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## **Oil Free Zone in the Province of Trento (Italy): the case of Primiero and Vanoi Community**

Authors:

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- L. Zeni, P. Secco, I. Fontana – ACSM Primiero
- A. Marella – University of Padua

- Scenario and targets
- Alternative fuels from renewable sources
- New model for sustainable mobility
- The contribution of Info-telematics
- The enabling opportunities of the Primiero and Vanoi Community: Oil Free Zone Project
- Conclusions

# A FEW DATA ON TRANSPORT SECTOR

IT IS FORECAST A TRAFFIC GROWING OF ABOUT 15% WITHIN THE 2020

## TRANSPORT SECTOR PRODUCES ECONOMICAL DEVELOPMENT

The turn over is over 1000 billions  
EURO

It generates more than 10% of European  
Union GDP

Employs more than 10 millions people



## ... BUT IT DETERMINES ALSO A SERIES OF PROBLEMS

### SAFETY

There is an increase of accidents number

### CONGESTION

On the roads, motorways, ..

(cost of 100 billions of euro/year, close to 1% of  
European GDP)

### ENVIRONMENT

Atmospheric pollution (26% of CO<sub>2</sub> emissions),  
health problems, acoustic pollution

### ENERGETIC CONSUMPTION

1/10 of consumed total energy (1950)

1/3 of consumed total energy (today)

# ALTERNATIVE FUELS



Today

Early 2010

2012

Time

Available technology  
Opportunities for improvement



Natural Gas  
'Downsizing'  
Turbo charging  
Multiair  
Technology



- 11 % CO<sub>2</sub> emission reduction  
respect to CNG

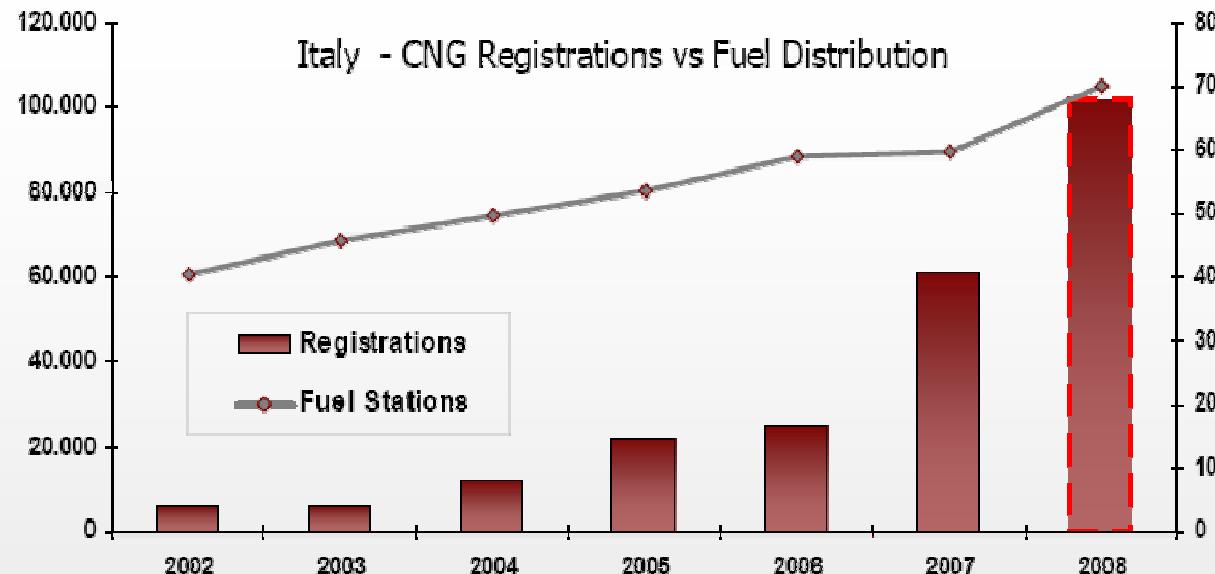
> 2020?

Hydrogen  
F.C.  
(?)  
Full electric

**EU mandatory: 10% of fuels for transport from renewable energies within 2020**

# METHANE AS VEHICLE FUEL - UE DISTRIBUTION

In Italy the market is growing faster than fuel distribution network



NGV Vehicles 2007

Country	CNG vehicles	Filling stations
Italy	410,000	588
Germany	50,000	655
Sweden	11,500	95
France	8,900	125
Switzerland	2,081	70
UK (85% trucks)	503	29
ESP. AT. PT. NL. BE	200 - 900 each	

Source: FIAT / Internet

Italy shows a large number of Gas Vehicles but a very low number of fuel stations compared to other countries. According to the results of recent conference on CNG organised by NGV Systems Italia (09/06/2009), the potential value of methane is very high but is necessary to:

- **Enlarge the number of filling stations** (Italy today one/700 vehicles - > one/300 Vehicles)
- **Have alternative filling system** (for example: “**home filling system**”)

# METHANE AS VEHICLE FUEL – “HOME FILLING SYSTEM”



**“2008 bonus”**

TIPOLOGIA/TECNOLOGIA: IMPIANTO FISSO PER IL RIFORNIMENTO DI GAS METANO PER AUTOTRAZIONE DOTATO DI UNA MANICHETTA

Per impianto fisso s'intende l'insieme costituito da: apparecchio di rifornimento, tubo di adduzione del gas e linea elettrica di alimentazione.

Rientrano nelle spese ammissibili a contributo il costo di acquisto dell'apparecchio e i costi relativi alla sua messa in opera, al netto dell'IVA. Il contributo è concesso solo se la spesa ammissibile e il costo complessivo a carico del richiedente non eccedono i limiti sotto indicati.

SOGGETTI RICHIEDENTI	PRIVATI	SOGGETTI ECONOMICI	ENTI PUBBLICI
1 AMMISSIBILITÀ LP 14/80	SI	SI	SI
2 CUMULABILITÀ	NO	NO	NO
3 CONTRIBUTO PARAMETRICO A CORPO	€ 3.200,00	€ 3.200,00	€ 3.200,00
4 SPESA MAX AMMESSA	€ 6.400,00	€ 6.400,00	€ 6.400,00
5 COSTO COMPLESSIVO MAX (IVA COMPRESA)	€ 7.680,00	€ 7.680,00	€ 7.680,00
6 PERCENTUALE	50%	50%	50%
7 CONTRIBUTO MASSIMO		DE MINIMIS	



Non è la trovata di un giornale goliardico, il gas si può produrre anche in casa. Bastano un bel po'di letame e un macchinario assemblato con parti di recupero



**“Auto Oggi”  
25.2.2009**



In Trentino Alto Adige, the local Government supported with funding the installation of **“Phill System”** (Fuel Systems Solutions) a domestic compressor for natural gas

# BIOGAS AND BIO-METHANE PRODUCTION

**Biogas** (mainly CH<sub>4</sub>+CO<sub>2</sub>) is produced by anaerobic digestion of a range of **organic and agricultural wastes**:

- Sewage sludge;
- Wet manure slurries from intensive styles of agriculture;
- Dry manures from animal beddings, known as farm yard manure (FYM);
- Waste from food processing;
- Food and organic waste from restaurants and other commercial operations;
- Household kitchen and garden waste.

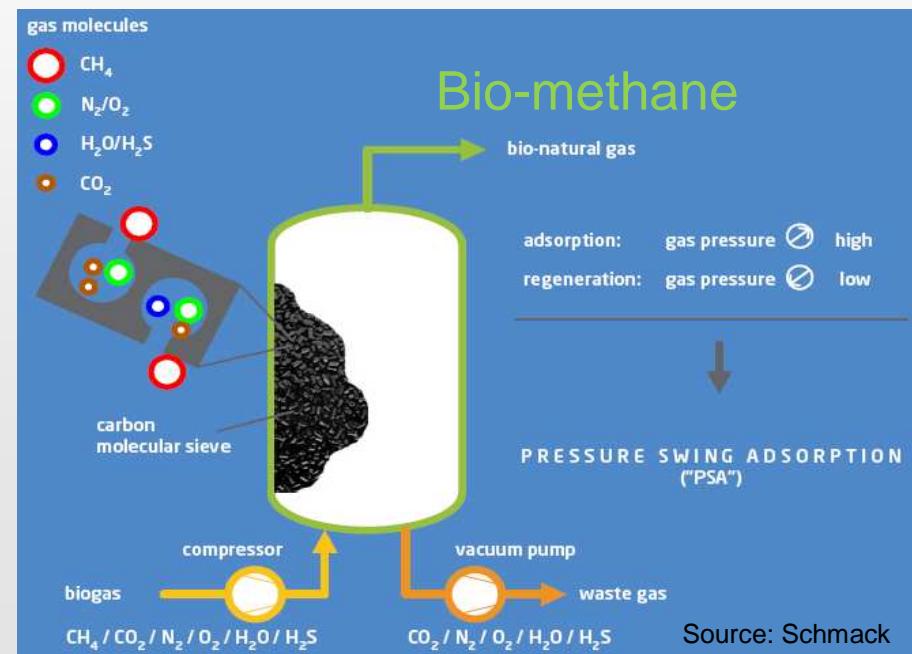


1MW biogas production plant

Biogas  
→

**Bio-methane** can be obtained from biogas by using for example the **Pressure Swing Adsorption (PSA)** process. This process has a 90% efficiency.

This technology rely on the fact that under pressure, gases tend to be absorbed to solid surfaces. Methane has a lower “affinity” to be absorbed, therefore it can be separated form the other gasses.

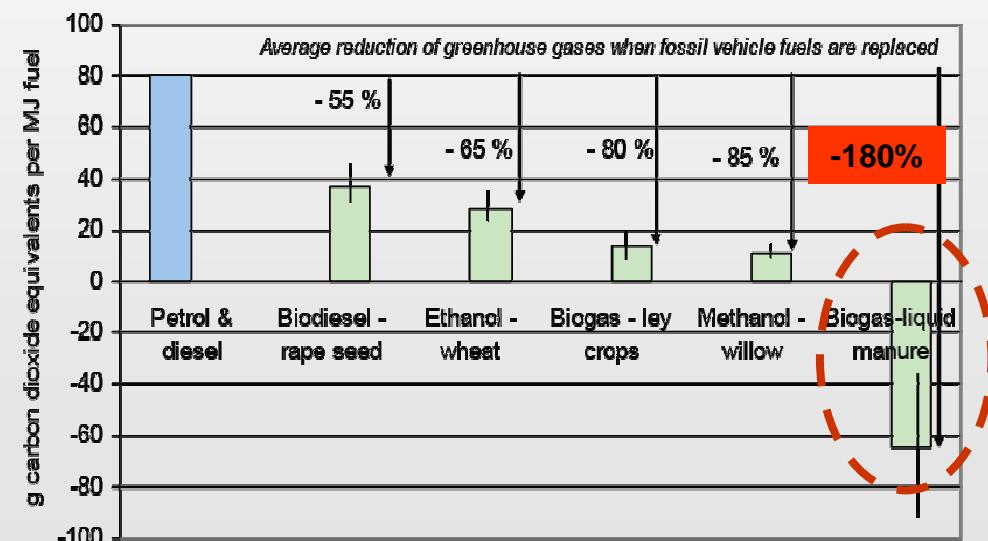
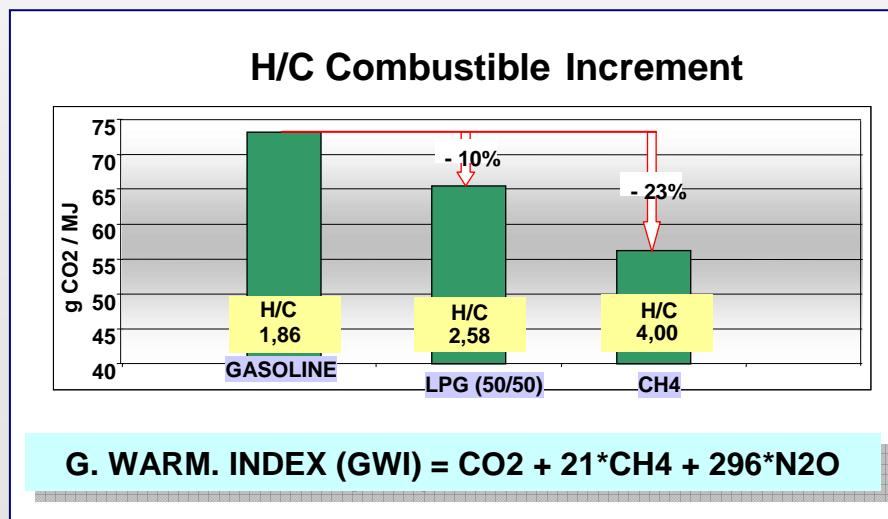


Source: Schmack

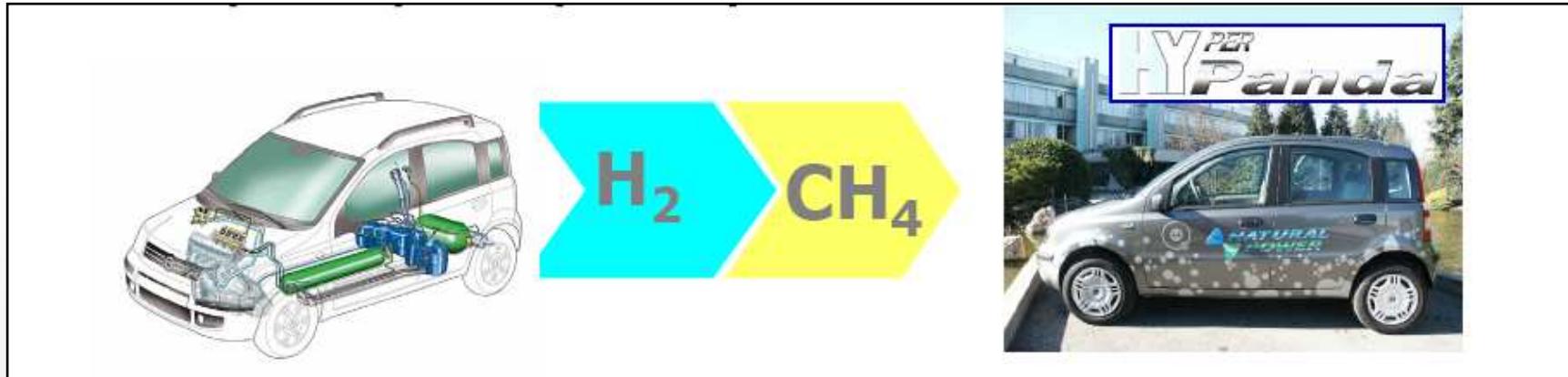
# BIOMETHANE : ATMOSPHERE PURIFICATION THROUGH MOBILITY

The production of biogas has two environmentally-friendly final products, biogas and organic residue (called bio-manure).

- **Direct environmental benefits:** reduced emissions of carbon dioxide and air pollutants when biogas is used as vehicle fuel;
- **Indirect environmental benefits:** anaerobic digestion can produce an effective and easily handled fertilizer which can be incorporated in soil in precise amounts (**the emission of nitrous oxide can be reduced by about 40% when digested instead of undigested manure is spread**).

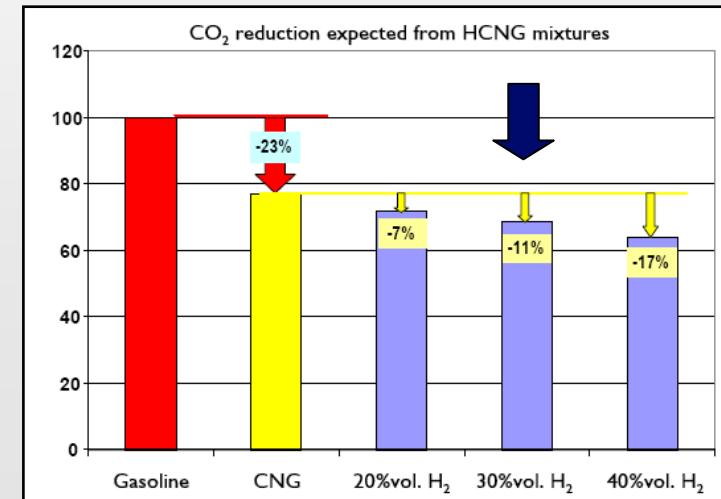


## Enabling technology versus investments into hydrogen infrastructure and vs. Fuel Cell implantation



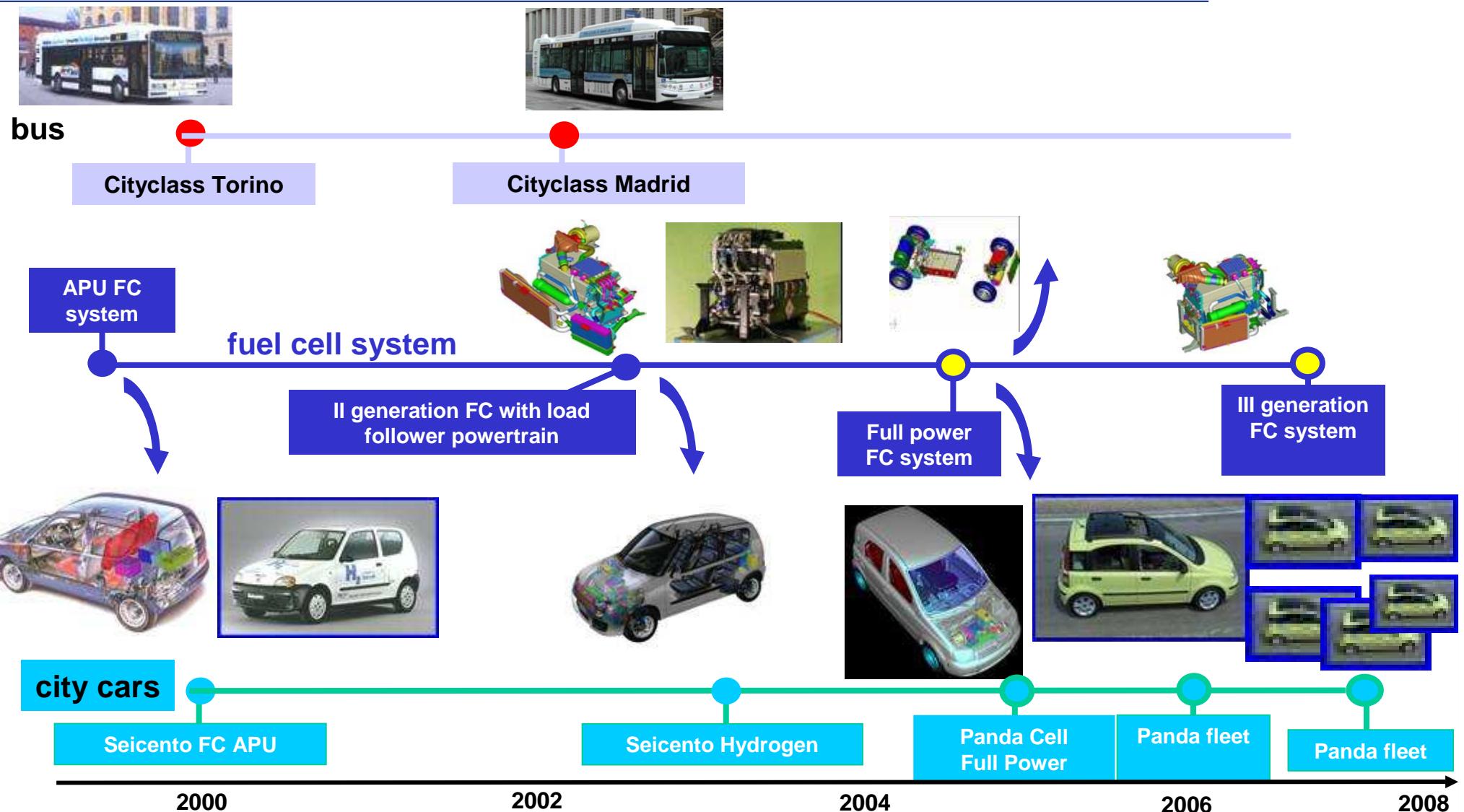
### Environmental benefits:

- Additional Reduction in CO<sub>2</sub> emissions higher H/C ratio): – 11% respect to methane (30% H<sub>2</sub>)
- Reduction in THC and CO emissions (higher H/C ratio, complete combustion)
- Potential increasing in engine efficiency (higher combustion speed)



# EXPERIENCE ON FUEL CELL TECHNOLOGIES

## (Centro Ricerche Fiat)



## THE FIRST FUEL CELL TRACTOR (Case New Holland - NH2)



- Zero emissions
- High efficiency
- Silent vehicle
- Reduced re-fuelling time
- Good performance
- Opportunity to activate electric equipment



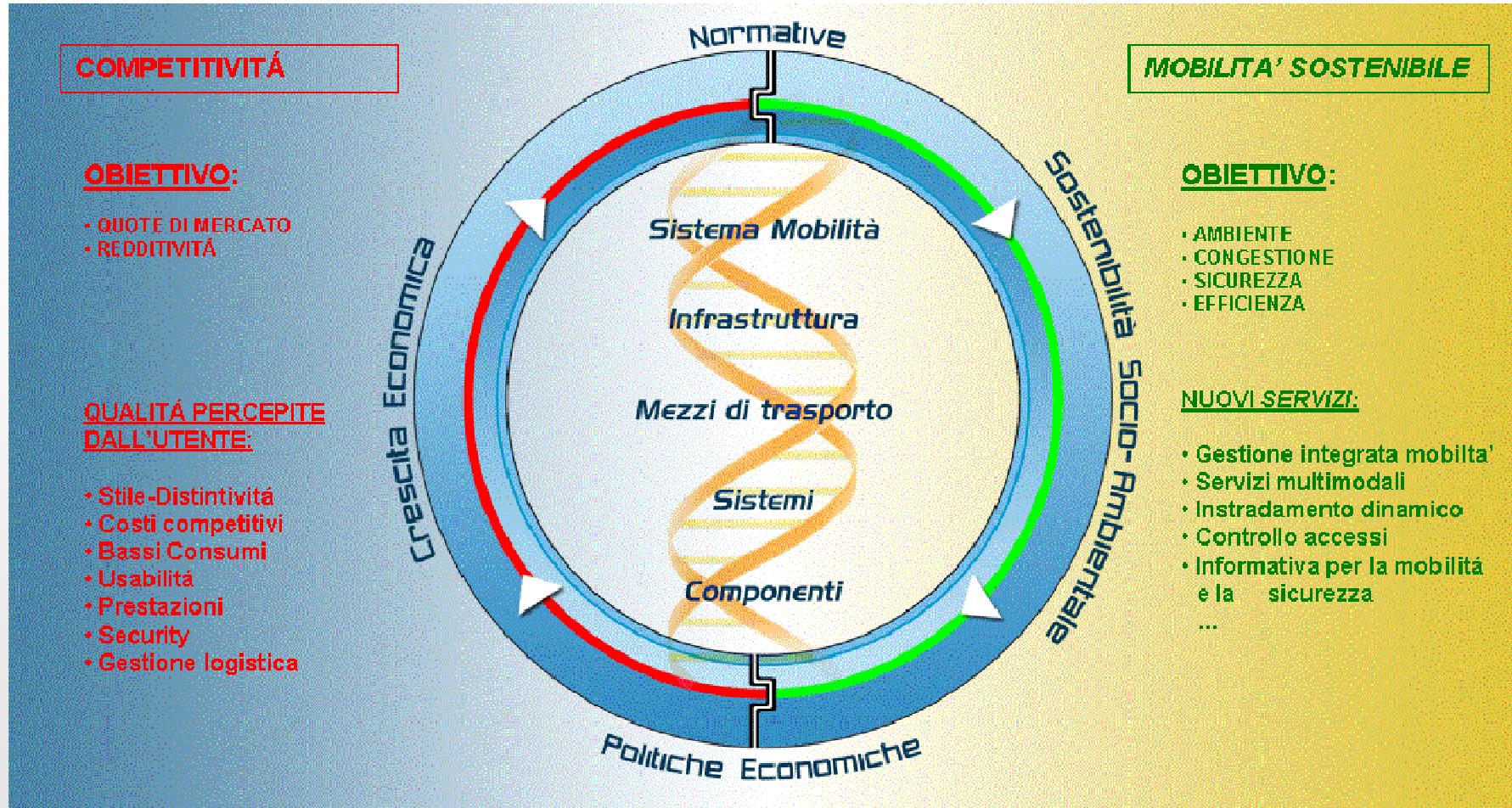
CNH Fuel Cell Engine



### FEATURES

- Fuel cell tractor (full power)
- PEM technology
- New generation air compressor
- Carbon fibers hydrogen tank
- Alternating current Induction electric motor

# ECOLOGICAL MOBILITY MODEL FOR A DEVELOPMENT OF AN INNOVATIVE STRATEGY



Involvement of users, service providers, industrial sectors, research organisations and public administration

# ECOLOGICAL MOBILITY MODEL FOR A DEVELOPMENT OF AN INNOVATIVE STRATEGY



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## Energies from renewable sources



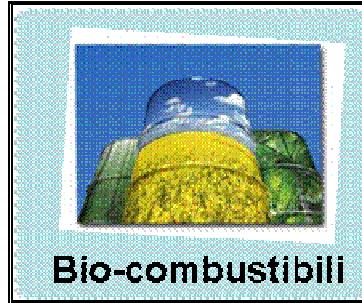
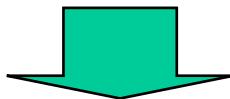
Idroelettrico

eolico

solare

Electricity

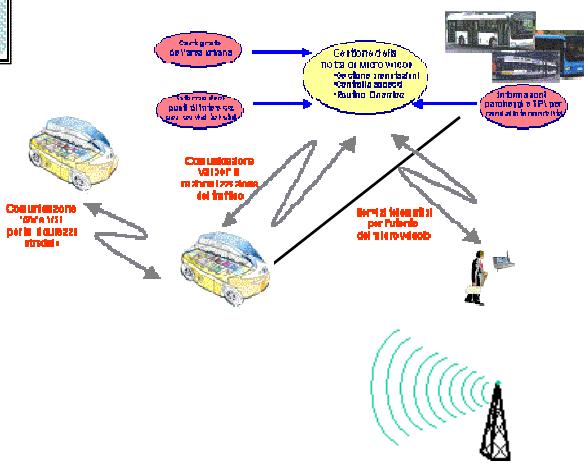
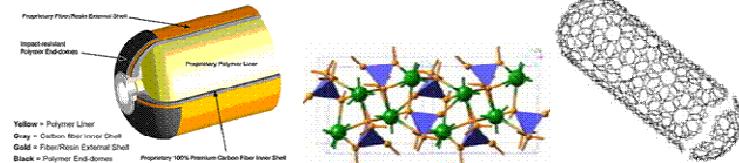
Hydrogen



Bio-combustibili

Bio-NG

## Storage systems and distribution

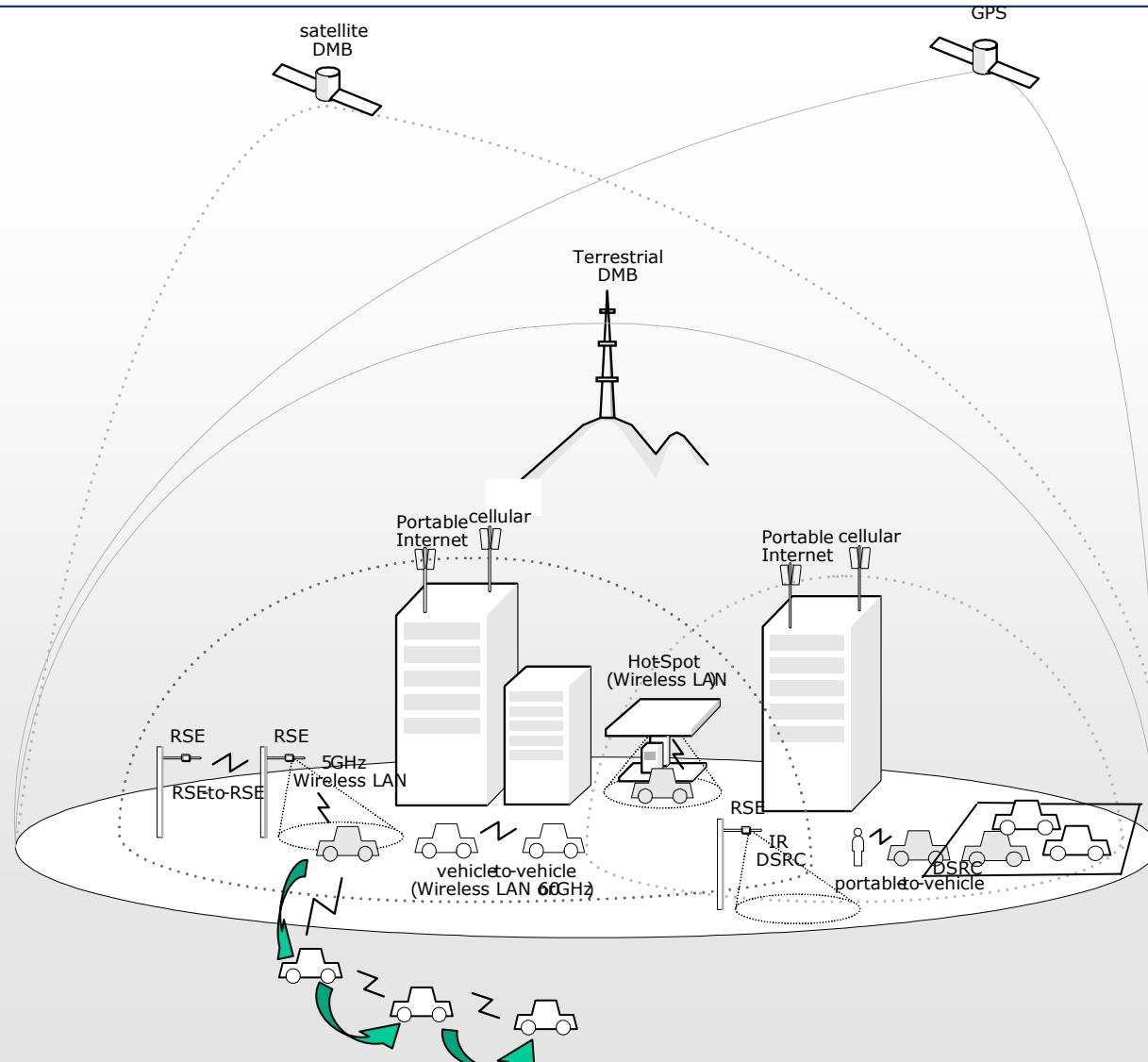


## Ecological fleets



Telematics  
server

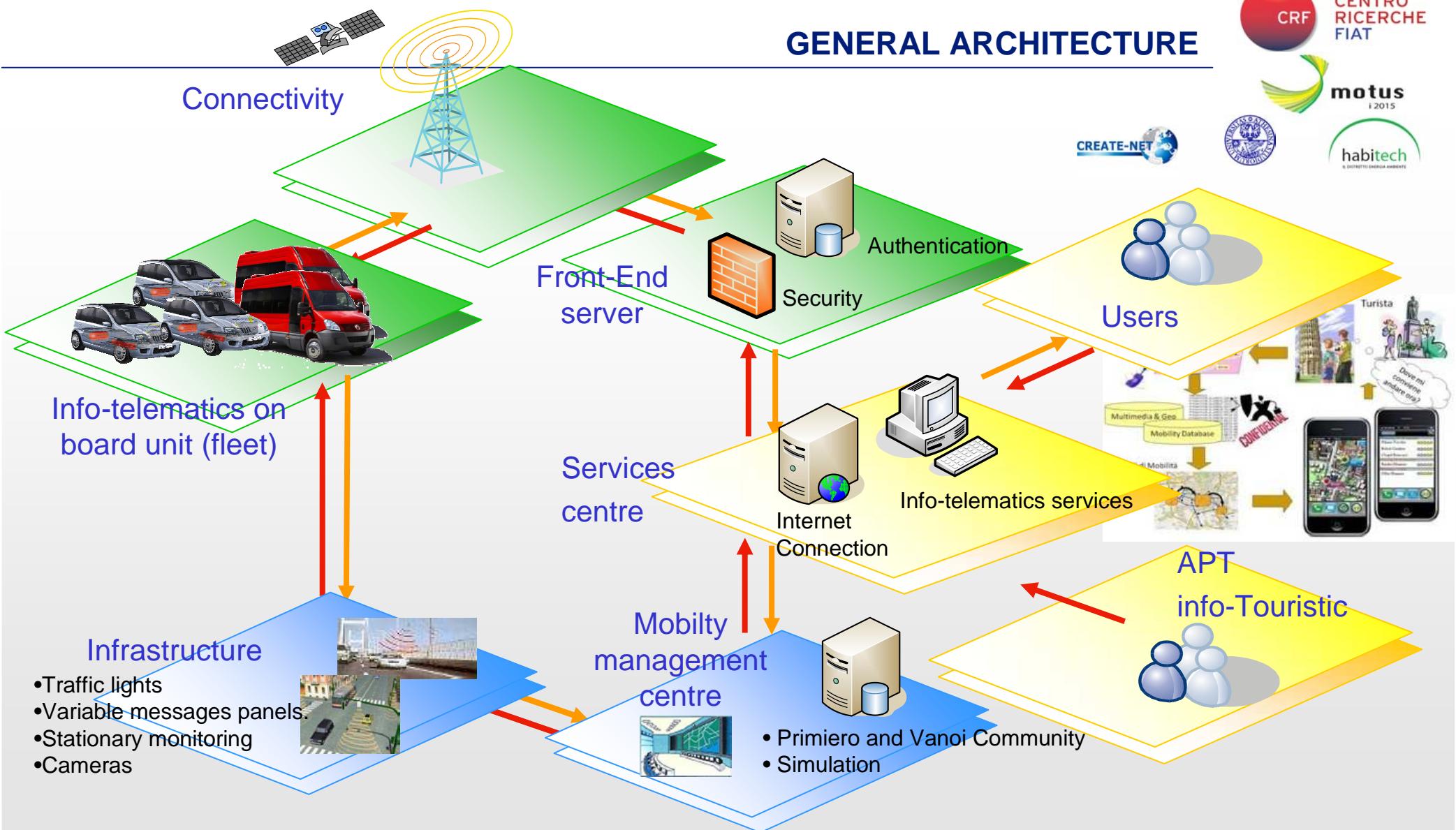
# INFO-TELEMATICS FOR INNOVATIVE SERVICES



Info-telematics can contribute to:

- reduce travel time
- reduce fuel consumption
- Preventive safety through cooperative systems
- New services

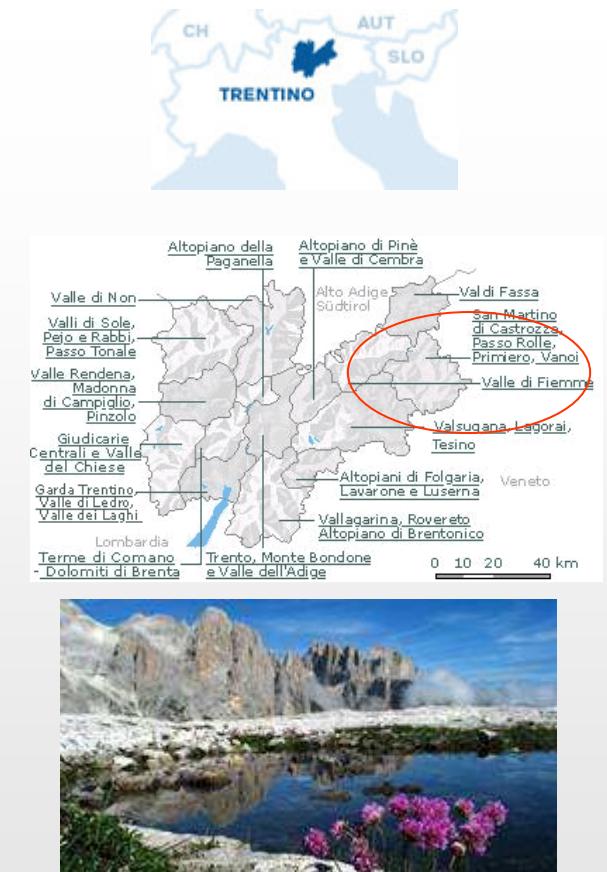
# INFO-TELEMATICS PLATFORM GENERAL ARCHITECTURE



# PRIMIERO AND VANOI COMMUNITY - TRENTO

Primiero – Vanoi area is located in the eastern part of Trentino and they are characterized for:

- Small extension (about 413 km<sup>2</sup>); altitude ranging from 600 up to 3000 meters
- Population: about 10.000 inhabitants with increase up to 1.3 Mio inhabitants during touristic season, not homogeneously distributed on the main 8 Municipalities (24.2 inhab./Km<sup>2</sup>)
- Mountains, peaks and valleys, rich of water and wood
- Touristic tradition (es.: National Park of Paneveggio, Pale San Martino)
- Economics based mainly on tourism and breeding (about 1500 Adult Units)



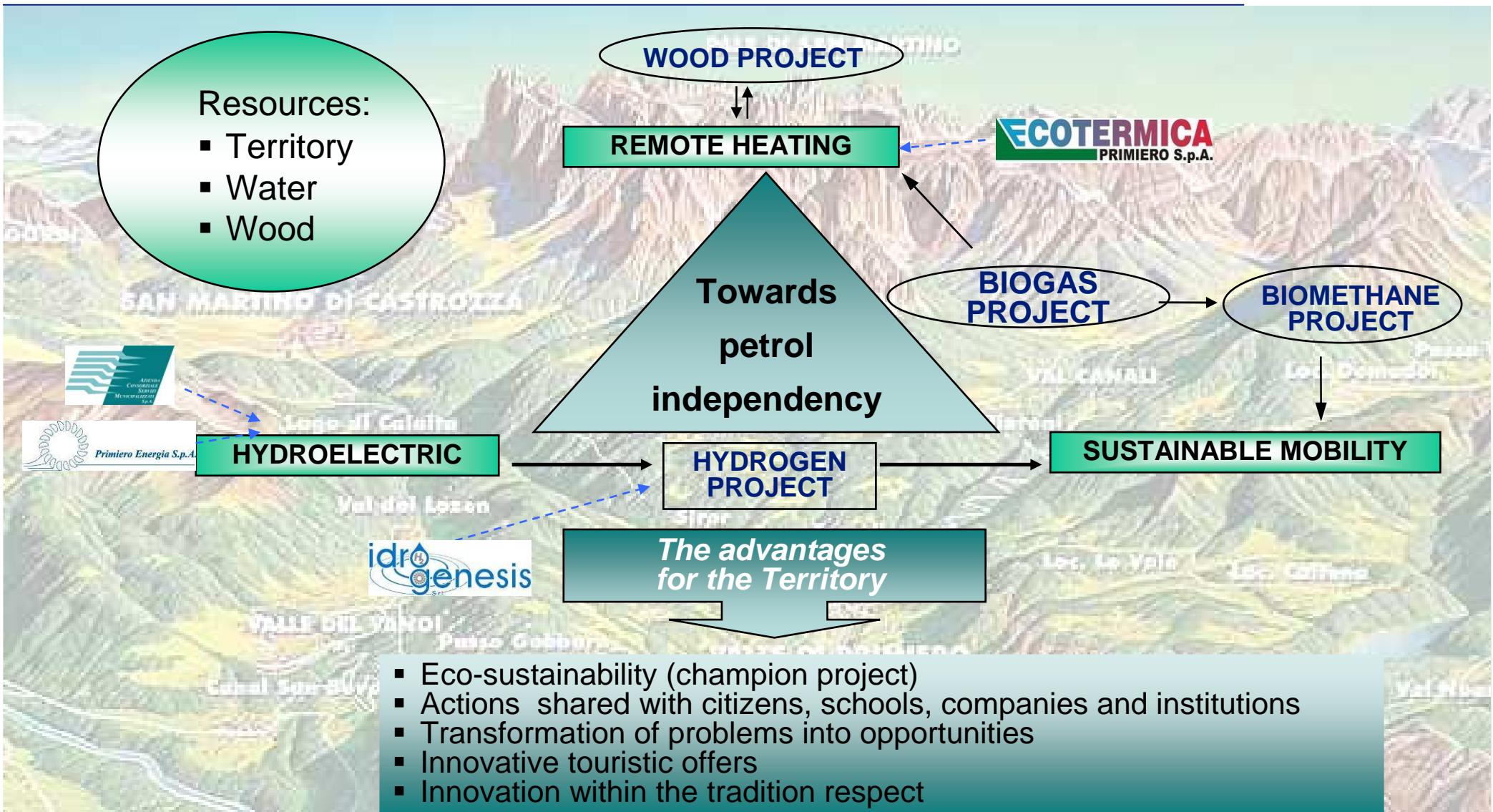
## THE ROLE OF A.C.S.M. Group

**ACSM is the local public multi-utility company, owned by the 13 local municipalities, whose role is the development of the area through:**

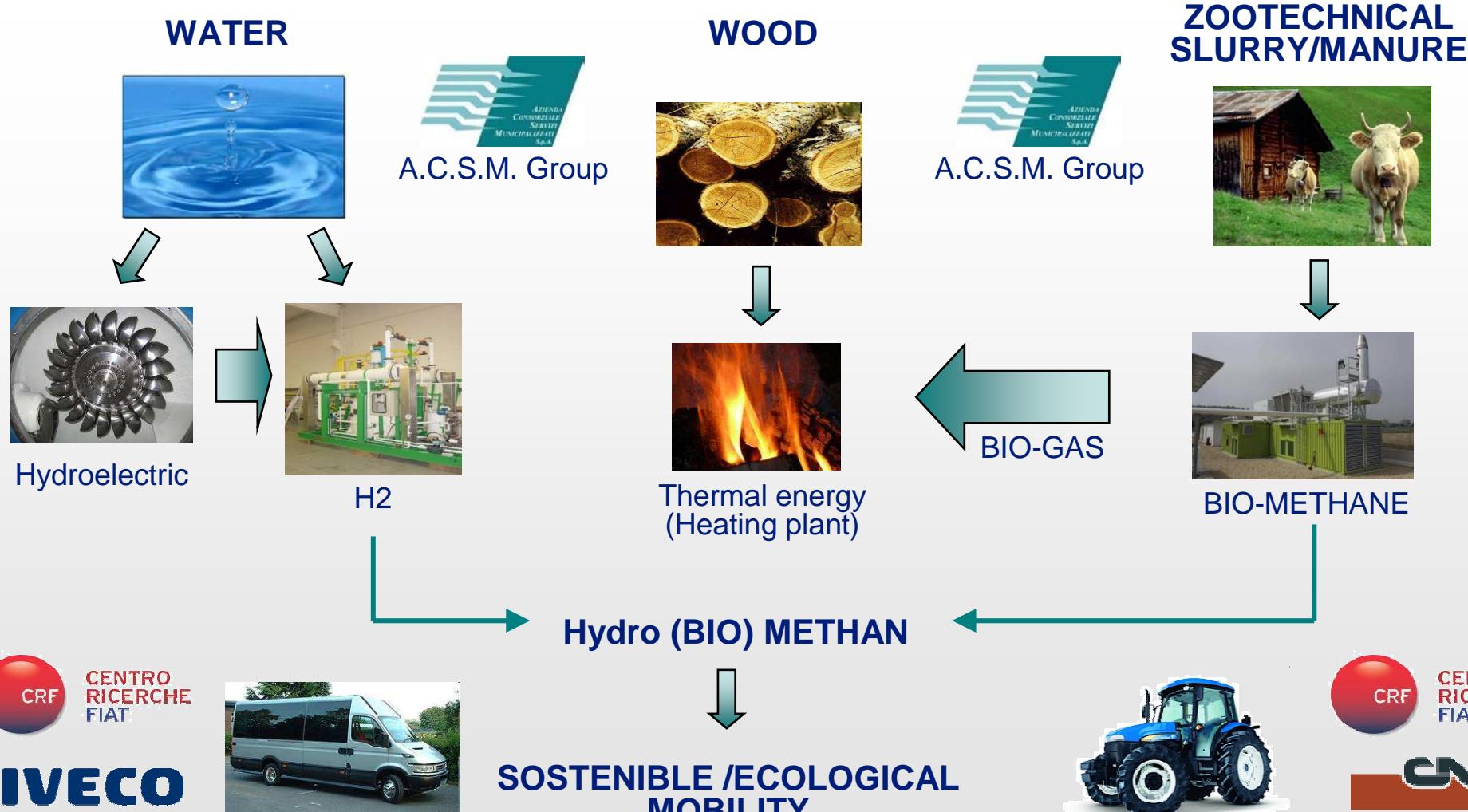
- Hydro-electric production (about 400 GWh/yr)
- Hydro-electric distribution (about 60 GWh/yr)
- Electric power sales on the free market
- Thermal power production from wood, distribution and sales
- Separate garbage collection
- Hygienic monitoring of potable waters
- Empowering tourism strategies and farming breeding activities



# OIL FREE ZONE PROJECT



# SCENARIO – OIL FREE ZONE PROJECT (TRENTINO)



# BIOMETHANE AS VEHICLE FUEL (Primiero community potentiality)

## Territorial advantages

- Environmental impact
- “Oil free zone” target
- Energy independency



## Agricultural advantages

- Transforming manure problem into opportunity
- Economic advantages
- “ON site” fuel production

- Manure: ~ 22.000 t/y
- Humid fraction: ~ 1.200 t/y

## Industrial opportunities

- New business opportunities (bio fuels production, distribution and by-products management)
- New green product in line with the evolution of UE expected scenario (renewable energies)

# APPLICATIONS – EXPERIMENTAL FLEET SCENARIO (PRIMIERO and VANOI COMMUNITY)

Fuel consumption:



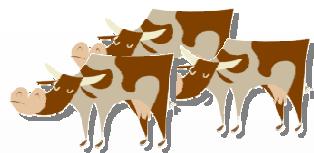
**11,8 kg NG/100 km**



**5,33 kg NG/100 km**



**75 kg NG  
65 kW, 8 hours, 50%**



**1500 UBA produce ~ 500 Kg of  
bio-methane per day**

	Number of Panda that travel for 100 km/day	Number of Daily that travel for 300 km/day	Number of tractors that work 8 h, 65Kw, 50%
A	10	4	4
B	3	9	2
C	12	2	5

**+ Humid fraction and hydrogen**

# BIO NATURAL GAS / HYDROGEN BLENDS



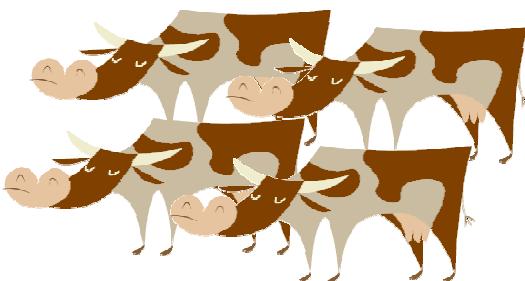
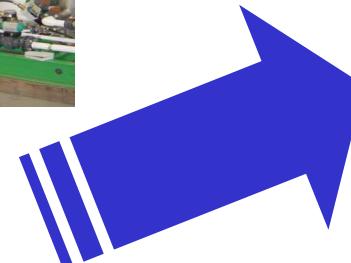
## HYDROGEN PRODUCTION PLANT:

- Electrolyze capacity of 25 Nm<sup>3</sup>/h
- Compressor with a range of 20 to 350 bar;
- Purification up to 99.99%
- Storage system;

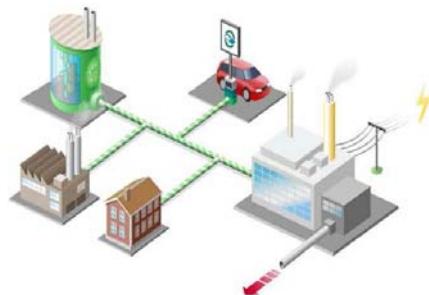
Expected hydrogen production:  
10 ÷ 14 tons/year



**BIO NATURAL GAS /  
HYDROGEN BLENDS  
(first application)**



## BIO-METHANE PRODUCTION PLANT:

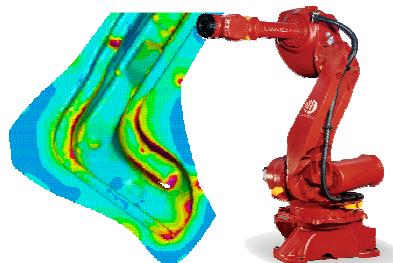


# CONCLUSIONS



- With objective of minimizing the CO<sub>2</sub> emissions, there are several technologies under development both for the vehicle and the powertrain;
- The fuels by renewable sources (2<sup>nd</sup> generation bio-fuels, not in conflict with the food sector) are increasing their importance and they will have an important role for the future (10% within the 2020);
- For enabling and promoting the development and application of renewable fuels, it is of extreme importance moving forward an system approach, where OEMs, suppliers, research institutes work together with the Public Institutions;
- The Primiero and Vanoi community will present a best practice of system approach (which could be duplicated in other areas) where the development of an “oil free zone” will permit mainly to:
  - develop local competence of excellence for the production of renewable fuels and info-telematics, creating new business opportunities;
  - transform manure problems into opportunities;
  - create innovative touristic offers, as strategic territorial advantage.

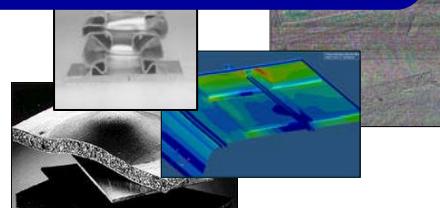
## Process Virtual Analysis and Wireless Control



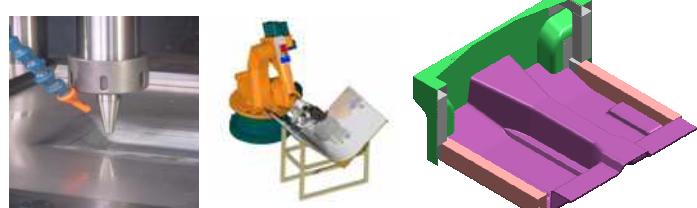
## Preventive Safety vs. Vulnerable Road Users



## High Performances Metallic & Composite Materials



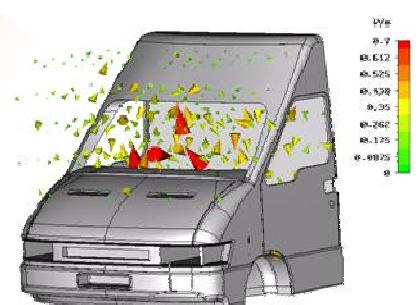
## Low Investments & Flexible Technologies



## Info-telematics for Public Mobility and Agriculture



## Electromagnetic Virtual Analysis



**THANK YOU !**

Centro Ricerche Fiat  
Trento Branch