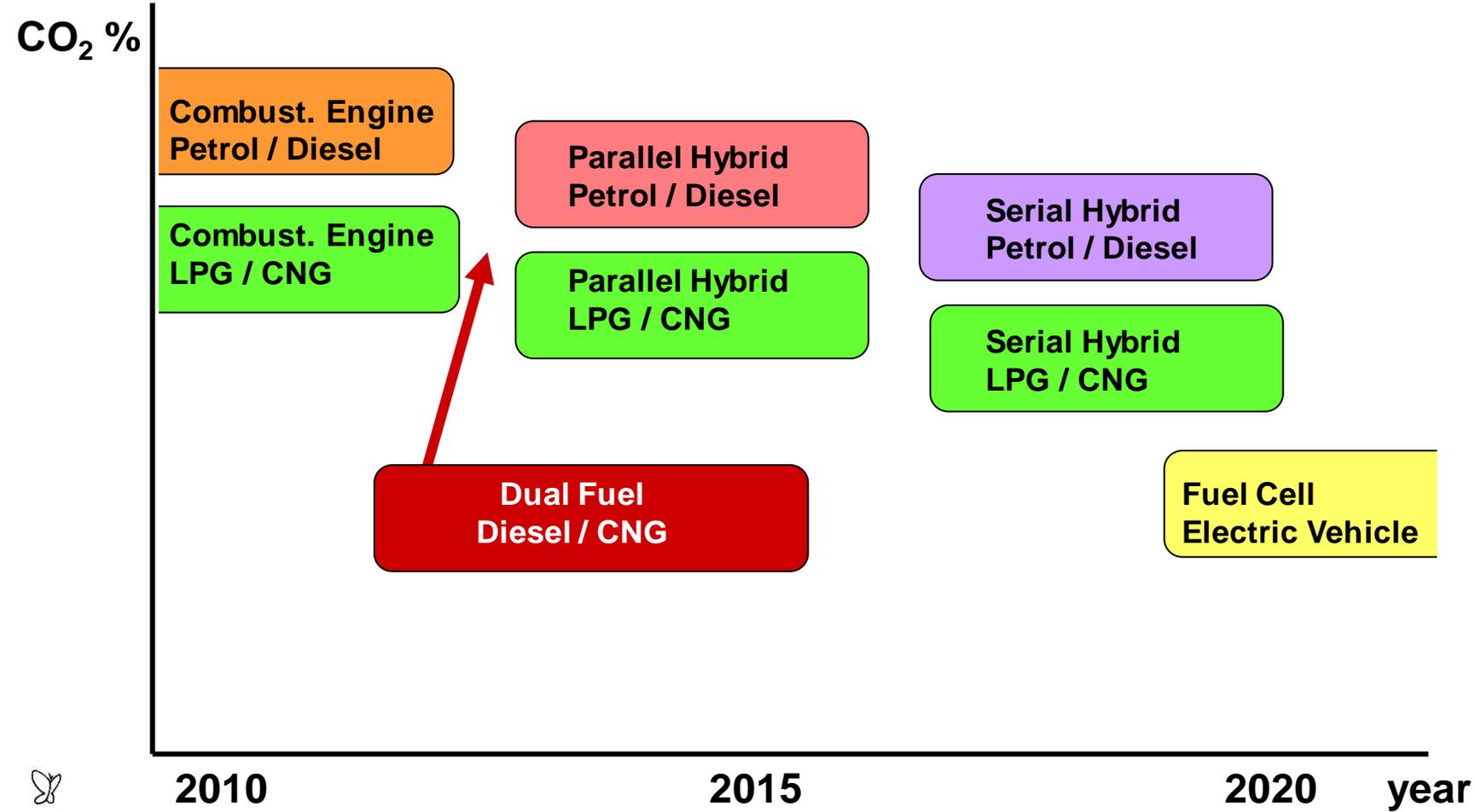
# Agenda



- Landi Renzo Introduction
- OEM Projects
- R&D Highlights
- **Gas Systems Trends**
- Typical CNG System
- New Technologies



# Trends in Powertrains / Fuels



# Agenda

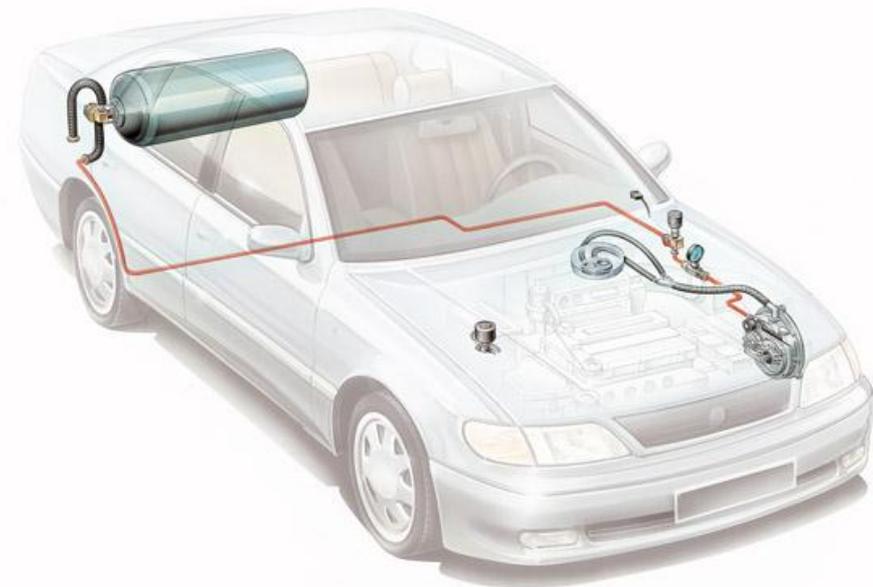


- Landi Renzo Introduction
- OEM Projects
- R&D Highlights
- Gas Systems Trends
- **Typical CNG System**
- New Technologies



# Landi Systems Overview

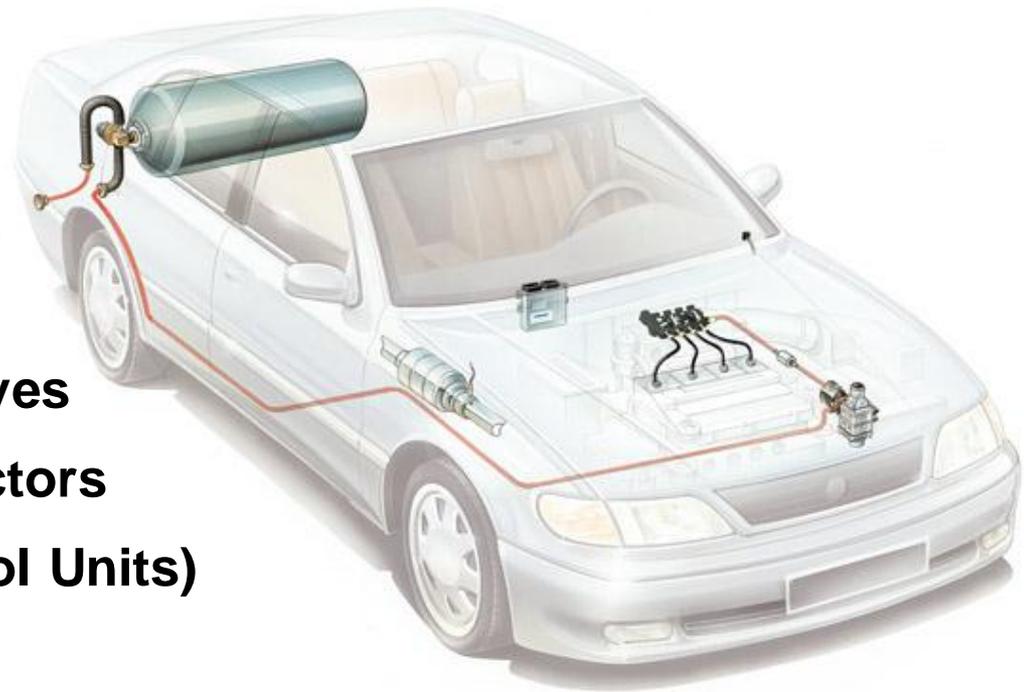
- Landi designs and produces “ready to go” CNG systems covering :
  - ✓ OEM and aftermarket installation.
  - ✓ Any type of alternative fuel from LPG to CNG and CNG-Hydrogen mixture.
- CNG system is installed “additionally to” existing petrol system.
- Focus :
  - optimised installation process
  - engine endurance
  - vehicle performance
  - exhaust emissions



# CNG Systems Overview

- **CNG systems mainly consist of the following components:**

- ✓ **Filler**
- ✓ **CNG tank (1 or more)**
- ✓ **Piping**
- ✓ **Pressure Reducer**
- ✓ **Manual / Electrical Valves**
- ✓ **Air / Fuel Mixer or Injectors**
- ✓ **ECU (Electronic Control Units)**
- ✓ **Switch**



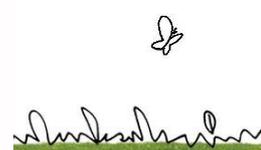
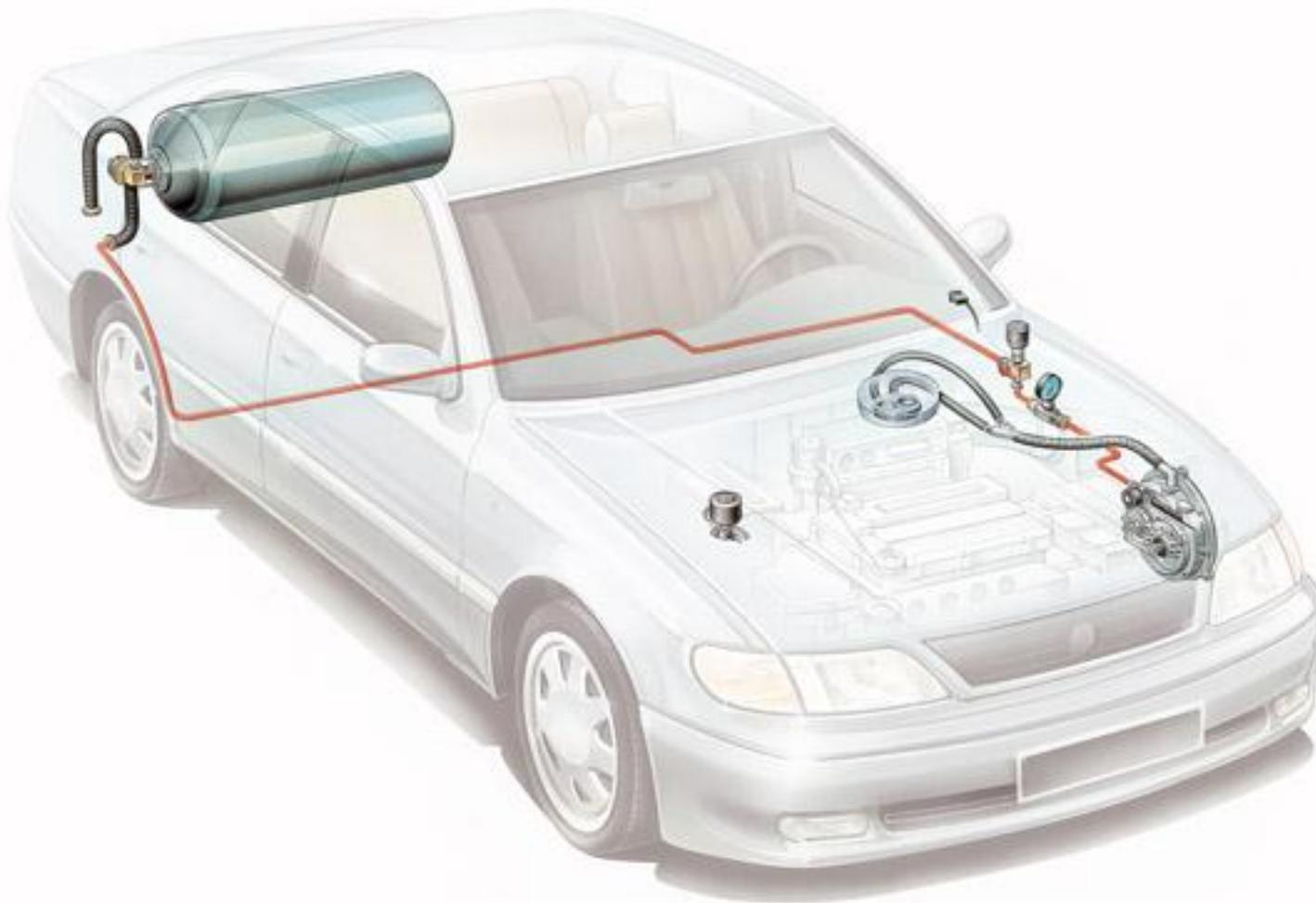
# CNG Systems Overview



- **Five generations of CNG systems**
  - **1<sup>st</sup> Generation** for Carburettor cars
  - **2<sup>nd</sup> Generation** for Fuel Injection Euro 1 & 2 cars
  - **3<sup>rd</sup> Generation** for Fuel Injection Euro 2 & 3 cars
  - **4<sup>th</sup> Generation** for Fuel Injection cars Euro 3, 4 and 5
  - **5<sup>th</sup> Generation** for Direct Injection cars



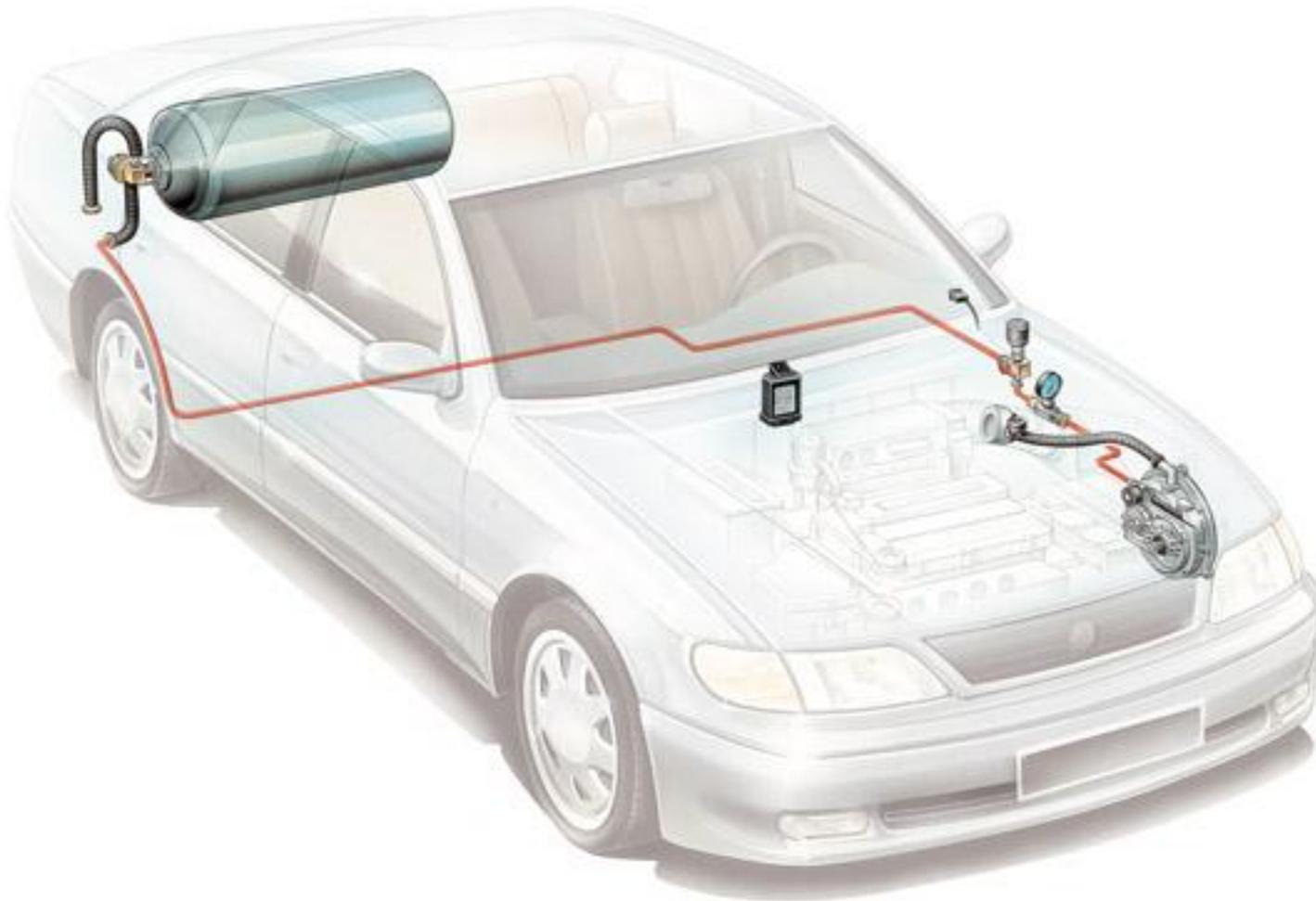
# CNG Systems Overview ; 1<sup>st</sup> Generation – Carburettor vehicles



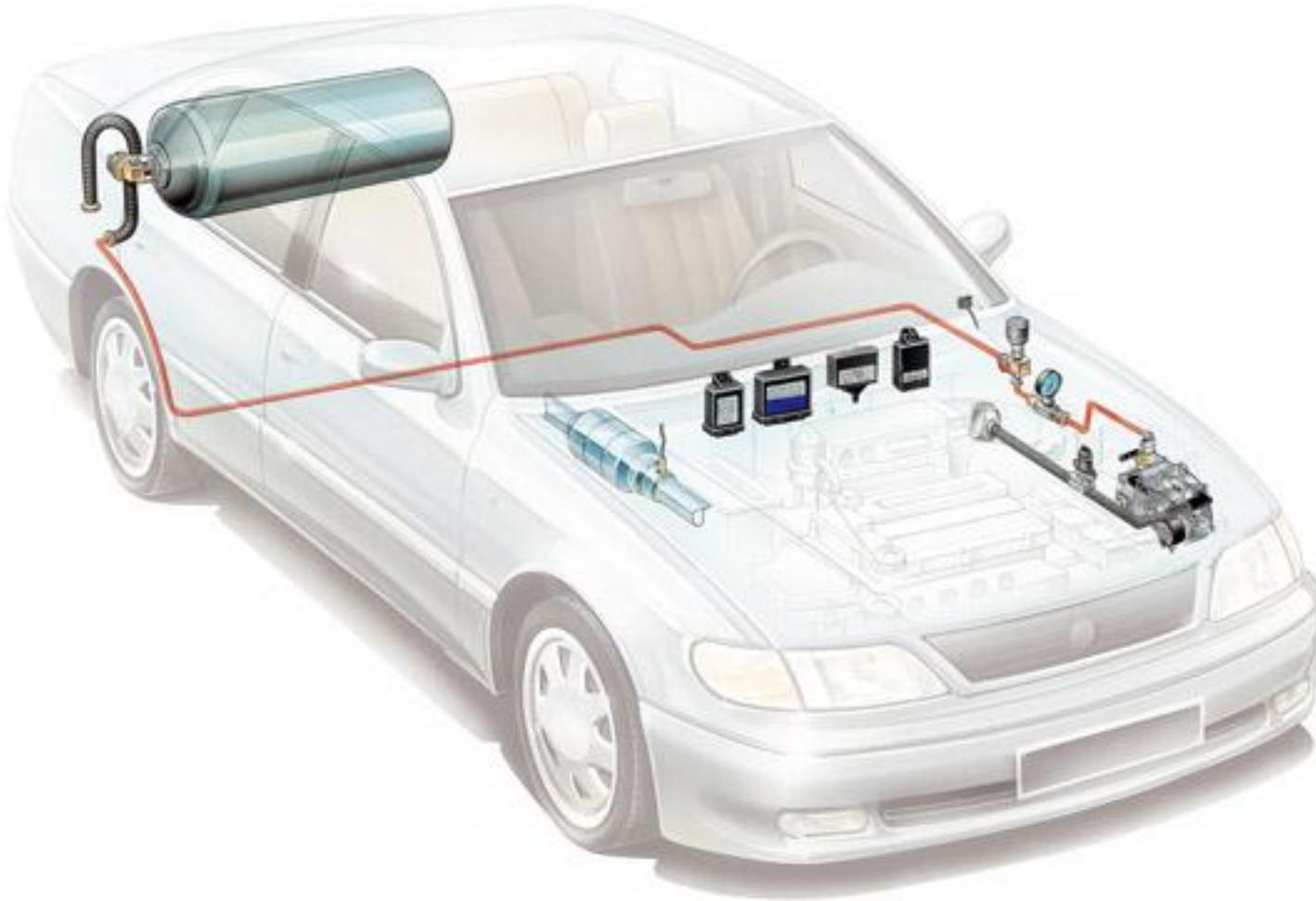
# CNG Systems Overview ;

## 1<sup>st</sup> Generation – Euro 0 & 1 Fuel Injection vehicles

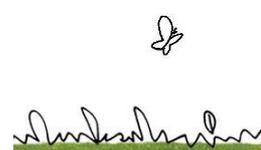
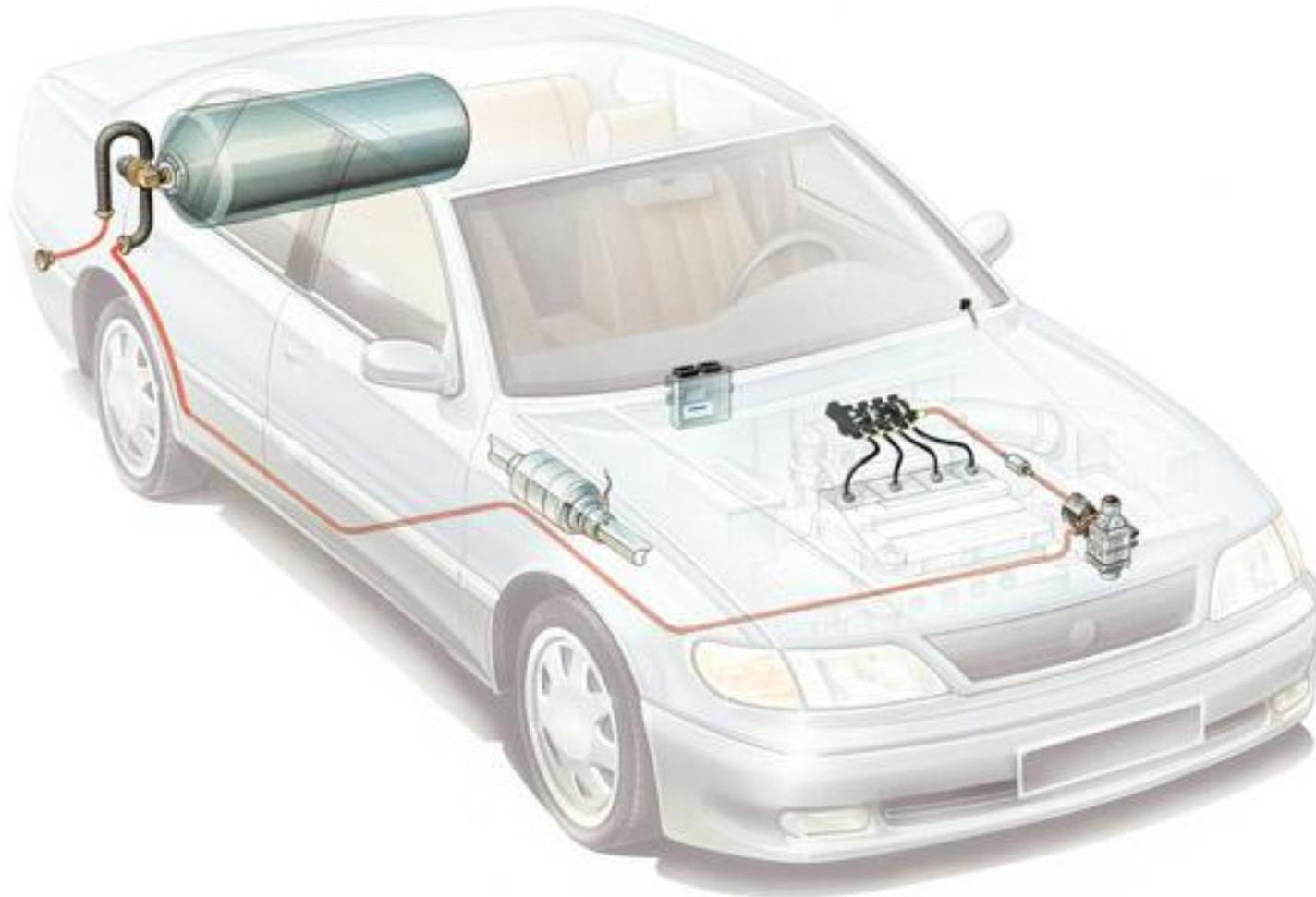
### No Lambda control



# CNG Systems Overview; 2<sup>nd</sup> Generation – Euro 1 & 2 vehicles Including Lambda Control



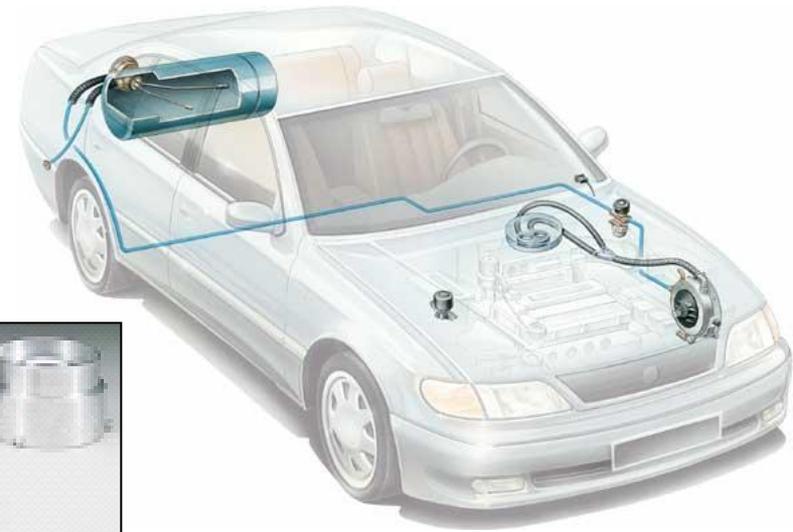
# CNG Systems Overview ; 4<sup>th</sup> Generation – Euro 3, 4 & 5 vehicles Sequential CNG Injection



# Mixer based CNG Systems



## Carburettor Vehicles



**3-stage CNG regulator**

**CNG mixer – vehicle specific**



**Dashboard switch including Fuel level indicator**



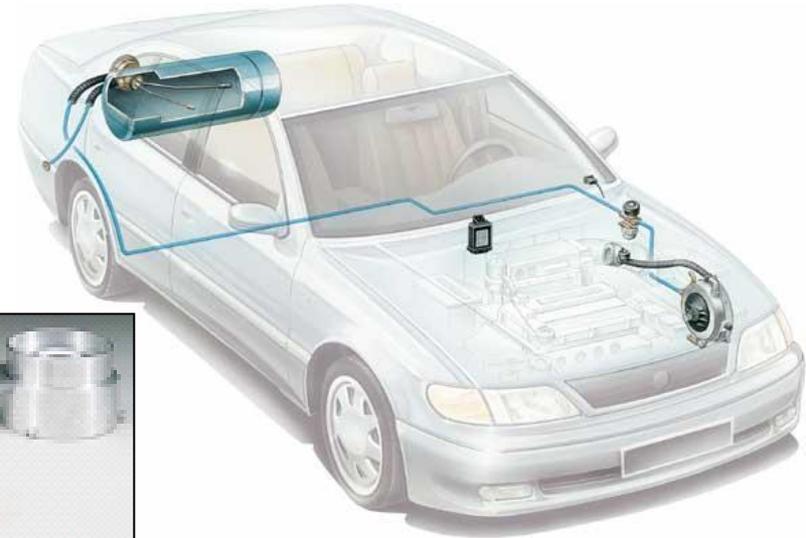
**Petrol lock-off valve**

(1) Mixer based systems have a Lambda control unit if a catalyst is present

# Mixer based CNG Systems



## Mixer Based System



**3-stage CNG regulator**

**CNG mixer – vehicle specific**

- Lambda Control ECU**
- Lambda Control Steppermotor**
- Wiring Harness**
- Switch with Fuel Level Indicator**



(1) Mixer based systems have a Lambda control unit if a catalyst is present

# Fuel Injection CNG Systems



## Multipoint Injection System



**Filter**

**2-stage CNG regulator**



**Injector Rail**



**ECU**



**Dashboard switch incl.  
Fuel level indicator**



# CNG Systems Overview ; CNG Filler Valve

- **Different Filler valves available**

- ✓ **NGV-1** For passenger cars & LCV's ISO 14469-1.4
- ✓ **NGV-2** For trucks & busses

- Italian Profile
- New-Zealand Style

source : EMER



Italian Profile



New-Zealand style



**NGV-1**



**NGV-2**

source : www.weh.com



# CNG Systems Overview ;

## CNG Storage – (Not produced by Landi Renzo)

- **Four types of CNG Storage cylinders**
  - **CNG-1 Full Steel**
  - **CNG-2 Steel + cylindrical wrapping**
  - **CNG-3 Metal liner + composite wrapping**
  - **CNG-4 Full Composite wrapping**



source : xperion

# CNG Systems Overview ;

## CNG Storage – (Not produced by Landi Renzo)



✓	<b>CNG-1</b>	<b>0,90 - 1,15 kg/L</b>	<b>Lifetime 20 years</b>
✓	<b>CNG-2</b>	<b>0,65 - 0,85 kg/L</b>	<b>Lifetime 20 years</b>
✓	<b>CNG-3</b>	<b>0,30 - 0,50 kg/L</b>	<b>Lifetime 15 years</b>
✓	<b>CNG-4</b>	<b>0,25 - 0,55 kg/L</b>	<b>Lifetime 20 years</b>

200 bar operation pressure

source : xperion 



# CNG Systems Overview ;

## CNG Storage – (Not produced by Landi Renzo)



Source: Vitkovice

**CNG-1**



**CNG-2**

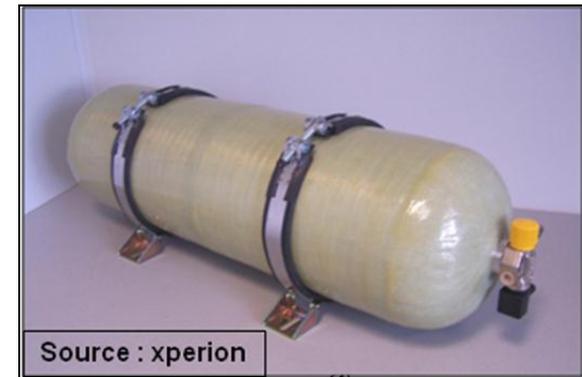
Source : China OGPE

**CNG-3**

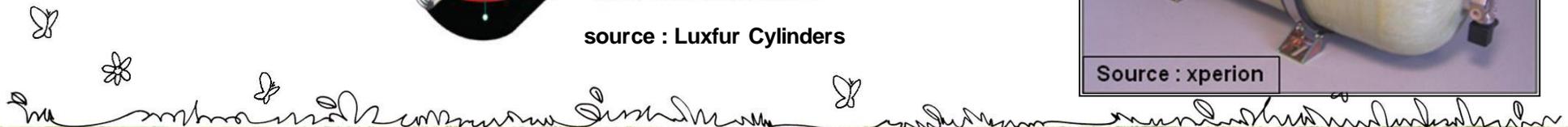


source : Luxfur Cylinders

**CNG-4**



Source : xperion



# CNG Systems Overview ; CNG Cylinder Valve



- **Cylinder valve should be equipped with minimally :**

- ✓ **Manual Service Valve**
- ✓ **Automatic Service Valve**
- ✓ **Excess Flow Valve**
- ✓ **Melting Fuse**

## Optionally

- ✓ **Integrated Check Valve**
- ✓ **Inner Venting**
- ✓ **Burst Disc**

### New MED CNG Valves



**CNG TANK SOLENOID VALVE WITH BUILT-IN VENTING - TYPE MNG 10.5**



**CNG TANK SOLENOID VALVE TYPE MNG 10.7**



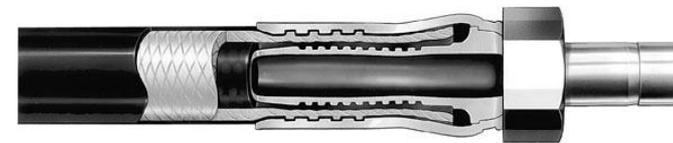
**CNG TANK MANUAL VALVE WITH BUILT-IN VENTING - TYPE MNG 10.6**



# CNG Systems Overview ; Piping & Fittings

- **Piping**

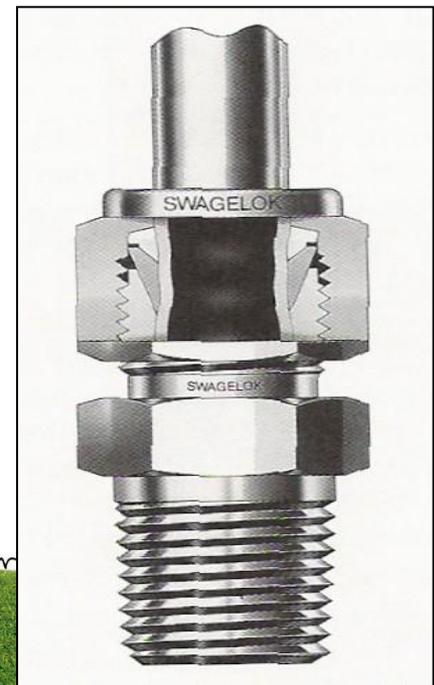
- ✓ **Stainless Steel**
- ✓ **Galvanized Steel**
- ✓ **Copper is **NOT** allowed**
- ✓ **Flexible Pipe → R110 approval**



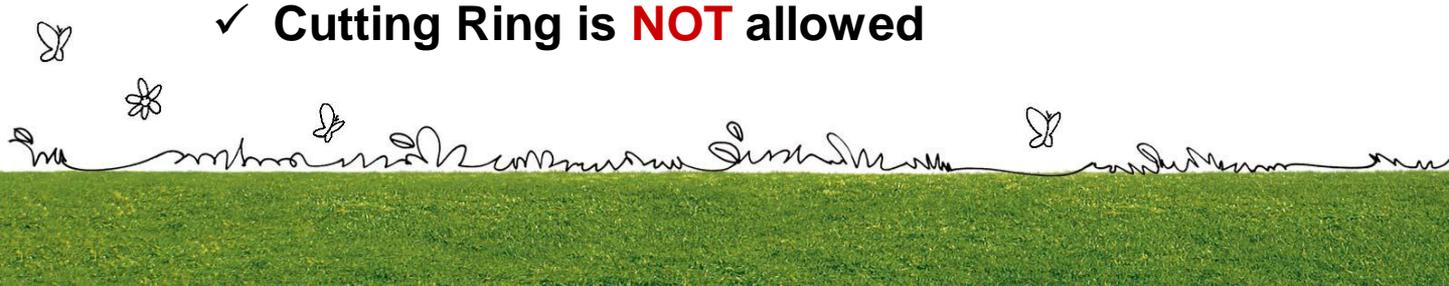
source : Swagelok

- **Fittings**

- ✓ **Double Ferrule (Stainless Steel)**
- ✓ **Bi-Cone (Steel)**
- ✓ **Cutting Ring is **NOT** allowed**



source : Swagelok



# Agenda



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## *New Developments*



- **Product improvement**
  - ✓ Further improve CNG reducers and injectors for new vehicle technology
  - ✓ Optimize ECU Software for new vehicle technology
- **New CNG components**
  - ✓ Electronic CNG regulator
- **Dual-Fuel Technology**
- **Electric Drive**
- **Upgrading** existing Public Transport Buses



# CNG Regulator road map



**Injection Engines**

**Carburetor Engines**



**NG2**



**NG1**



**Electronic Pressure Reducer CNG and H2**



**TN1**

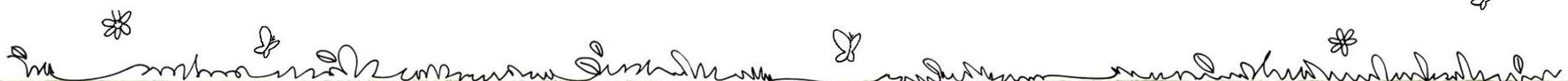


**TN1STEP**

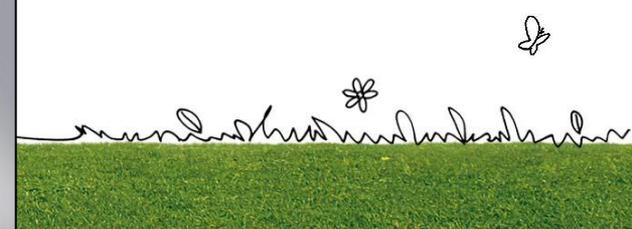
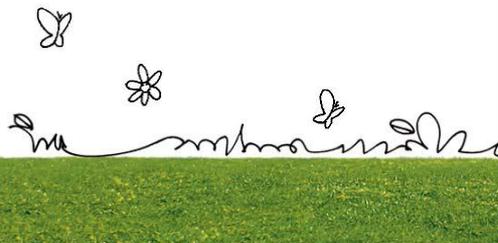
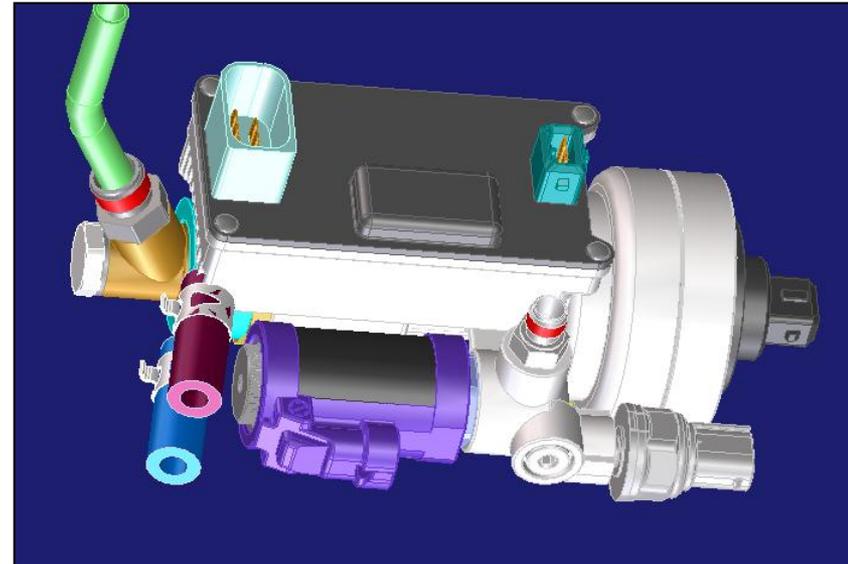
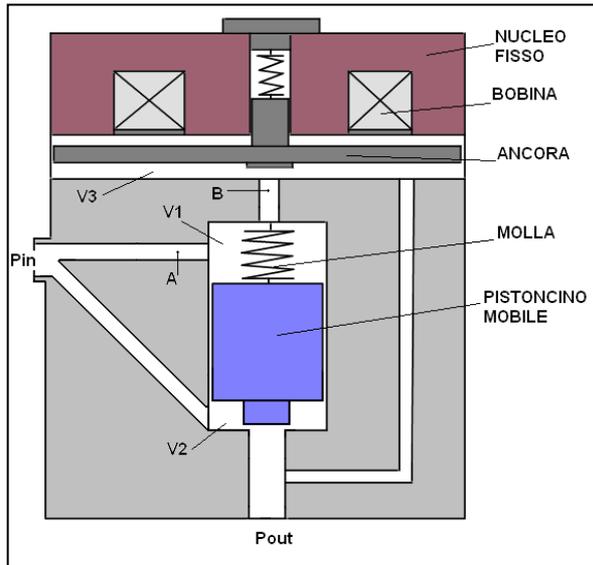


**CN04 compact**

1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015

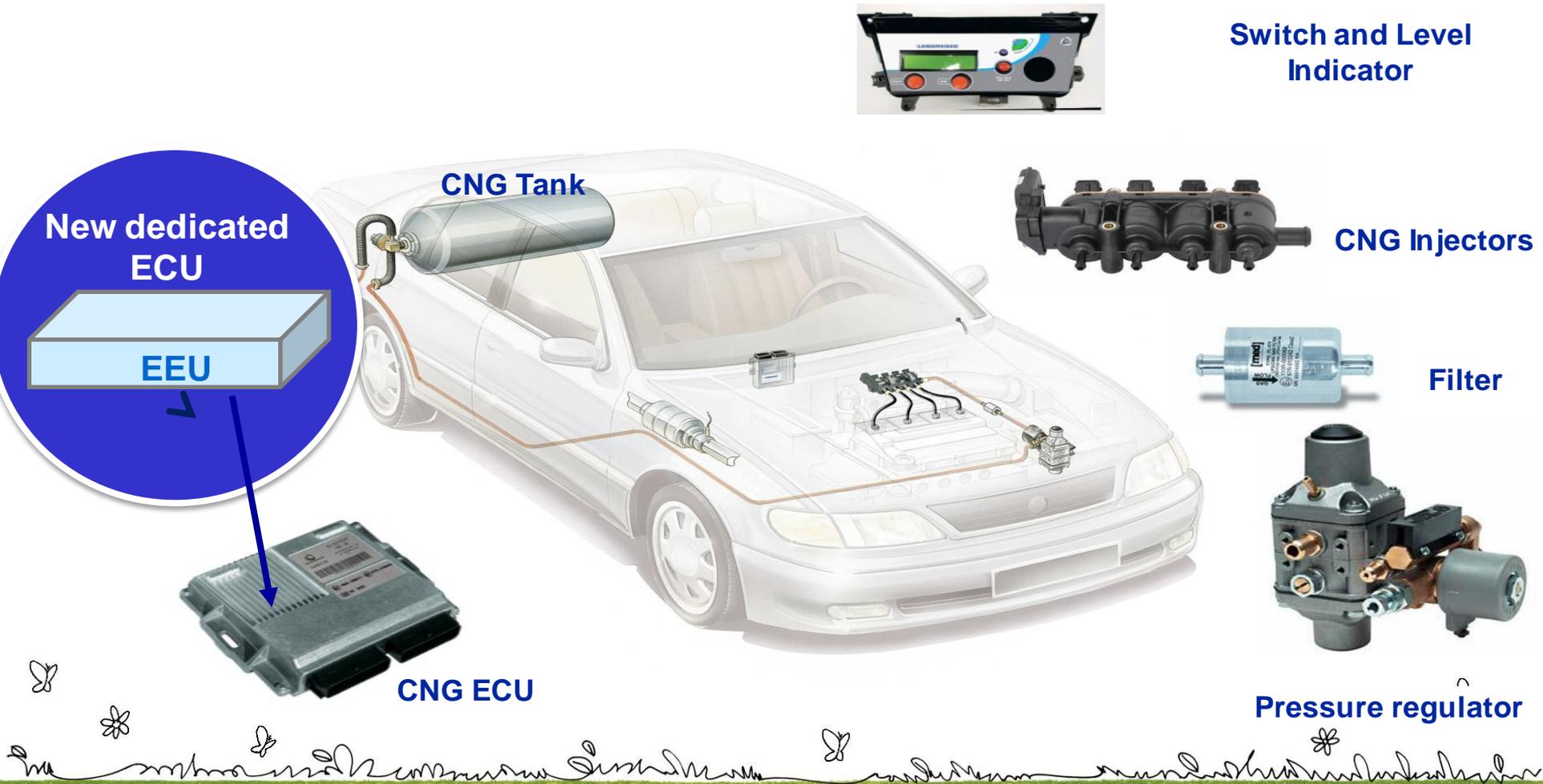


# Electronic Pressure Reducer CNG



# Dual Fuel Conversion System

The Dual-Fuel conversion kit is very similar to standard Bi-Fuel CNG retrofit conversion kit



# Dual Fuel - Laboratory Vehicle

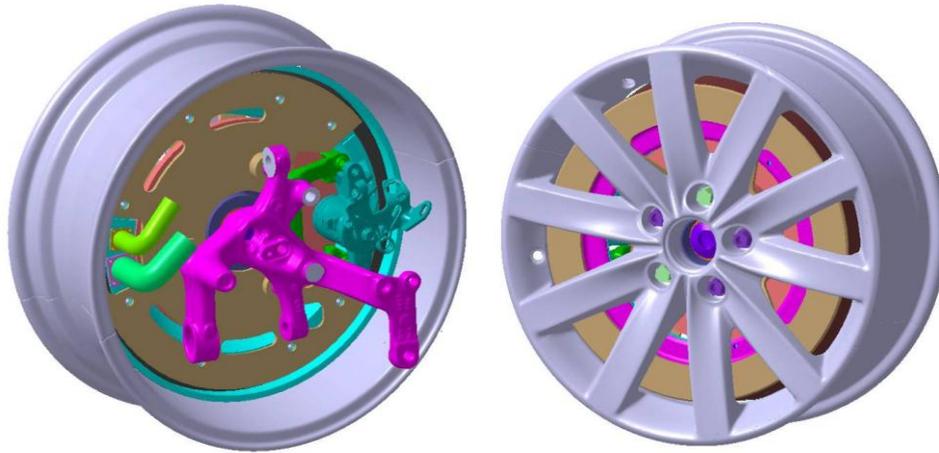


## Hybrid: Motor-in-Wheels



Landi Renzo has developed a proprietary solution for integration of electrical motor in a standard vehicle wheel

- Improvement of vehicle dynamic
- No impact on vehicle braking system



Integration design for motor in wheel



Motor-In-Wheel installed



# PROPOSAL OF A COMPLETE LINE OF PRODUCTS FOR BUS **UPGRADING**





## The Business Idea

Trasformation of old pollutant engines into an ecological updated engines offering a recycling opportunity for old parts.



**Dual fuel:** Diesel & CNG

**Mono fuel:** complete conversion to CNG

**Hybrid:** electrical powered with a CNG combustion engine

- Reduction of CO<sub>2</sub> (& operating costs)
- Reduction of PM's (to almost zero in case of CNG monofuel)
- Extension of the life of the bus



**LANDIRENZO®**



***Thank You  
for your attention !***

***Visit us at :***

***www.Landi.it***

***Mr. Aldo Pertile***

***apertile@landi.it***

***Mr. Giovanni Maccini***

***gmaccini@landi.it***

