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"Gheorghe Asachi" Technical University of Iasi, Romania

LOW ENVIRONMENTAL IMPACT OF ALTERNATIVELY SUPPLIED CARS. RESULTS OF AN INVESTIGATION CARRIED OUT IN THE NORTH-EAST OF ITALY

Veronica Novelli*, Paola Geatti, Luciano Ceccon, Lucas Toscani

Department of Economics and Statistics, University of Udine, via Tomadini 30/A, 33100 Udine, Italy

Abstract

The transport of both goods and passengers notably influences air quality. If strong decisions by the governments will not be taken, oil consumption for transport will be nearly doubled in 2030 if compared with 2000, thus considerably increasing the atmospheric presence of greenhouse gases. To boost the purchase of alternatively supplied cars would avoid serious, if not catastrophic, climatic changes. Our investigation shows what the situation is concerning new cars sold by SINA, an official concessionary firm of ten brands in the province of Pordenone, in the North East of Italy, covering about 40% of the local market. The supply types and the brands of the new cars sold in the branch offices of the firm from 2011 to August 2015 have been taken into consideration. The most sold cars are still petrol and diesel supplied, whereas alternatively supplied cars (liquefied oil gases, methane and electric) represent nowadays only 7.51% of the total in this territory. Processing of the data that have been put at our disposal by the firm allowed to compare the situation of the province of Pordenone with the Italian one, and to put in light the critical aspects still hindering the purchase of alternatively supplied cars.

Key words: alternatively supplied cars, carbon dioxide emissions, North East of Italy

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1. Introduction

The quality of air is a prior factor for the environmental welfare. The environmental pollutants are due in particular to industrial activities, heating systems and vehicular traffic. Specifically, combustion processes which take place in all (terrestrial, marine and aerial) vehicles are one of the main causes of non-desired atmospheric emissions, which provoke harms to the environment and consequently possible negative effects to human health (Burgarella, 2014; Gasana et al., 2012; Stankovic et al., 2015). Atmospheric pollution is a global, not only local, problem; in fact, pollutants, because of the atmospheric agents, can easily move and provoke harmful effects also very far from where they are produced. In detail, the transport sector is a significant source of the both CO_2 (the main responsible for greenhouse effect) and particulate (PM_{10} and $PM_{2.5}$) air emissions (Ilyas et al., 2010; Kim et al., 2004; Stefan et al., 2015). This situation is particularly worrying in Italy, where the main part of commodity and person transport is carried out on rubber, in comparison with other Countries (in Europe and in the world), where railway transport is leasing with a consequent emission reduction. In 2014, road traffic was responsible for 25.5 % of total CO_2 emissions (Ispra, 2015). Furthermore, the amount of CO_2 emitted by private cars moving in Italy during 2013 was 166.0 g/km, referred to petrol cars, and 158.6 g/km for diesel cars (Ispra, 2015).

Current European rules concerning air quality control are specifically represented by the Directive 2008/50/EC (EC Directive, 2008). In Italy, this Directive was adopted by the Legislative Decree No 155/2010, which fixed the objectives for PM_{10} and

* Author to whom all correspondence should be addressed: e-mail: veronica.novelli@uniud.it; Phone: +390432249335; Fax: +390432249229

$PM_{2.5}$ reduction. In particular, it defined the limit of PM_{10} concentration as 50 μg/m^3, relatively to the daily average, not to be exceeded for more than 35 times a year (Legislative Decree, 2010). The same Legislative Decree imposed limits gradually more restrictive for $PM_{2.5}$, by establishing that the year average, from January 1st 2015, cannot exceed 25 μg/m^3.

In 2009, the European Parliament ratified the so-called "20-20-20 package" (Directive 2009/28/EC), which fixed the following guidelines:

a) to reduce by 20% the emissions of greenhouse gases within 2020, compared with those of 1990;

b) to reach 20% of energy saving, in general heat recovery from combustion processes;

c) to increase to 20% consumption of energy from renewable sources (EC Directive, 2009).

European policies for reduction of greenhouse gases in the transport sector brought to voluntary agreements between the associations of car makers, European Car Manufacturers' Association (ACEA), Japanese Automobile Manufacturers' Association (JAMA) and Korean Automobile Manufacturers' Association (KAMA). The goal of these agreements was to fix the average CO_2 emissions for the new registered cars at 140 g/km in the European countries within 2008.

This target would be obtained by technological innovations upgraded on the cars. This commitment was not observed by the car makers, so in 2009 the Regulation 443/2009/EC fixed, from 2012, the average CO_2 emissions at 130 g/km and the goal of 95 g/km within 2020 (EC Regulation, 2009). This Regulation stated that the limit of 130 g/km would be obtained by technological motorcar innovations. The difference, 10 g/km, would be obtained by technical measures on pneumatics, fuels, air conditionings, etc. To reach this goal, the Regulation fixed the limit values for CO_2 emissions of the cars depending on their mass; so the limit to be respected increases with the increasing of vehicle mass.

Every year car producer companies have to demonstrate that the sold cars have average CO_2 emissions in line with the limits fixed by the above-mentioned Regulation. These limits are calculated by considering the number and the mass of the sold cars. Otherwise the car producer companies are subjected to sanctions by the European Commission. Actually an agreement was reached on the topic, in order to calculate the weighted average of 95% of the sold cars and excluding some sport cars characterized by high levels of CO_2 emissions.

In 2011, the Regulation No 725/2011/EU was issued, with the aim of further reducing CO_2 emissions, by providing incentives to the car companies able to develop new, innovative technologies in order to reduce environmental pollution (EU Regulation, 2011). In 2014, the Regulation No 333/2014/EC was promulgated, partially revising the Regulation No 443/2009/EC, keeping the goal of 95 g/km (as emission level) for the new cars from 2020. The main modifications of this Regulation are:

a) define the average CO_2 emission of every vehicular brand. The following percentages have to be considered: 65% in 2012, 75% in 2013, 80% in 2014, 90% from 2015 to 2019, 95% in 2020, 100% from 2021;

b) assign "super credits" for the achievement of the goal of 95 g/km: every new car with emission lower than 50 g/km will be counted as two cars in 2020, 1.67 in 2021, 1.33 in 2022 and 1 starting from 2023 (EC Regulation, 2014).

1.1. The environmental pollution due to vehicular traffic

The Legislative Decree No 155/2010 fixed the limits for the main air pollutants in Italy: PM_{10}= 50 μg/m^3; $PM_{2.5}$= 25 μg/m^3; NO_2= 40 μg/m^3 (maximum annual average) or 200 μg/m^3 (average value), not to be exceeded in 25 days a year. The increase of vehicular traffic is due to increased population and industrial activities. At a local level, emissions depend on the fuel supply, but also on the local environmental policy.

Vehicular traffic is one of the main causes of climate changes: in fact, it is responsible for 25.5% of the total CO_2 emissions, due to fossil fuel combustion (Ispra, 2015). Other pollutants, coming from fuel combustion, are: CO, NOx, SOx, VOC, secondary O_3 (Serafini, 2008). Volatile hydrocarbons from petrol vehicles have been studied because of the production of photochemical smog (Schauer et al., 2002). Vehicles are responsible for the major amount of fine particles in urban air (Sharma et al., 2010).

Many investigations were carried out on health environmental implications. Air pollution due to traffic generally has important effects on respiratory diseases, allergy and asthma (Ilyas et al., 2010; McConnell et al., 2010), in particular on respiratory children's health (Gasana et al., 2012; Kim et al., 2004). Polycyclic aromatic hydrocarbons (PAHs) are very dangerous for human health because of their cytotoxicity and mutagenicity (Slezakova et al., 2011), particulate matter, coming from vehicular heavy traffic of highways, is associated with cardiac and pulmonary mortality (Brugge et al., 2007). "Secondary" ozone, produced by the reaction of benzene, formaldehyde, small organic particles, NO_2 and other organic substances deriving from fossil fuels in the presence of sun light, is very dangerous for human breathing apparatus. Finally, PAHs and benzene can cause cancer pathologies (Burgarella, 2014).

1.2. The influence of fuels on air pollution

From January 1st 1993, to install a catalytic converter is mandatory in all the cars fed by petrol, in order to reduce pollutant emissions, in particular of carbon oxide (CO), unburned hydrocarbons (TOC) and nitrogen oxides (NOx).

Cars fed by liquefied oil gases (LOG) emit less CO_2 if compared with petrol and diesel cars and can be considered to emit zero particulate matter (Econometrica, 2009). Furthermore, they release lower amounts of PAHs, if compared with petrol, methane and diesel cars; the last ones are the most pollutants from this point of view. Sulphur (S) amount is very low, as well (Orsini et al., 2014).

Methane combustion produces 72% less NOx in respect of petrol; it produces 14% less CO_2 and 95% less NOx if compared with diesel combustion (Econometrica, 2009).

1.3. Less pollutting cars: hybrid cars

Hybrid vehicles are characterized by two propulsion systems: the thermic and the electric one. Three types of cars are distinguished, depending on hybrid system, power and electric energy installed in respect of total power supplied by the car: micro hybrid, mild hybrid, full hybrid. In particular, full hybrid are the only hybrid cars able to run by using also the electric propulsion; in fact, they can move by using the electric or the endothermic engine or by a combination of both. Usually the electric propulsion feeds the start phase of the vehicle or the way at low velocity, by ensuring zero both fuel consumption and CO_2 emissions. The endothermic engine ensures the supplementary power needed during the speeding up phase and when high velocity of the vehicle is required. The full hybrid system is able to choose the best suitable feed by storing, for example, the energy wasted during the baking to recharge the electric accumulators.

Among the hybrid vehicles, the solution "plug-in" (cable equipped) represents a further evolution, similar to the electric cars: these cars have a set of batteries that can be recharged by a cable, in specifically equipped service stations or otherwise by a domestic 220V socket, but in a longer time for the complete recharge. The car can move according to the vehicle set up modalities, either in electric or in hybrid way. Generally, when the car exceeds a certain speed (i.e., 50 km/h), or a greater power is required, for example during an overtaking, the endothermic engine starts up, anyway saving fuel and therefore with lower pollution.

During the last years, the marketing of this type of vehicles has increased significantly, representing a right compromise between the traditional and the electric cars. Hybrid vehicles are much more efficient in comparison with the traditional ones, not only for their lower environmental impact, but also for their advantage, due to their lower fuel consumption. In fact, average fuel consumption is about 20-30% lower than a traditional car fed by petrol along urban roads.

Unfortunately, up to now, the criticalities of these cars are the purchasing costs, still too high, also due to the electric equipment and their innovative technology. The use of these cars is more suitable in particular for the urban cycle, because their higher weight can reduce the saving advantages or fuel in comparison with traditional engines along the highways. The greatest part of hybrid cars is constituted by a petrol + electric engine; diesel + electric engine is not yet very present in the market, even if it could represent a good alternative for the lower consumptions and emissions with respect to a traditional diesel car, using the diesel characteristics for the extra-town and highway runs and the electric characteristics for the town runs (Melis, 2012).

1.4. Electric cars

At present, electric cars are equipped by a set of lithium rechargeable batteries, able to improve the vehicle autonomy with respect to the previous batteries, in particular the lead ones, and with an average performance three times higher in terms of operation time. Nevertheless, they are still more expensive and their high price is an important disincentive for the success of this type of cars. Another important criticality is the limited autonomy that does not allow long trips without battery recharge; for this reason they are normally used within urban tours, not for long times. These vehicles are equipped with electric engines; batteries are periodically recharged by the electric main supply. The recharge timing depends on both battery type and supply. Normally, if they are recharged by an electric 220V cable, a period from six to eight hours is necessary. The needed recharge time is shorter if dedicated electric power supply sockets are used. Electric cars represent the only cars with zero CO_2 emissions. Electric energy would be obtained by renewable sources, like the photovoltaic one, in order to be considered sustainable. According to a study of the Commissione Italiana Veicoli Elettrici Stradali (Cei-Cives) and the University of Pisa (Menga and Ceraolo, 2010), an electric car or a hybrid plug-in one in electric modality presents a total environmental impact three times lower than a petrol Euro 5 car, considering the reduction of greenhouse gases, the reduction both of oil consumption and of costs for human health and the eco-system due to the emissions.

In this segment of vehicles, technology has developed the electric cars with fuel cells, fed by hydrogen, even if this technology is still in progress. The combustion cell represents an electrochemical generator producing electric energy directly from hydrogen or other fuels, either liquid or gaseous, containing hydrogen. In this way, energy is produced by a chemical reaction between hydrogen, stocked on board, and oxygen contained in the air (Pizzolato, 2011; Sartori, 2011). Hydrogen fuel cell vehicles are able to improve air quality, health and climate (Jacobson et al., 2005).

In the last years, several papers have been published on the development of innovative technologies and the promotion of buying of cars with alternative supplying (Engerer and Horn, 2010; Hillman and Sanden, 2008; Hoyer, 2008; Kley et al., 2011; Orbach and Fruchter, 2011; Petschnig et al., 2014).

The aim of this paper is to put in light the diffusion of alternative cars in the Province of Pordenone, in the North East of Italy, by the analysis of the new cars sold by SINA, official car dealer of ten brands in the territory considered. Data related to the last years are examined to establish whether critical conditions are hindering the development of alternatively supplied cars.

2. Case study presentation

From about the last 50 years, SINA is a firm marketing and assisting cars and commercial new and used vehicles. At the beginning, it was the unique concessionary firm for the brand Fiat car; at present it markets Fiat, Fiat Professional, Alfa Romeo, Lancia Abarth, Jeep, Volvo, Nissan and Subaru.

The main branch is located in Pordenone, while the other offices are located in Spilimbergo, Sacile, Portogruaro and Venice. Pordenone, Spilimbergo and Sacile are located in the Friuli-Venezia Giulia region, while Portogruaro and Venice in the Veneto region, both in the North-East of Italy. With more than 300,000 cars sold during its whole activity, SINA represents one of the most important realities in Italy in the field of automotive. Furthermore, it sells about 35-40% of the total cars sold in the province of Pordenone (about 320,000 inhabitants).

Our attention has been focused on the selling of alternative cars in the North-East of Italy, in order to compare the behaviors of the citizens of this part of Italy with the rest of the country. For this aim, we have interviewed the society management about the new car selling in all the branches, classified for both brand and type of fuel supplied. Only private cars have been taken into consideration. Data were collected from the company offices located in the province of Pordenone: Pordenone, Spilimbergo, Sacile, Nuova di Corva. Data available refer to the years from 2011 to 2014 and to the first eight months of 2015.

3. Results and discussion

3.1. Italian situation

In 2013, the cars on road were more than 70% of the total road vehicles. In 1990, the cars were little more than 27 millions, while in 2013 they were almost 38 millions, with an increase of about 38% (Ispra, 2014). In 1990, this meant 0.484 cars per capita, while in 2013 it corresponded to 0.611 cars per capita.

As can be observed in Fig. 1, from 2007, with the record of cars sold close to 2 millions and 500 thousand units, the market suffered a huge recession until 2013, with 1304454 registered cars, which means a decrease of 48% with respect to 2007. The car market began to increase only in 2014, the last year for which national data are available, when the registered cars were 1360441. However, a more detailed analysis can be made by taking into consideration the registered cars in the last 10 years, divided by the various types of fuels (Table 1).

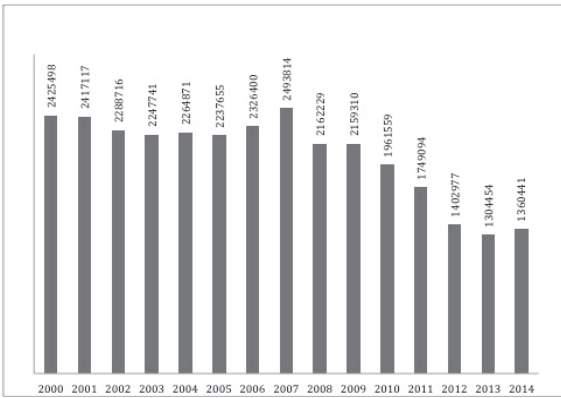

Fig. 1. Registered cars in Italy from 2000 to 2014 (Unrae, 2015)

We can observe an almost constant decrease of the selling of cars fed by petrol, which in 2014 represented 28.96%. Cars fed by diesel do not show a clear trend, even if they always presented the largest percentage in the global car market. During the last years, a significant interest in alternative cars has been observed (petrol-LOG, petrol-electric, petrol-methane, electric, methane); in 2013 they reached 15.34% and in 2014 16.13% of the market. In particular, in 2013 the share of cars fed by LOG was 8.89% and in 2014 9.15%.

Also the percentage or cars fed by methane increased slightly with respect to the previous year, reaching 5.32%, without financial incentives specifically dedicated. Hybrid cars switched from 15156 in 2013 to 21488 in 2014. Electric cars reached 864 units registered in 2013 and 1100 in the following year. In the last two years, registered electric cars, in particular hybrid cars, increased in a significant way, even if they still represent a very low percentage of the global car market. The consumers do not know if electricity is generated by renewable, not renewable or a mix of renewable-not renewable sources (Rezvani et al., 2015).

The share of cars fed by gases (methane and LOG) circulating in Italy is the biggest in Europe: in fact, Italian people choose alternative feeds that are able to provide the same performance and comfort, but with lower utilization costs, in comparison with traditional cars (Orsini et al., 2014). It is interesting to consider CO_2 average emissions of the cars registered in Italy in the last 10 years, which has progressively decreased up to a value lower than 120 g/km in 2014 (Fig. 2). In particular, according to an Anfia (Associazione Nazionale Filiera Industria Automobilistica) elaboration, the emissions in Italy of the new cars divided by supplied fuels in 2013 were: 122.3 g/km for cars fed by petrol, 123.8 g/km for those fed by diesel, 120.1 g/km for those fed by

LOG, 99.2 g/km for those fed by methane and 88.2 g/km for hybrid cars (Anfia, 2014).

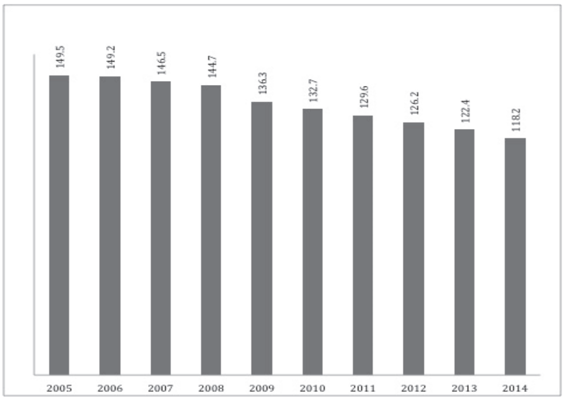

Fig. 2. CO_2 average emissions (g/km) of the cars registered in Italy from 2005 to 2014 (EEA, 2014)

The factors responsible for the efficiency of the car emissions are several, such as the feeding, the car weight and the power of the engine. Finally, at the individual level, users can reduce CO_2 emissions by 10-15% with good driving practices (safe driving style, respect of the rules of the road, etc.) (Unrae, 2015). To understand consumers' behavior is the starting point for any market decision. In the last years, consumers' behavior changed, since it was influenced mainly by the international economic crisis. In such a critical context, which is characterized by a both strong demand decrease and fierce competition, the definition of consumers' characteristics became more and more complex. Present situation relative to spread of the various types of car supplies and to emissions produced may be represented by a pyramid.

Table 1. Number and percentage of registered cars in Italy, divided by year and supplied fuel (Unrae, 2015)

Supplied fuel/year	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***
Petrol	903628	941781	1011681	911780	780931	710785	683980	467625	401725	393972
%	40.38	40.48	40.57	42.17	36.17	36.24	39.10	33.33	30.80	28.96
Petrol + electric	1110	2179	3450	3337	7584	4843	5150	5638	14057	20831
%	0.05	0.09	0.14	0.15	0.35	0.25	0.29	0.40	1.08	1.53
Petrol + ethanol			7	96	125	77	59	52	5	1
%			0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Petrol + LOG	1822	3502	30004	74262	339596	279129	55792	128833	115938	124476
%	0.08	0.15	1.20	3.43	15.73	14.23	3.19	9.18	8.89	9.15
Petrol + methane	19296	24655	52203	71013	122189	62310	35614	48323	56076	60562
%	0.86	1.06	2.09	3.28	5.66	3.18	2.04	3.44	4.30	4.45
Diesel	1308379	1352271	1387985	1093445	903116	901127	965488	745411	702725	747018
%	58.47	58.13	55.66	50.57	41.82	45.94	55.20	53.13	53.87	54.91
Diesel + electric	2	13	2				12	1198	1099	657
%	0.00	0.00	0.00				0.00	0.09	0.08	0.05
Electric	30	28	25	132	63	117	307	524	864	1100
%	0.00	0.00	0.00	0.01	0.00	0.01	0.02	0.04	0.07	0.08
Methane	3338	1971	8457	8164	5706	3171	2692	5373	11965	11824
%	0.15	0.08	0.34	0.38	0.26	0.16	0.15	0.38	0.92	0.87
Total	2237655	2326400	2493814	2162229	2159310	1961559	1749094	1402977	1304454	1360441
%	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The most required types of supplying, diesel and petrol, producing the greatest emissions, are located at the base of the pyramid. By going up along the pyramid, the alternatively supplied cars are found; both their request and the level of emissions decrease at the same rate. Electric cars are placed at the vertex; they represent the less required cars, but at the same time they are characterized by zero emissions. However, the patterns of car purchase are destined to change: the pyramid pattern may be substituted by a clepsydra pattern, where the both base and vertex are made up by important contributions, whereas the central area is represented by a lower number of consumers.

According to a future purchase estimate, in 2020 consumers will buy smaller, lighter, safer and more comfortable cars, characterized by lower both consumptions and emissions. Selling of plug-in and electric cars will considerably increase, thus contributing to the decrease of atmospheric pollutant emissions. Furthermore, a greater amount of synthetic fuels could be used, as e-Deasel, a new synthetic fuel which can be produced without employing fossil sources, as it is obtained by water, CO_2 and renewable energy (Candelo, 2009). A recent investigation put in light that Italian motorists think that three characteristics are essential when choosing a car: safety, reliability and fuel efficiency. The 39% of Italian consumers prefer full-optional cars and are willing to pay more in order to obtain surer cars (Mohanarangam, 2014).

The item relative to consumptions represents a determining element nowadays in the choice of a car. This essential factor led potential consumers to take into greater and greater consideration mainly hybrid cars and to a lesser extent electric cars, in particular by consumers living in the cities.

3.2. The situation in the Friuli-Venezia Giulia region

In the Friuli-Venezia Giulia region, 624.7 cars were circulating for one thousand inhabitants in 2013; this meant a car fleet of 767990 cars (ACI, 2015). The number of cars sold in the last ten years, divided by the four provinces, is shown in Table 2. A general and almost constant decrease may be observed starting from 2007, as the effect of the well known economic crisis.

The number of cars supplied by LOG is greater than that of methane cars in the Friuli-Venezia Giulia region, where an important distributive network is present: in fact, there are 81 filling stations, of which 29 in the province of Pordenone. Methane cars are penalized in respect of LOG cars, as a consequence of a poor distributive network. Only four methane filling stations are present in the Friuli-Venezia Giulia region; two are located in the province of Pordenone. Electric cars are even more penalized by the lack of stations of battery recharging, which are concentrated in the main cities. Only one recharging station, which is not yet active it is present in the province of Pordenone. Furthermore, reductions are not available for electric cars as far as parking is concerned.

In 2014, the alternatively supplied cars sold in the province of Pordenone reached the level of 8.8 per cent. This figure is in line with the Italian mean value.The CO_2 average emissions of the cars registered in the Friuli-Venezia Giulia region in the last years are shown in Fig. 3. The trend is similar to that relative to Italian situation, already presented in Fig. 2. However, the values of the Friuli-Venezia Giulia region have always been slightly higher than the Italian ones, and in 2014 the objective of 120 g/km was not reached.

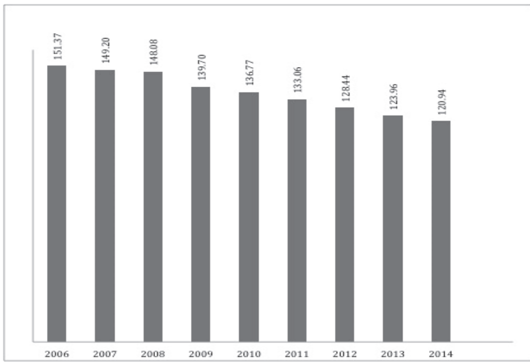

Fig. 3. CO_2 average emissions (g/km) of the cars registered in the Friuli-Venezia Giulia region from 2006 to 2014 (Unrae, 2015)

3.3. Case study

The results relative to the case study are shown in Table 3. In line with the situation of the Friuli-Venezia Giulia region and of the province of Pordenone, which has been already reported in Table 2, total car sell decreased progressively from 2011 to 2015. However, it is important to understand also the choices of the buyers with respect to the type of fuel. The cars supplied by conventional fuels largely represented the highest percentage of the selling for all the period considered, even if the trend showed some fluctuations. Furthermore, the percentage of diesel cars overcame that of petrol cars starting from 2012. However, some types of the most sold cars exceed (even if slightly) the limit of 120 g/km fixed by European rules for CO_2 emissions; almost all other types exactly respect the limit or are characterized by emissions only slightly lower.

One of the most sold cars in the last three years shows emissions of 99 g/km, but its price is about twice the other most sold cars. In 2012, the alternatively supplied cars quadrupled the selling percentage in respect of 2011, but a constant decrease was observed in the subsequent years. Electric cars began to be sold only in 2013, but in 2015 their number increased in a very significant way in respect of the two previous years, even if their share is quite insignificant in respect of the other types of cars. SINA began to sell hybrid cars only during 2016.

Table 2. Number of registered cars in the Friuli-Venezia Giulia region, divided by province (Unrae, 2015)

Province/ year	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
Gorizia	5347	5513	6567	5430	6162	4271	3796	2377	2239	2618
Pordenone	11417	12085	12946	11518	11191	9915	9448	7084	6550	7335
Trieste	8009	8215	9182	7421	7770	6464	5676	4126	3956	4231
Udine	19792	19254	22059	18318	19106	16668	15539	11819	11024	11777

Table 3. Number and percentage of cars sold by SINA, divided by year and supplied fuel

Supplied fuel/year	*2011*	*2012*	*2013*	*2014*	*2015*[a]
Petrol	1745	1098	899	862	827
%	49.69	41.75	36.84	36.65	42.52
Diesel	1647	11 64	1225	1283	972
%	46.90	44.26	50.21	54.55	49.97
Traditional fuels	3392	2262	2124	2145	1799
%	96.59	86.01	87.05	91.20	92.49
Petrol + LOG	70	281	227	147	107
%	1.99	10.68	9.39	6.25	5.50
Methane	50	87	87	58	20
%	1.42	3.31	3.57	2.47	1.03
Electric	-	-	2	2	19
%			0.08	0.08	0.98
Alternative fuels	120	368	316	207	146
%	3.41	13.99	12.95	8.80	7.51
Total	3512	2630	2440	2352	1945
%	100.00	100.00	100.00	100.00	100.00

[a] *January-August*

People living in the province of Pordenone preferred to buy diesel supplied cars during the considered period of time, at least from 2012 afterwards. Methane fed cars were less required, even if methane is less pollutant than petrol and diesel. Electric cars seem to be the best solution to reduce the both use of fossil fuels and environmental pollution, as they do not emit CO_2, but their number is still very low.

4. Conclusions

Petrol and diesel cars are still the most bought ones both in Italy and in the province of Pordenone. Alternatively supplied cars are little bought; in particular, methane cars are penalized by an insufficient distributive network, but also by a limited range of car models. Hybrid cars, in particular plug-in cars, represent a compromise between conventional and electric cars. This type of cars represents the most ecological solution for the near future and from this point of view the data relative to domestic selling are comforting.

Electric cars would be the best solution, but their number is almost negligible, as the conditions which may warrant their commercialization are lacking.

Our analysis, carried out in the province of Pordenone, showed that the preferred supplying is diesel, followed by petrol. The obtained results underlined the weak interest towards alternative supplying, which is characterized by a clear predominance of LOG cars in respect of methane and electric ones.

The critical aspects of the distributive network represent a serious drawback for the growth of methane and electric cars. In fact, it was put in light that only two methane and one electric recharging (even if not yet active) stations are present in the province of Pordenone. Furthermore, reductions for the motorists who are owners of electric cars are not available in the municipality of Pordenone.

A further consideration relative to methane and electric cars is the poor supply in the market: car firms are not yet interested in boosting these types of supplying, even if the range of electric cars offered by the various firms is destined to increase in the future.

The objective to be reached would be a substantial reversal of present pyramid, to reduce the contribution of the most polluting types of supplying to a minimum.

Italian motorists are sensitive to environmental topics and therefore they are ready for innovative and ecological choices; however, these choices are hindered by distributive networks and incentives that are insufficient or even non-existent.

Also the incorrect behavior of some car firms has not to be underestimated: the official data relative to consumptions and emissions are sometimes different in respect of the real ones, thus leading consumers astray.

The definitive change in environmental protection will depend mainly on new European and domestic rules, which have to be more incisive and feasible. A deep improvement towards these themes will be necessary, with a series of practical interventions aiming at boosting production and purchase of ecological cars, by granting greater advantages to the owners of these cars and by providing the national territory with suitable services as a satisfactory distributive network.

Some solutions to reduce the environmental pollution in the central areas of the cities, due to vehicular traffic, could be: to limit the private vehicular traffic; to promote public local transport for both extra-urban and urban areas; to give tax concessions for season tickets for public transport, in particular for the shifts home-work-school; to improve electric car parking for the commodity logistic in the town centres; to promote pedestrian and bicycle mobility; to promote the use of fuels with a low environmental impact, in general by pushing the sustainable electric mobility (Arpat, 2016).

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