1. INTRODUCTION

The Spanish Automotive and Mobility Technology Platform is pleased to present the third edition of its strategic research agenda. The aim of the present plan is twofold: On the one hand, it reflects of the values of the Spanish automotive industry nowadays. On the other hand, it is an outline that helps us prepare for the Strategic Plan for 2020. Private companies, technology centers and public research organizations will benefit from the present document. They can use it as a guide to establish their particular strategies and action plans. European, national and local governments will also find it very useful. It will assist them in defining and implementing tools to increase R&D&I in the sector. Likewise, it indicates how public resources can be used for existing demands and needs.

Since the Spanish Automotive Technology Platform began in 2005, it has worked towards a set of specific objectives. One of these is to be **a tool for developing and following up on initiatives for innovation** in the sector. Another of its goals is to **create a culture of innovation and a common line of work.** As a result, the industry will **improve its competitiveness** through research, development and innovation of products and processes. In addition, the platform has increased its scope of action. In the past three years, new members have joined from the automobile industry and related fields. Some examples are the Spanish Association of Automobile and Truck Manufacturers (ANFAC) and the intelligent transport systems companies (ITS España).

Platform members have been participating in different working groups since 2006. These groups establish R&D&I priorities for the automobile sector in Spain and update them periodically. They also identify strategic areas for platform members based on existing technological know-how and R&D potential in Spain. Furthermore, the working groups look for technological challenges that represent opportunities for companies in the automotive and sustainable mobility sectors. These opportunities can help them guarantee their longevity and improve their position.

Finally, a noteworthy accomplishment was the endorsement of national strategic priorities before the European Technology Platform ERTRAC (European Road Transport Research Advisory Council). This was possible thanks to the participation of Spanish experts in the working groups that put together ERTRAC's strategic research agenda and the implementation roadmaps[1].

[1] ERTRAC: ERTRAC Strategic Research Agenda 2010: Towards a 50% more efficient road transport system by 2030 – (October 2010);
http://www.ertrac.org/pictures/downloadmanager/6/50/ertrac-researchinnovation-roadmaps_60.pdf

2. HISTORICAL OVERVIEW: THE NEED FOR THE PLATFORM AND AN ANALYSIS OF THE SECTOR

Auto manufacturing is a global, complex and oligopolistic industry. In terms of economic impact, it can no doubt be considered the most important industry in the world. The economies of producer countries all benefit from the production, international trade, employment and wealth that it generates. Compared to other production sectors, it has an immense ripple effect and an enormous economic pulling power. This translates into considerable direct, indirect and induced economic growth. For instance, the industry represents 10 percent of Western European industrial production. In addition, it either directly or indirectly generates employment for almost 10 million workers.

Automobile manufacturing in Spain dates back to the beginning of the 20th Century. However, it wasn't until the mid 1900s when the industry as we know it today was founded. Even with the difficulties Spain has experienced in accessing various industrialization processes, the industry has grown enormously. The country is now one of the leading automobile producers in the world. In the year 2010, **Spain** produced 2,387,900 vehicles, 1,913,513 automobiles and 474,387 commercial vehicles. This makes it **the 2nd largest producer in Europe, the largest producer of commercial vehicles and the 8th largest producer in the world.** As a whole, the automotive industry in Spain has a positive contribution in the Spanish balance of trade. In the year 2010, 87% of the vehicles manufactured in Spain were exported all over the world. The majority were destined for the European market, where France and Germany received nearly 50%.

In Spain there are **11 companies** that have **18 vehicle production plants.** The overall business derived from the automobile industry in our country means direct employment for **over 250,000 people.** This figure takes into account both auto manufacturers and the auto parts industry. If we include the indirect employment generated, there are **an estimated two million people working for the sector.** If we include the auto parts industry, we are talking about more than **6% of the Gross Domestic Product.**

Spanish components and equipment manufacturers make up **a strong and competitive industry on a global scale.** The sector in Spain has received investments from abroad for the past 30 years. All of the major multinational companies in the industry are present, though Spain has also developed an industry of its own. The domestic industry includes various internationally strong groups of Spanish capital. Most notably, the country has developed its own tier 2 and tier 3 quality local supply chain. The sector is made up of around **1,000 companies** whose combined **revenue in 2010** was **27,162 million Euros.** Of this, 60 percent corresponds to the export market.

One of the things that characterizes the automotive industry in general is its advanced technological know-how. New market demands and strict safety and environmental standards are the reason for this. New products that consume less energy, produce fewer emissions and offer more comfort and safety for users are necessary. In order to develop these things, considerable investments in R&D&I should be made. The overall investment is very similar for vehicle manufacturers and components manufacturers alike.

Some of the most noteworthy strategic and technological challenges faced by the Spanish automotive sector are:

- **The Environment.** We are witnessing important technological restructuring in vehicle propulsion systems and transmission. This is due to factors such as the Kyoto Protocol, directives on reducing CO_2 emissions and recycling end-of-life vehicles. Other causes include the shortage of fossil fuels or the instability of raw material markets. Clearly, this means research needs to be done on alternative fuels and the electrification of vehicles and infrastructures.

- **Changes in Society.** We need to consider the constant changes in our society. Some examples are new concepts in comfort, ergonomics and connectivity. Likewise, we need to keep in mind pedestrian safety and different social sectors such as the elderly, the disabled and children.

- **The Production Capacity of Low-Cost Countries (LCCs) and Globalization of the Industry.** Vehicle manufacturers are taking their investments to new markets such as Eastern Europe, Asia and South America. They are asking their suppliers to develop supply chains in these areas. Spanish companies should consider changing their management models and restructuring. Most importantly, they should invest in the innovation of products and processes. Some examples include flexibility in manufacturing, optimizing logistics and including activities in the value chain as a key factor in global competitiveness.

- **Raising Social Awareness.** Safety has become an important issue for drivers and for society in general. One reason is the elevated economic cost associated with accidents. Another reason for increased awareness it the number of vehicle related fatalities. In the year 2000 the European Union set a goal to reduce the number of accident victims on the road. The new goal set in 2010 is to reduce this number another 50% by the year 2020. This presents the challenge of including technology such as accident prevention and mitigation systems, as well as tools for post-accident attention.

- **Transportation and Sustainable Mobility.** Using resources appropriately and improving urban, intercity and commercial traffic are top priorities in all public policies. In a joint statement, the European Commission and industry representatives pointed out that the automotive industry in Spain is too important to let it disappear. However, current production models need to be improved to guarantee its prolonged existence.

The automotive industry and all related sectors need to be able to meet these challenges. Logically, the appropriate framework for this would be the Spanish R&D&I system. Therefore, the government should work with the private sector, technology centers, universities and research institutions. Together, they could elaborate combined strategies for action. **The Spanish Automotive and Mobility Technology Platform is that meeting point for the technology stakeholders from all vehicle-related sectors.**

3. THE SPANISH AUTOMOTIVE AND MOBILITY TECHNOLOGY PLATFORM – MOVE TO FUTURE

Since 2005, the Spanish Automotive Technology Platform has been a successful development tool for companies in the automotive industry in Spain, becoming the reference organization for the sector. The priority of the forum was and still is to join the private sector, technology centers, public research organizations and universities. Together they define a common strategic research agenda. They do so through working groups, meetings and other conferences organized by the platform. In fact, member contributions have become the terms of reference in the 2008-2011 National R&D&I Plan, renewed until 2012.

Also worth mentioning is SERtec's spirit of cooperation. It has been eager to collaborate with other technology platforms and transportation and logistics-related initiatives. Obviously, finding solutions for common concerns and synergy in mutual interests is vital. SERtec has participated in bilateral meetings and helped create tools to coordinate efforts. Some examples are its coordinating role in the Spanish ERTRAC Forum and the Transportation Monitoring Committee.

Green Cars[2]: Vehicle and Infrastructure Electrification

By the year 2020, electric cars may represent 10% of the vehicles in Europe. Electric vehicles and renewable energy in transportation are important components of EUROPE 2020 – A Strategy for Smart, Sustainable and Inclusive Growth[3]. This economic recovery plan aims to guarantee prosperity and sustainable development.

Europe is not only staking part of its industrial future on electric vehicles. It is also compromising the future of energy and technological development in Europe. Thus developing electric vehicles combines industrial and technological competitiveness with renewable energy. It does this by developing software for recharging batteries, smart grids and smart meters.

The year 2009 marked a turning point for the platform. In part, this was due to the critical economic situation affecting the sector. However, the European Green Cars Initiative was also a factor. This proposal was outlined in the European Economic Recovery Plan of November 2008[2]. The objective of the plan was to offer the automotive sector new opportunities to participate in the development of future vehicles.

Moreover, we have witnessed the rapid evolution of how cars interact with their environment. This is because of the available information and communication technologies and the tendency towards electrification.

Consequently, the Platform has evolved and amplified its scope of activities related to the automotive industry. By including new players, we also acquire new capabilities. For instance, SERtec evolved toward **Move to Future - M2F.**

M2F has been particularly involved in sector-relevant R&D&I forums and the work they are doing. Here are some examples: The Spanish Ministry of Science and Innovation has delegated its participation in ERTRAC plenary and MS representatives meetings to

[2] http://www.green-cars-initiative.eu <http://www.green-cars-initiative.eu>
[3] COM (2010) 2020 (3.03.2010) "EUROPE 2020 – A Strategy for smart, sustainable and inclusive growth"
[4] COM (2008) 800 (26.11.2008) "A European Economic Recovery Plan"

M2F. It also partakes in the Support Action to promote Spanish participation in the European Green Cars Initiative[5].

Some other important priorities of M2F have been: making contributions to the work programmes of the 7th Framework Programme, updating ERTRAC's strategic agenda, and creating the road map for the European Green Cars Initiative.

SERNAUTO, the Spanish Automotive Equipment and Components Manufacturers Association, has been coordinating the platform from the beginning. Following is the 2011 administrative structure:

The **Governing or Executive Board** is made up of the individuals that hold the presidencies and secretariats of the various working groups (LEAR Automotive (EEDS) Spain S.L., Fundación CIE I+D, FICOSA International S.A., ANFAC, Corporación GESTAMP, Fundación TECNALIA Research and Innovation, INSIA-UPM, ITS España, Robert BOSCH España S.L.U. y SERNAUTO). It is the body that proposes and implements the initiatives approved by the Plenary.

The **Plenary** is comprised of experts from the research units of universities, OPIs (Public Research Organizations), companies, technology centers and engineering agencies, among others. Through its working groups, it establishes platform strategy as well as which activities will be implemented and by whom.

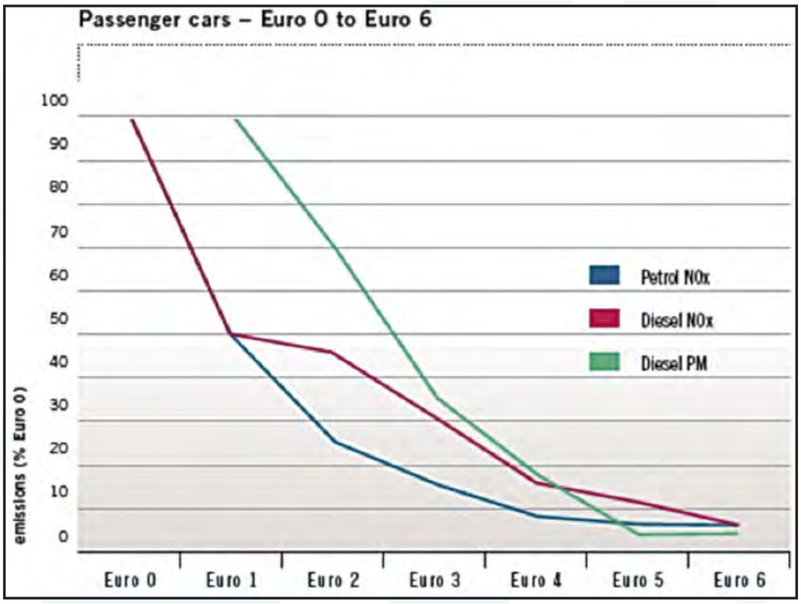
Participation is open to all technology stakeholders in the sector. It is voluntary, public and free. Participating organizations may have as many contact persons as they wish in all the working groups they are interested in. In order to participate, interested individuals should contact the platform secretariat or send the completed form, available on the website, to cecilia.medina@move2future.es.

[5] http://www.fp7greencars.es

There are five working groups: four are technical and one is a cross-disciplinary group dedicated to support measures for the sector.
Each group is coordinated by a Chairman and a Secretary:

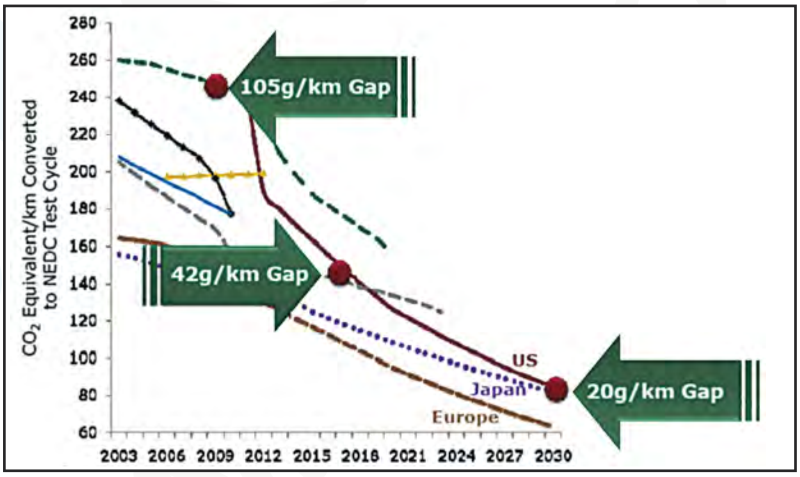
1. INTRODUCTION

Growing environmental awareness in society nowadays means more and more restrictive limits on lead, NOx, SO_2 and CO emissions.



Source: ACEA

The EU has established a set of air quality objectives that affect the industry. In order to comply with these regulations, we must make a constant effort to reduce vehicle emissions. Therefore, we need the pertinent information about the established emissions limits.



Source: SCM

The directives Euro 5 and Euro 6 supersede the previous regulations on emissions. They set out the limits member states should apply for refusing the approval, registration, sale or entry into service of all vehicles that do not meet the standards. These ordinances also include the dates when these restrictions go into effect.

Euro 5 became effective on 1st September 2009 for standardization. As of 1st January 2011 it applies to the registration and sale of new types of vehicles. In the case of Euro 6, it will be effective for standardization on 1st September 2014. For the registration and sale of new vehicle types, the date is 1st September of the following year.

Limites de Emisiones

Cuadro 1: Limites de emisiones Euro 5

		Masa de referencia (MR) (kg)	Valores Límite													
			Masa de Monóxido de Carbono		Masa de Hidrocarburos (HCT)		Masa de Hidrocarburos no Metálicos (HCNM)		Masa de Óxidos de Nitrógeno (NOx)		Masa combinada total de Hidrocarburos y Óxidos de Nitrógeno reales (HCT)_NOx)		Masa de Partículas (MP)		Número de Partículas [1] (P)	
			L_1 (mg/ km)		L_1 (mg/ km)		L_2 (mg/ km)		L_3 (mg/ km)		L_4 (mg/ km)		L_5 (mg/ km)		L_6 (mg/ km)	
Categoría	Clase		PI	CI	PI	CI	PI	CI	PI	CI	PI	CI	PI[2]	CI	PI	CI
M	-	Todos	1000	500	100	-	68	-	60	180	-	230	5,0	5,0		
N_1	I	MR ≤ 1305	1000	500	100	-	68	-	60	180	-	230	5,0	5,0		
	II	1305 < MR ≤1760	1810	630	130	-	90	-	75	235	-	295	5,0	5,0		
	III	1760 < MR	2270	740	190	-	108	-	82	280	-	350	5,0	5,0		
N_2			2270	740	190	-	108	-	82	280	-	350	5,0	5,0		

Clave: PI = encendido por chispa. CI = encendido por compresión

[1] Se establecerá una norma relativa al número lo antes posible y, a más tardar, tras la entrada en vigor de Euro 6.

[2] Las normas sobre normas de masa de partículas de los vehículos de encendido por chispa se aplican únicamente a los vehículos con motores de inyección directa.

Limites de Emisiones

Cuadro 1: Limites de emisiones Euro 5

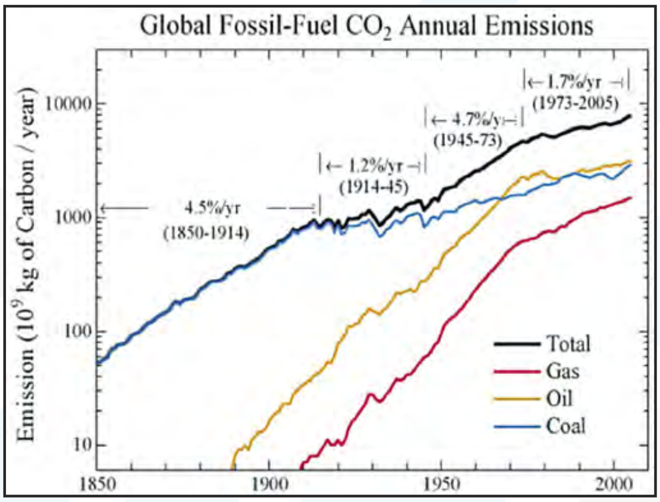
		Masa de referencia (MR) (kg)	Valores Límite													
			Masa de Monóxido de Carbono		Masa de Hidrocarburos (HCT)		Masa de Hidrocarburos no Metálicos (HCNM)		Masa de Óxidos de Nitrógeno (NOx)		Masa combinada total de Hidrocarburos y Óxidos de Nitrógeno reales (HCT)_NOx)		Masa de Partículas (MP)		Número de Partículas [1] (P)	
			L_1 (mg/ km)		L_1 (mg/ km)		L_2 (mg/ km)		L_3 (mg/ km)		L_4 (mg/ km)		L_5 (mg/ km)		L_6 (mg/ km)	
Categoría	Clase		PI	CI	PI	CI	PI	CI	PI	CI	PI	CI	PI[2]	CI	PI	CI
M	-	Todos	1000	500	100	-	68	-	60	80	-	170	5,0	5,0		
N_1	I	MR ≤ 1305	1000	500	100	-	68	-	60	80	-	170	5,0	5,0		
	II	1305 < MR ≤1760	1810	630	130	-	90	-	75	105	-	195	5,0	5,0		
	III	1760 < MR	2270	740	160	-	108	-	82	125	-	215	5,0	5,0		
N_2			2270	740	160	-	108	-	82	125	-	215	5,0	5,0		

Clave: PI = encendido por chispa. CI = encendido por compresión

[1] Se establecerá una norma relativa al número para esta etapa.

[2] Las normas sobre normas de masa de partículas de los vehículos de encendido por chispa se aplican únicamente a los vehículos con motores de inyección directa.

The limitations on emissions, the global rise in fuel prices and the short-to-mid term threat of fossil fuel shortage are all bringing about certain concerns about the future of energy. These factors are partially contributing to the use of non-petroleum-derived fuel alternatives. Such alternatives include natural gas, second generation biofuels or hydrogen.



Source: SAE

To define initiatives aimed at developing a new generation of vehicles with more efficient and sustainable propulsion technology is necessary. At the same time, we should guarantee economic activity and competitive advantages for the automotive industry.

This means that **electric vehicles, plug-in hybrids and the electrification** of infrastructures will all play an important role in the future. They will be priorities on national and European strategic research agendas.

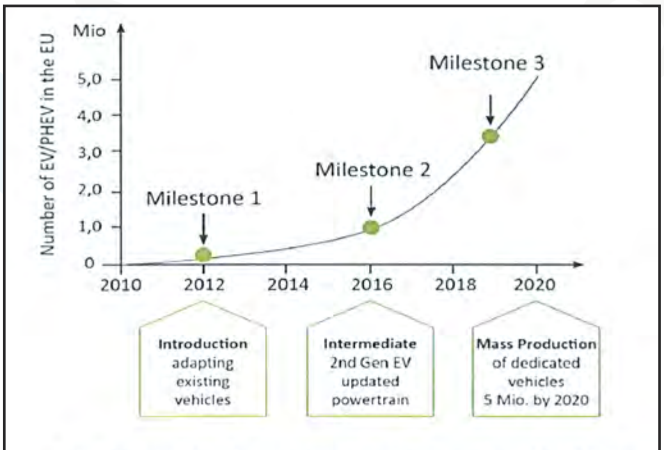
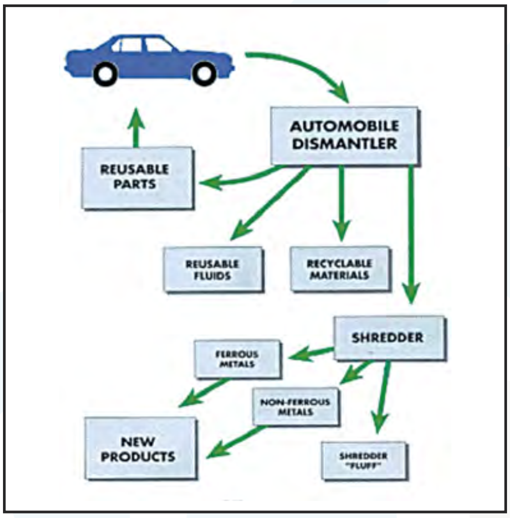


Figure 1: Milestones of the European Industry Roadmap for Electrification of Road Transport

Source: ERTRAC

Furthermore, there are new objectives for vehicle recyclability and the elimination of toxic substances. They affect every single company that manufactures automobiles and auto components. On the other hand, all vehicle-related products are undergoing innovations in their material make up and manufacturing processes. These improvements are mainly aimed at reducing vehicle weight, consequently consuming less fuel and producing fewer emissions.



Electric Vehicles[1] could represent 10% of the cars in Europe by the year 2020. In fact, this is a central component of EUROPE 2020 – A Strategy for Smart, Sustainable and Inclusive Growth. This EU economic recovery plan aims to guarantee prosperity and sustainable development.

The development of electric and hybrid vehicles will unite renewable energies, new technologies and the automotive industry.

The Spanish automotive industry is now facing the issues brought on by these new vehicles: "clean" technologies, how to produce them, and how to finance them.

CO_2 in g/NEDC WTW for the Vehicle and LCA for the E-Energy source

	Wel to Tank (Bateries)	Tank (Bateries) to Wheels	Total CO_2 emsions
Conventional ICE Car	25-35	120-180	145-215 *
Electric Vehicle 27 % Nuclear, 20 % Renewable, 53 % Fossils (EU-27 mix 2010)	85-105	0	85-105
Electric Vehicle 11 % Nuclear, 20 % Renewable, 69 % Fossils (italian mix 2010)	120-140	0	120-140
Electric Vehicle 75 % Nuclear, 20 % Renewable, 5 % Fossils (French mix 2010)	20-25	0	20-25
Electric Vehicle 30 % Photo Voltaic on board, 60 % other Renewable, 10 % Fossils	18-22	0	18-22
Electric Vehicle 50% Photo Voltaic, 50% Wind (Carbon free communities)	8 5 km per kWh and 40 g/kWh	0	8

Table 3: Comparison of WTW CO_2 emissions for conventional ICE vehicles and EVs in relation to the electricity mix. **Note:** EU-27 Electricity from renewables < 40% by 2020 (*): 14% hybro (now), 14-16% wind as projected by EWEA, 12% PV as projected by EPIA, 5% biomass+waste+geothermal electricity. *For some compact ICE cars that are smaller than the reference vehicle considered her the total TW CO_2 emissions are as low as 100g/km.

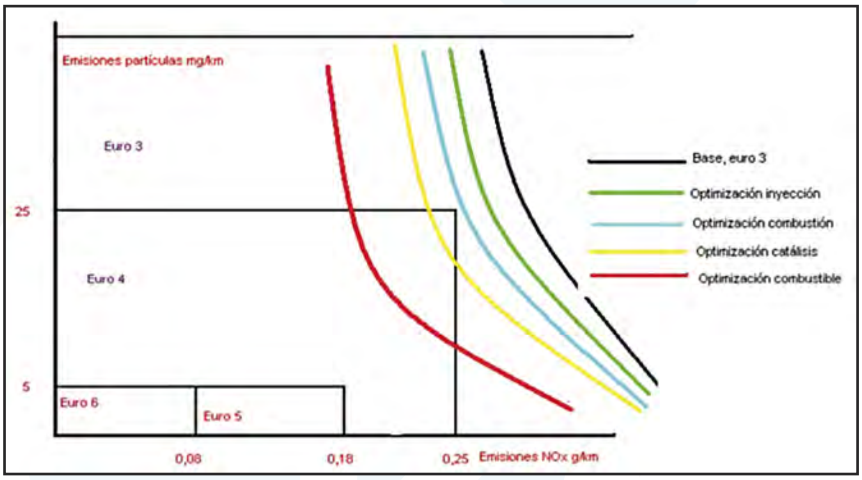
Source: CSM

[1] According to the European Roadmap Electrification of Road Transport, the term electric vehicles means all kind of vehicle that provide at least 50km of pure battery-electric range such as pure electric vehicles, electric vehicles equipped with range extender and plug-in hybrids.

2. PRIORITIES

VEHICLES WITH EFFICIENT INTERNAL COMBUSTION ENGINES AND ALTERNATIVE FUELS

Various ideas for optimizing internal combustion engines and exhaust systems exist.



Source: ANFAC

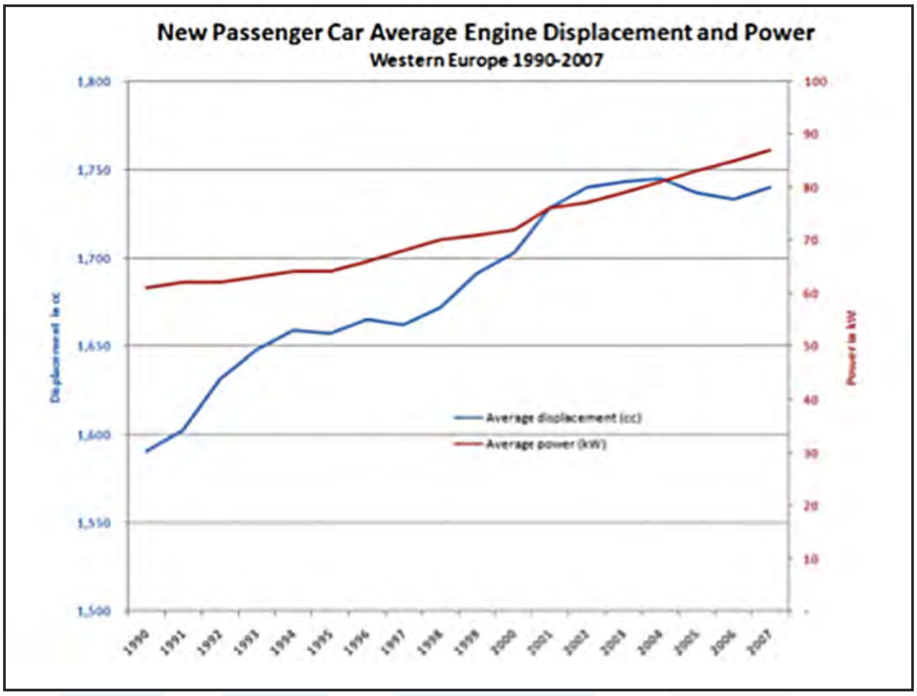
New injection system design

Increasingly accurate devices in the mixture system are needed to make combustion more efficient. Consequently, they consume less fuel and produce fewer contaminating emissions. The concept of a lean burn mixture in gasoline engines is a radical change. Smaller engine size also plays an important part in fuel consumption.

Reducing mechanical loss in internal combustion engines is a substantial technological challenge, considering that it negatively affects engine performance and power. The Electronic Engine Management system requires optimizing the inclusion of different sensors and actuators. In addition, it demands higher quality and improved performance of the electric power supply system (the battery).

Making smaller engines

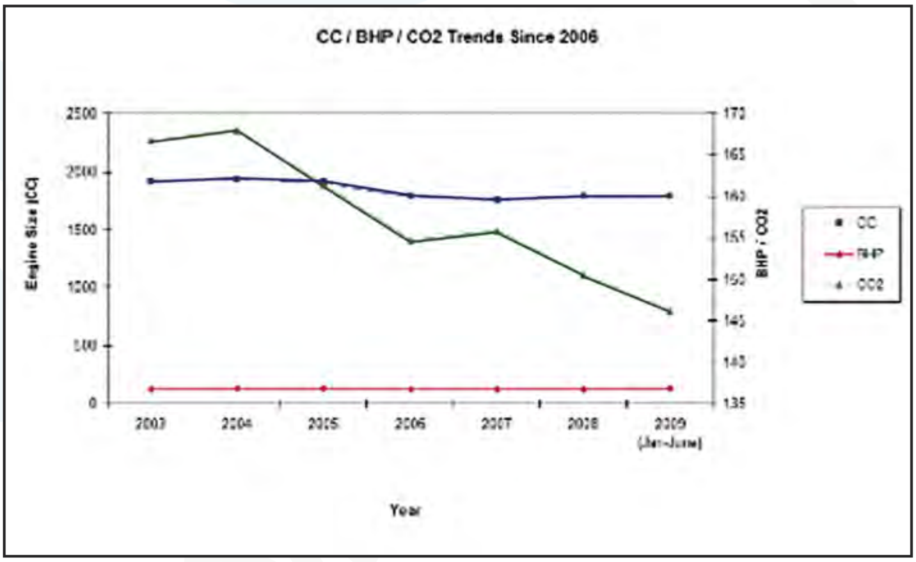
For decades, engines were getting larger and larger. However, since 2006 there has been a change in the engine size trend. This is partially because of the increasing ecological awareness of EU member states and the automobile industry. Manufacturers have been able to improve performance while making engines more efficient. Therefore, they consume less fuel and release fewer emissions.



Source: SAE

New concepts in combustion combined with new fuels

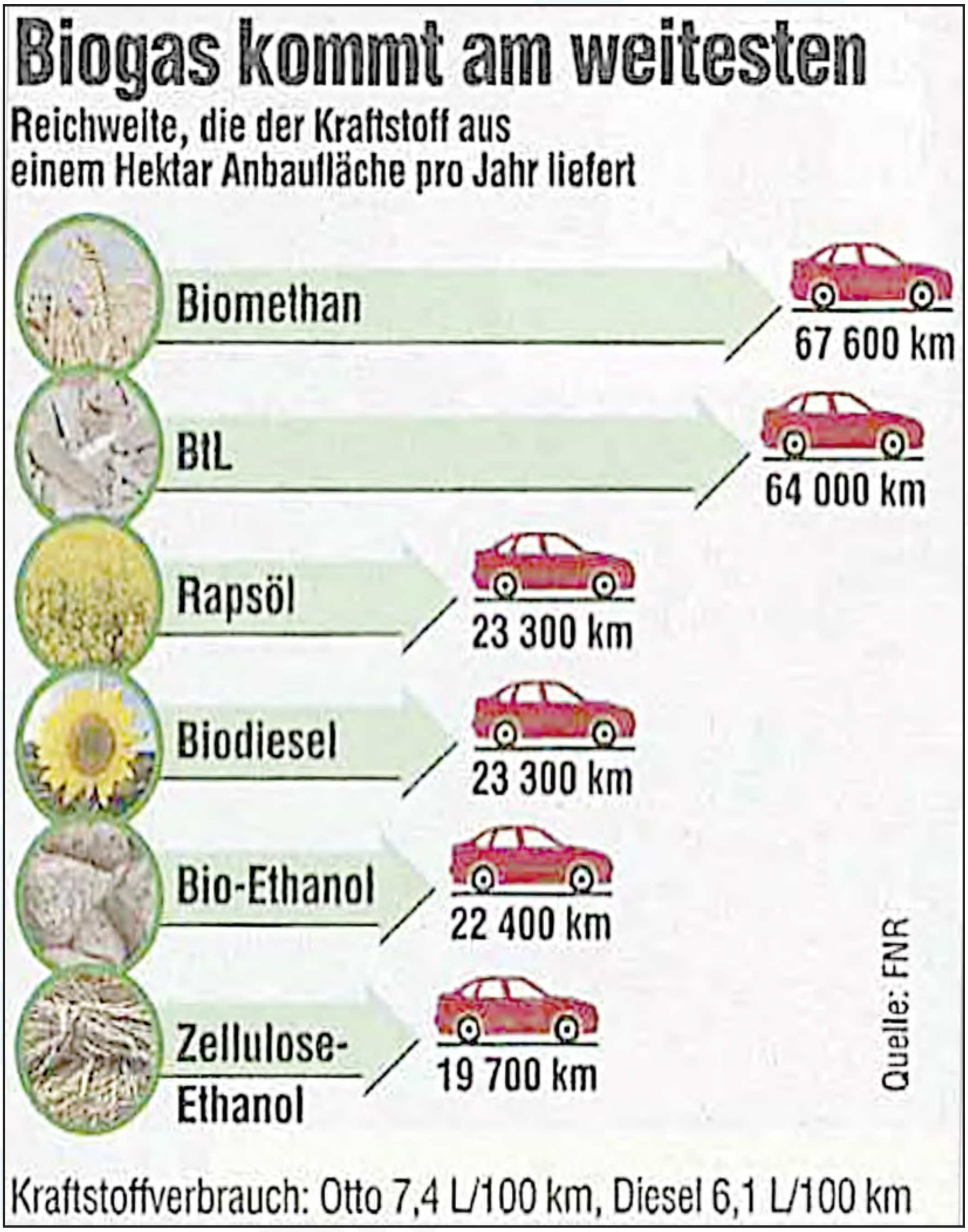
The traditional concepts of homogeneous and heterogeneous combustion need to be adapted to new engine requirements. This would improve performance and lower the emission of pollutants. Homogeneous charge compression ignition (HCCI) seeks to make a homogenous mixture in the chamber. This would cause ignition at a constant temperature below 1550° C without using a spark plug.



Source: ALD

Advanced biofuels that produce fewer greenhouse gases

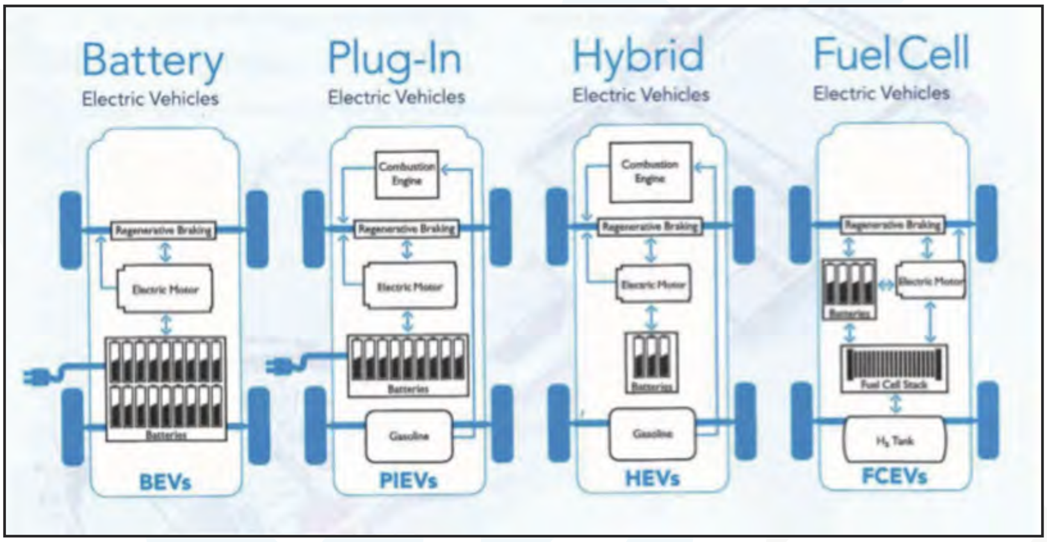
We need to develop advanced biofuels with technical specifications equivalent to petroleum based fuels for use in automobile engines. They should be produced with plant raw materials by optimized production processes, creating minimum greenhouse gases.



Source: AMS

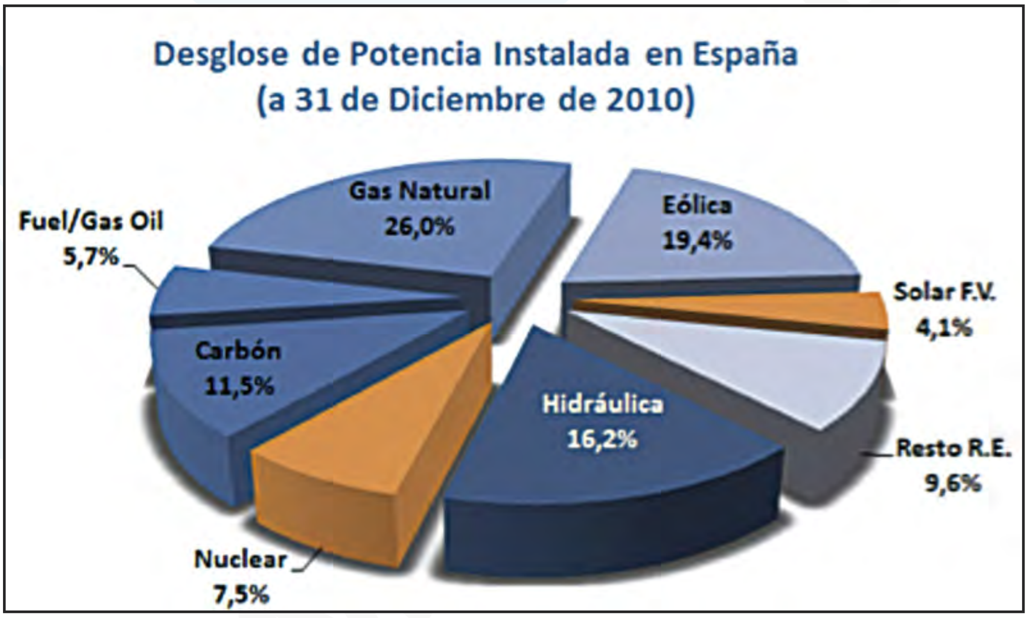
HYBRIDIZATION / ELECTRIFICATION OF VEHICLE PROPULSION SYSTEMS AND ENERGY MANAGEMENT

We need sturdy, simply designed hybrid systems with new components that improve the overall efficiency of the system. We should focus on electrical power components, electric machines and new energy storage systems such as batteries and ultracapacitors.



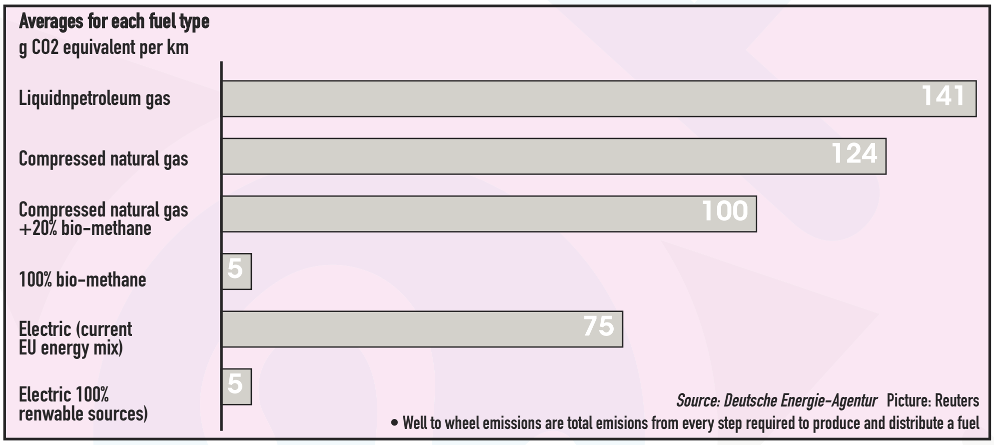
Source: AN

We can define electric vehicles (EVs) or plug-in hybrid vehicles (PHVs) as those propelled by electric power. This power comes from a battery that is charged by plugging it in.



Electric vehicles are still not in a position to take over the automobile market. The main reason for this is that they have a limited range due to battery charging and energy storage limitations. Nevertheless, EVs offer an increasing number of services. They are currently a realistic, viable and acceptable alternative for the majority of mobility needs in and around major urban areas. The EU is counting on it. The electric vehicle is included as a central aspect of EUROPE 2020.

While the mobility of electric cars is "theoretically clean," we should consider the real mix of electric power sources.



Source: FT

For instance, an "electric" Ford Focus in the German state of North Rhine-Westphalia would emit the equivalent of 145 g CO_2/km, not 0 g CO_2/km. This is because electric power in NRW is generated by coal.

Due to the current European energy mix, an electric vehicle in Europe releases the equivalent of 75 g CO_2/km on average.

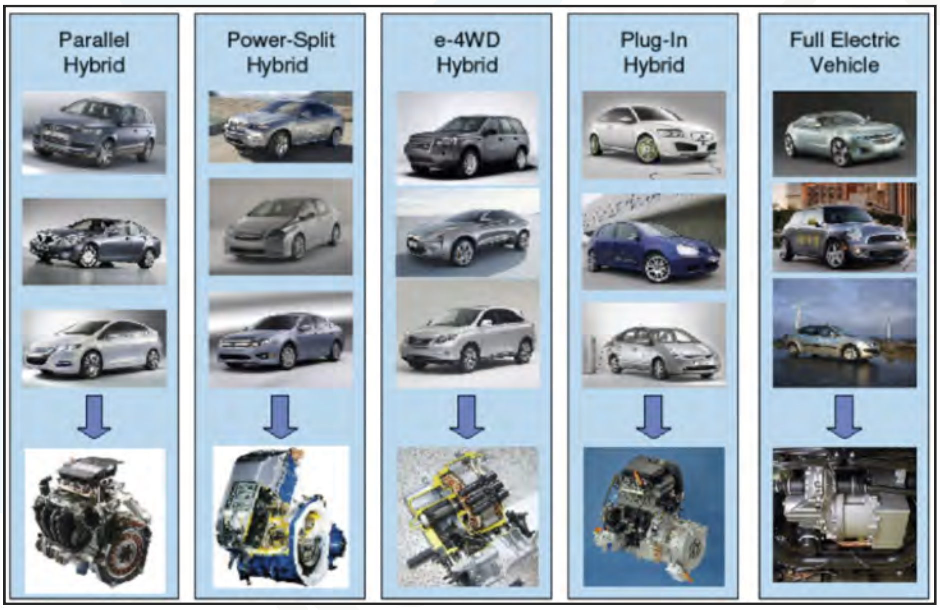
Year	Power	Grid Efficiency	Inverter AC/DC Efficiency	Battery Effiency (Slow Charge	Power Electrical Efficiency (DC/DC, DC/AC)	Motor and MAgnetic Gear Efficiency	Energy Consump-tion Ideal mid size car Wh/km #	Total Consump-tion of Primary Energy Wh/km*
2008 Range 150 km	0.42	0.80	0.90	0.80	0.90	0.80-0.86	120	641-589 -15% Reg. Braking
2008 Range 150 km	Renegable Energy only	0.93	0.90	0.80	0.90	0.80-0.86	120	235-219 -15% Reg. Braking
2008 Range 500 km	WTW Powertrain Efficiency of a Conventional Internal Combustion Engine car in relity: 0.16-0.23						120	750-522 -10% micro-mild hybrib

Table 2: Primary energy consumption with reduced power plant and grid efficiencies as well as fast charge mode.
Energy need to move an ideal mid-sized vehicle in NEDC.

Year	Power Plant Efficiency	Grid Efficiency	Inverter AC/DC Efficiency	Battery Effiency (Slow Charge	Power Electrical Efficiency (DC/DC, DC/AC)	Motor and MAgnetic Gear Efficiency	Energy Consump-tion Ideal mid size car Wh/km #	Total Consump-tion of Primary Energy Wh/km*
1998 Range 20 km*	0.39	0.88	0.85	0.70	0.85	0.65-0.70	120	987-1064 -7% Reg. Braking
2008 Range 150 km	0.45	0.93	0.90	0.90	0.90	0.80-0.86	120	457-492 -15% Reg. Braking
2008 Range 150 km	Renegable Energy only	0.93	0.90	0.80	0.90	0.80-0.86	120	205-221 -15% Reg. Braking
2008 Range 600 km	WTW Powertrain Efficiency of a Conventional Internal Combustion Engine car in relity: 0.16-0.23						120	522-750 -10% micro-mild hybrid

Table 1: Evolution of primary energy consumption of electrical vehicle, and comparison to the conventional power train. # Energy needed to move an ideal mid-sized vehicle NECD. · Reduced battery weight. * Cars smaller than the reference vehicle may have less energy consumption.

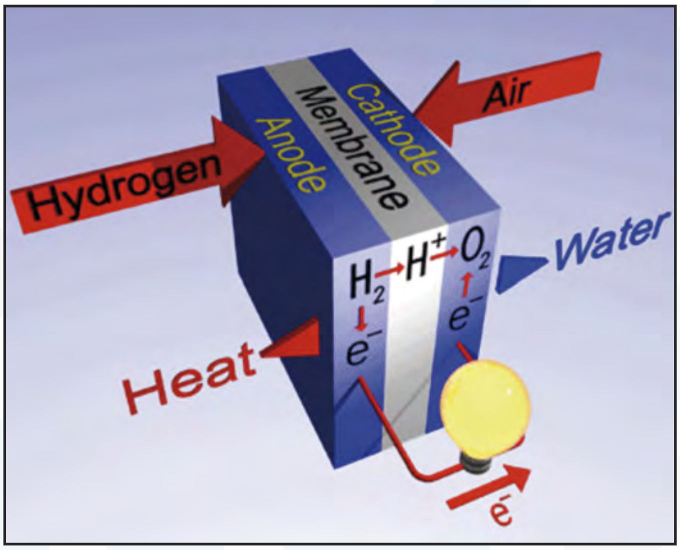
Hybrid vehicles combine the range of conventional cars and the environmental benefits of electric cars. The result is a vehicle that consumes less fuel and produces fewer contaminating emissions. The main drawback of hybrids is the cost, due to the increased level of sophistication. The best solution is to simplify the design and the incorporation of components.



Different types of hybrid vehicle architectures currently in use

FUEL CELL VEHICLES AND LOW CARBON CONTENT FUELS

Fuel cell designs that include high-temperature membranes, bipolar plates and air and humidity management systems



Source: NASA

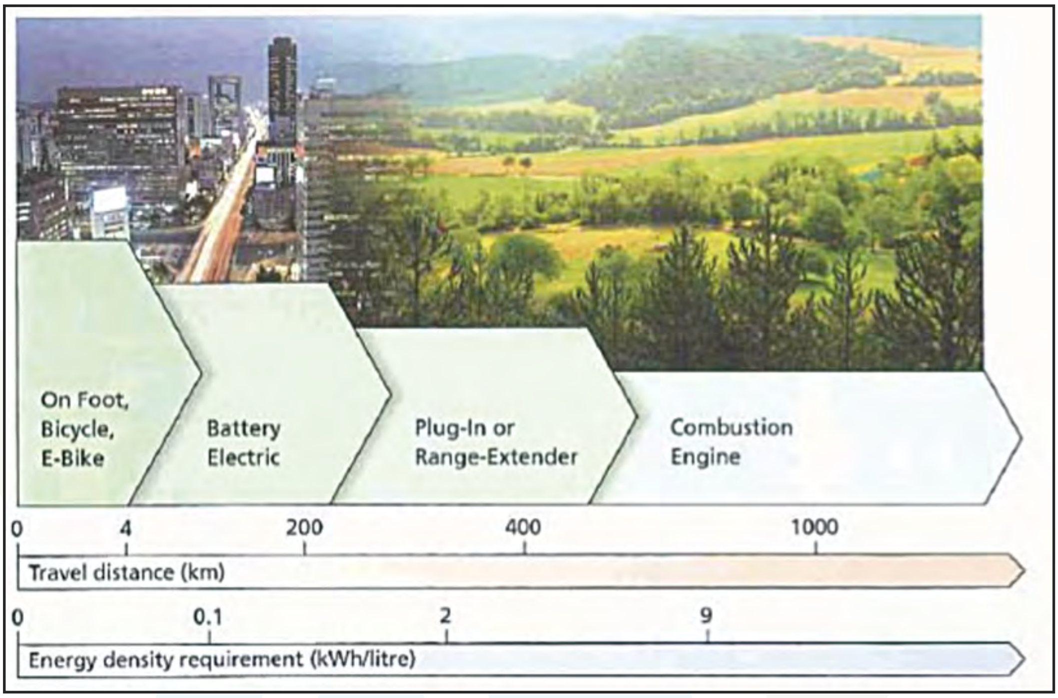
Hydrogen storage with the intention of improving the cost and performance of the fuel cell system

Success in using hydrogen as an energy carrier is contingent, in part, on the development of its storage capacity. Therefore we are faced with two main challenges: applying this technology to transportation, and the need for high energy hydrogen storage.

Developing low cost, reduced greenhouse gas methods for hydrogen production and distribution

Can we use renewable energies to obtain hydrogen? This is a very interesting question. It is true that we can produce the necessary volume of hydrogen with clean energies. We can also use it to store the energy generated. This would help eliminate the inconsistency of resources caused by weather conditions. Electricity produced by renewable sources could be used for splitting water through electrolysis. The hydrogen could then be used as an energy carrier. This way the current costs associated with operating renewable power plants could be reduced. Likewise we would be able to choose the source of electricity according to the production desired. So, whether on a small or large scale, on the basis of a distributed or centralized system, we could decide.

These specific objectives hope to guarantee the sustainable evolution of the automobile. That is why we are promoting the development of technology and new materials.



Fuente: ERTRAC

Figure 5 Mobility solutions for both urban and long-distance travel

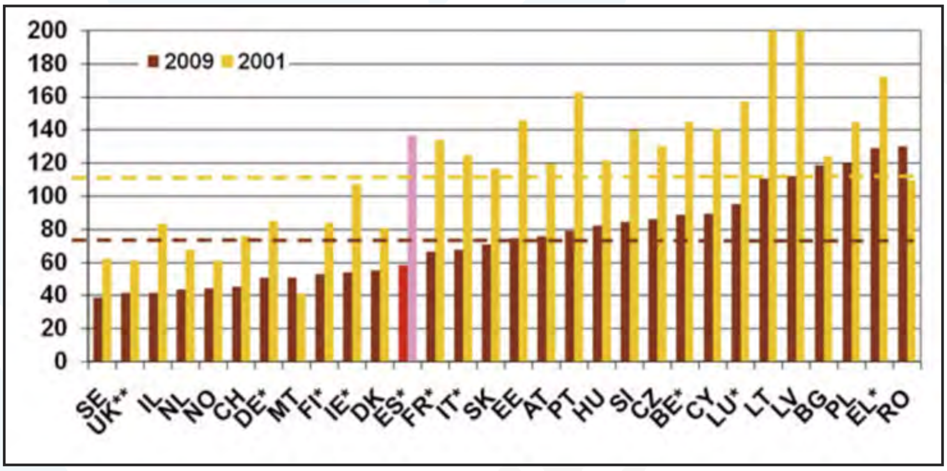
1. INTRODUCTION

Road safety in Europe has improved notably in recent years. In spite of this fact, in 2009 an average of 95.5 people a day died on the road in the European Union (EU27). The cost of traffic accidents is also considerable, representing approximately 2% of the GDP in the EU.[1]

In 2001 the European Commission submitted the White Paper "European Transport Policy for 2010: Time to Decide"[2]. One of its main objectives was to reduce the number of deaths caused by road traffic accidents by 50%. At this time the official figures for 2010 from all EU27 countries are not available. However, in 2009 there was a 36% reduction in the number of fatalities. While this is less than the original goal, it does denote a significant change. The number of road victims in Europe has remarkably decreased in the past decade.

The EU Road Safety Programme 2011-2020[3] is already underway. It aims to diminish the number of road related deaths by another 50% by the end of the period.

Spain has certainly accomplished this goal because the number of road related deaths caused by traffic accidents was reduced by 57.7% between 2001 and 2010. This is a considerable feat that has been recognized by public and private European institutions such as the General Directorate for Transport and Mobility (DGMOVE) or the European Transport Safety Council (ETSC).

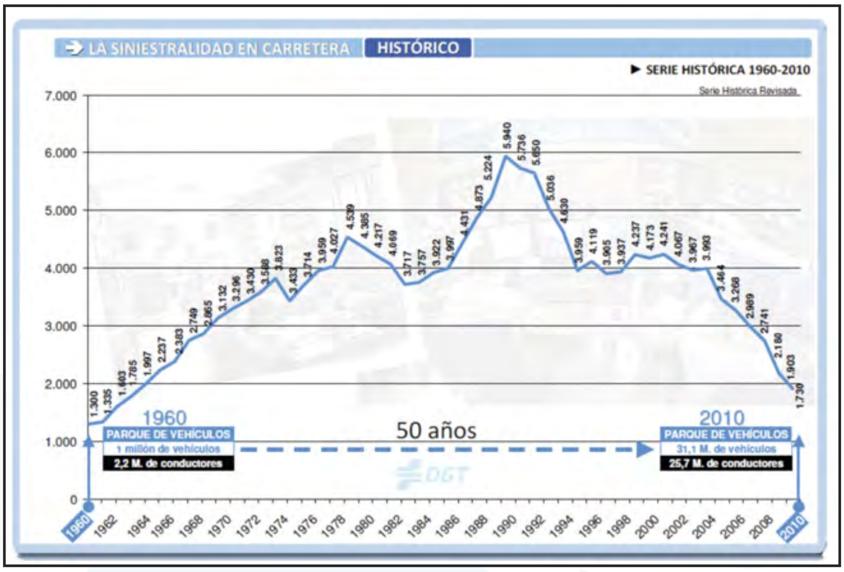


Source: CARE (EU road accidents database)

Figure 1.- Number of deaths caused by traffic accidents per million residents

In 2001, there were 128 deaths per million residents caused by road traffic accidents in Spain. By the year 2009, this number was reduced to 59. To look at it another way, in 2010 the total number of fatalities (1,730 deaths) was equivalent to the early 1960s. Back then, there were one tenth of the drivers we have nowadays. (See Figure 2)

[1] Preventing road traffic injury: a public health perspective for Europe, World Health Organization, 2004.
[2] http://ec.europa.eu/transport/white_paper/documents/doc/lb_texte_complet_es.pdf
[3] http://ec.europa.eu/transport/road_safety/pdf/com_20072010_en.pdf



Source: DGT (Spanish Directorate General of Traffic)

Figure 2.- Evolution of the number of fatalities caused by traffic accidents in Spain between 1960-2010

Overall we should be very pleased with these results. They are thanks to the effort of each and every person who works to make our roads safer. This being said, we need to keep up and intensify our efforts. One example of this is the commitment made by the Spanish Directorate General of Traffic (DGT, for its initials in Spanish). Their goal is to reduce the number of road related deaths by another 35% by the year 2020.

We need to continue to improve our safety ratios while adapting to new social and economic constraints. Some of the latter include: lowering emissions of green house gases and local vehicle pollutants, increasing global competitiveness, and the growing demand for "mobility". The M2F Platform's Working Group number 2 (WG2) believes that it is possible to achieve the objective for reducing road traffic deaths. In order to do so, we must analyze certain key elements that we will establish in this document.

With this in mind, the WG2 has created the present outline of the strategic areas where improvements in vehicle and road traffic safety are proposed. The summary begins by focusing on means aimed at avoiding traffic accidents, providing a list of factors related to the mobility of particular groups such as the disabled. Next, it enumerates issues that can mitigate and reduce the effects that accidents have on people. And finally, safety issues concerning the electrification of vehicles are itemized. This section has been included due to the relevance of the topic nowadays.

2. PRIORITY AREAS

PREVENTING TRAFFIC ACCIDENTS

Research on traffic accidents and events

- Accident analysis: analyzing the causes; understanding the events leading up to the accident; evidence that confirms the accident; identifying future needs
- Research methods for accidents and events: (online) data bases; combining collected data; statistic methods
- Reconstruction methods: advanced simulation tools; common methods; developing collision countermeasure systems
- Sources of new data: data collection; analyzing and implementing information in existing data bases; Event Data Recorder (EDR)- black box systems, special emphasis on data confidentiality
- Evaluation of safety measures efficiency: expected and observed efficiency; feedback to assure system improvement

Doing research on traffic accidents can help to identify and understand what happens on public roadways. This gives investigators and governments the information they need to improve traffic laws and road safety policies.

Vehicle technologies – ADAS (Advanced Driver Assistance Systems)

- Safety systems: collision warning; speed alert; Emergency Brake Assist (EBA); Electronic Stability Program (ESP) and traction control; lane departure warning; automatic windshield wipers
- Control: X-by-wire; unified chassis control
- Sensors and recognition: automatic distance control; automatic speed control; location detector; night vision and poor weather systems; image recognition; road conditions detection; map based sensors; parking assistance
- Driver and vehicle monitoring systems: driver drowsiness detection; distraction and carelessness alerts; health and alcohol detection; occupant identification in case of accident; unfastened seatbelt detection; tire pressure monitoring system; dynamic vehicle safety management system
- Headlamps: automatic headlamps; adaptive light control; high-intensity discharge headlamps (xenon and bi-xenon); adaptive headlights
- Cooperative navigation systems

New safety functions geared towards avoiding collisions have been included here in the vehicle technologies section. In order to avoid accidents, sensors and advanced systems should be developed. They should be capable of monitoring the vehicle and its surroundings, as well as the driver's behavior and physical condition. With this data, such devices and systems can warn the driver of possible dangers or prepare the vehicle to reduce the severity of unavoidable accidents.

Co-operative systems

- Vehicle-to-vehicle and vehicle-to-infrastructure communication: interoperability; coordination; warning systems; vehicle-infrastructure connection
- Proposals for improvement of new communication standards for Intelligent Transportation Systems (i.e. DSRC/WAVE standards) to guarantee the speedy delivery of critical messages
- Dynamic traffic management: greater transportation efficiency; business models for vehicle manufacturers; highway operators; service providers
- Vehicle technology: extended environment sensors; lane change assistant/blind spot detection; weather condition detection; etc.
- Infrastructure technology: extended environmental information; traffic information; weather conditions; control and changes in the infrastructure
- Autonomous drive vehicles and systems and associated technologies

This section deals with vehicles that communicate with infrastructures and other vehicles on the road. By improving the quality of communication vehicles have with one another and with infrastructures, the traffic information drivers receive will be more useful. As a result, both measures to prevent accidents and traffic safety will improve. Even the possibility of autonomous driving could be a reality. Such improvements in communication and the use of co-operative systems can help automatically process and identify dangerous areas. This would reduce reaction time and increase safety for road users and pedestrians.

Human factors

- Adapted and integrated HMIs: interaction between the vehicle and the driver; incorporation of HMIs and advanced interaction (voice, haptic, gestures, etc.)

Communication between systems incorporated in the vehicle and the driver should not distract the driver's attention from the road. Therefore, systems that evaluate how much attention needs to be paid to driving at any given time should be developed. The priority should be to design systems that require as little distraction as possible when interacting with vehicle systems.

Vehicles for collective transportation, transporting goods, the elderly, the disabled, etc

- Research assessments prior to legislation
- R&D&I of vehicles, devices and adaptations for the transportation of disabled individuals, including those in wheel chairs
- Special vehicles for school children, paying special attention to safety features
- Restraints, comfort systems, occupant evacuation systems and cargo restraint systems
- Driver's seat ergonomics and safety
- Applying control technologies and telecommunications to operating fleets, helping drivers and informing users
- Adequate advanced interaction with disabled individuals

Vehicles for collective transportation notably increase the capacity of roadways. Greater safety and comfort are key aspects that will encourage more passengers to use this option. An effort should be made to meet the safety, comfort and accessibility needs of all users. This means including special characteristics for users such as children, disabled individuals and the elderly.

MITIGATING THE EFFECTS OF TRAFFIC ACCIDENTS

Protecting vulnerable road users (pedestrians, cyclists, etc).

- Pedestrians and cyclists: active and passive safe car fronts
- Vulnerable road user detection equipment located in infrastructures
- Vulnerable road user detection located in vehicles
- Integrating detection systems in urban and intercity Intelligent Transport Systems (ITS)
- Intelligent tools that detect dangerous situations, requiring decision making for warnings/alerts
- Developing co-operative I2P/V2P warning systems aimed at pedestrians/drivers using portable mobile devices
- Developing adaptable systems to improve pedestrian safety (changes in lighting, hidden signals, adjustments to traffic light times in red/green)

Vehicle architecture and compatibility

- Lateral, rear-end and head-on collisions: regulations; materials that absorb energy
- Collision detection and preparation: sensors; object recognition (including pedestrians); emergency brake assistance (BAS)

The most relevant topics in this group of objectives are: lateral impact safety, collision detection and avoidance architectures and sensors, and new materials and joining technologies that absorb more energy than traditional materials in accidents.

Retention and protection systems

- Structural design of vehicles
- Seat belts: pre-tensioning; limited effort belts; anti-submarine seats
- Airbags
- Active head rests
- Retention systems for children and in collective transportation

The priority areas in this group focus on interior elements of the vehicle. The systems, materials and designs listed here aim to reduce the injuries of vehicle occupants in lateral, head-on and rear-end collisions.

Post-accident

- Automatic crash notification systems: emergency service alert; precise accident information; location of passengers; dangerous objects
- Rescue procedures: response scenarios; optimal cooperation; rescue vehicles with the best possible navigation systems; blue corridor
- General in-vehicle application for making emergency calls (E-call)
- Occupant identification with sensors and systems in case of an accident
- Emergency medical service vehicles

Reducing the response time of emergency services has been proven to be an effective policy for improving the recovery prospects of injured accident victims.

Structural materials / components

Considering their future relevance regarding safety and the changes in legal requirements in the near future, materials and components have been included here.

The priority topics identified in this area are:

- **Active structures:** Structures that adapt to accident scenarios in order to minimize effects as much as possible

- **New materials:** Materials that adapt better to new sector regulations; further pollution reduction; lower fuel consumption; material recyclability

Tools and procedures for safety evaluation

- Biomechanics: injury mechanisms; body impact limits; biomechanical data bases

- Virtual models and tests: perfected virtual human models and tests

- Crash test dummy development and mathematical models, including characteristics of age and gender

In this group of objectives we have tried to prioritize and encourage the development of tools that effectively evaluate existing systems. Evaluations should be applied on all levels: active (pre-crash), passive (crash) and post-collision. They should also test the overall level of road safety taking into account all involved elements (vehicles, infrastructures and drivers.)

The main priority areas to be developed are:

- **Simulation and virtual testing tools for creating integrated safety systems.** Safety systems should offer protection for a wide range of circumstances that can lead to accidents. One evaluation method that allows an exhaustive assessment of existing safety systems is the simulation tool. It takes into account the vehicle, human and environmental characteristics in accidents. Virtual testing reduces development costs, fortifies safety systems and allows for more test scenarios.

- **Field Operational Test (FOT).** Field tests are an effective instrument for testing and improving developing technologies. They are especially helpful for analyzing and better understanding behavior in real driving situations.

- **"Active" human models and advanced dummies.** With the concept of integrated safety (primary + secondary safety), human reactions prior to an accident are increasingly important in developing safety systems. Therefore, there is a need to improve the design of ACTIVE human models. Moreover, the bio-accuracy of these models and their corresponding numeric models will be a key factor in determining behavior of roadway users and their injury degree in case of accident.

Likewise, human reaction should be taken into account in the design process. Therefore, it will be necessary to design advanced dummies that can reproduce these reactions.

VEHICLE ELECTRIFICATION

SYSTEMS AND COMPONENTS FOR ELECTRIC AND HYBRID VEHICLES:

Ergonomics concepts in electric vehicles

Nowadays, hybrid vehicles maintain the same architecture as conventional cars. However, flexibility in the location of batteries, motors and steering systems may change our current concept of cars. This implies new and interesting challenges for designers. They are faced with a new space that has fewer limitations. It also requires thorough knowledge of what drivers are capable of, and what they are willing to accept.

- **New architectures in electric vehicles:** A new philosophy, building around passengers instead of around a motor
- **Human limits for technological possibilities:** How flexible vehicle design can be while still being accepted by the user

Passive safety of electric vehicles

It is crucial to keep in mind that changes in vehicle design will affect passive safety of occupants as well as pedestrians.

- Modifying the design of car fronts to protect pedestrians, taking into account battery location and possible redistribution of vehicle components
- Using new materials to compensate the added weight of batteries

Safety measures related to vehicle batteries

- Ultra fast power off systems
- Fail safe architectures (ASILD for SW and HW)
- New sensors in the fail safe loop (temperature, voltage, current, etc.)
- Secure communication with BUS and new node management
- Grounding studies
- System voltage studies
- New materials

- New isolating systems
- EMC immunity (a new dimension in connecting to the electricity grid)
- Accidentology studies (new effects and types of failure)
- Gas discharge / flammability studies

Safety issues related to electric vehicles and their environment – vulnerable road users

EVs lower noise pollution and reduce gas emissions. On the other hand, the lack of noise can be dangerous for vulnerable road users such as children or the disabled. It could mean more accidents and pedestrians being hit by cars.

- Systems for making the presence of silent cars more evident in urban settings

Pedestrian protection design

- Study of consequences (both inside and outside the vehicle) of the absence of noise produced by EVs; the definition of noise free environments and variable visibility (day/night) raises the question of what signs and signals warn us of vehicle presence
- Incorporating new elements to collect information from the exterior; how this information is presented inside the vehicle; analysis of dangerous situations from the pedestrian's point of view

Safety for rescue workers

Electric vehicles contain high voltage batteries, power electronics and onboard communication systems. As a result, firefighters, police officers and emergency response workers will require training to understand new situations and risks and react accordingly.

- Creating warning systems for rescue workers: Beyond eCall
- Protocols for security forces in the case of accidents involving electric vehicles

INTELLIGENT SYSTEMS AND SERVICES FOR ELECTRIC VEHICLES:

Defining HMIs for onboard information management

- New dashboard design as an identifying characteristic for electric vehicles
- Study of the relevance of visual, auditory and haptic devices for static electricity generated, consequences and proposed procedures
- Study of the relevance of visual, auditory and haptic devices for real time battery charge status (i.e. information about partial charging through regenerative braking)
- Study of optimal battery operation indicator design (voltage, charge, etc.); batteries that do not work properly should be disconnected from the system without affecting the others parts
- Defining and designing adequate sound, haptic and/or auditory devices for information on vehicle behavior
- Defining and designing adequate sound, haptic and/or auditory devices for information on real time vehicle status and anticipated status

STANDARDIZING, APPROVAL AND SAFETY REGULATIONS FOR ELECTRIC AND HYBRID VEHICLES:

This strategic research area is of special interest considering the emerging need to deal with new risks associated with electric cars. The traction, structure, architecture and performance of electric vehicles are quite different from those of motor vehicles.

Study of typical driving ERRORS (type, frequency, consequences, etc.)

- Paying attention to the remaining charge of one or several independent batteries instead of watching the road
- Acquired habits from driving internal combustion engine vehicles that could be risks for safely driving an electric vehicle
- Errors derived from being accustomed to the location of controls in conventional vehicles (possible study of errors derived from using the gear shift; possible alternative systems for changing gears)

Protocols and procedures

- Defining safety protocols for charging electric vehicles with different architectures

- Regulatory or design proposals for standardizing plugs for charging batteries; defining standards of safe and efficient use of fast and slow charge plugs in all brands of cars; defining battery models and performance (see standards AENOR/CTN 26)

- Proposals to standardize procedures for handling components with risk of electric shock; high voltage power

- Procedures for using complementary and comfort devices in low battery situations

- Procedures for checking the condition of the vehicle before starting and driving an electric car

Repair and maintenance safety for electric vehicles

Electric vehicles will carry high voltage batteries, power electronics and onboard communication systems. All vehicle technicians (auto-body workers, mechanics, auto painters, etc.) will need specific training that takes into account the risks associated with working on electric vehicles.

1. INTRODUCTION

The European industrial sector is currently undergoing a transformation. This is because of new global trade blocs, their relations, and the revision of their social and economic values. The automotive industry is an essential part of our society. It manufactures vehicles, participates in the GDP and has important social implications. Logically, it too is reconsidering the model used up until now and planning for the future.

Industrial technology and automotive production processes are often considered a point of reference for other sectors. They represent new, large-scale, cost-effective manufacturing concepts. They serve as a necessary catalyst for developing new technology in design and global production. Therefore, they have a decisive influence on social progress.

Along these lines, the "Factories of the Future" initiative in Europe clearly states the improvements the industry needs. It focuses on how to increase value and competitiveness, inspire new production methods and develop sustainable production models. It also prioritizes applying new information and communication technology to manufacturing, assembly and design.

Due to market pressure, technological research is once again asked to deliver more (and better) for less. We are challenged to manufacture more products with less material, less energy, less waste and at a lower cost. In addition, we need to be more flexible and adapt products to consumer specifications in our ever changing market.

In this respect, it is necessary to focus on developing:

- A new production model in the West. It should be able to adapt itself to the needs of businesses and customers. It should be highly productive and able to produce customized vehicles. It should be efficient using resources, human potential and know-how

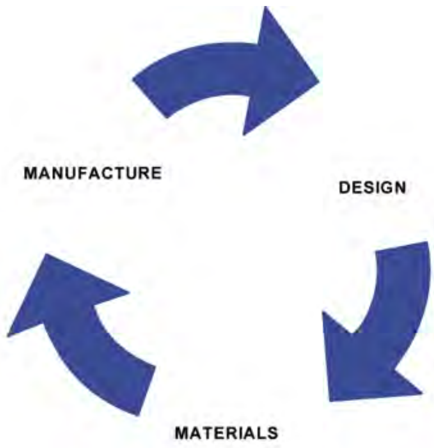
- Autonomous, flexible production processes that use advanced technologies to produce high quality goods

- Sustainable technology, methods and processes. They should be able to design, manufacture and assemble complex components using new materials. At the same time, the cost to the consumer should not increase for products with similar functionality

Countries such as the USA, Japan or Korea are high level competitors. They produce good quality products using state of the art technology. Emerging economy countries and the BRIC countries are on another level. They are less expensive, yet they are promising competitors and on the rise. In order to achieve a positive balance with all of these economies, businesses of every size should make some important adjustments.

The three main pillars of automobile production technology continue to be material, design and manufacturing. Another constant goal is to reduce costs without diminishing quality, and at the same time increase benefits and added value.

Materials play a vital role in new concepts of vehicles and propulsion systems, such as electric cars. These cars will require the incorporation of elements such as electric motors and batteries. As a result, we need to reduce the weight of other parts. Therefore, we must have information about all available materials. We have to know how they can be used in new products. Likewise, we should understand the implications they have in the manufacturing processes.



2. PRIORITIES

DESIGN

Methodology and tools

This section includes the technology, tools, methodologies and organization we need to design new products according to customer and/or market demands. We will look at the following points:

1 Functional analysis and specification

- Systematizing the functionality of products
- Developing and using guides of best practices and lessons learned
- Focusing on customers and their needs
- Design and creativity training
- Applying techniques such as QFD, HOQ and/or VOC to reduce modifications and promote innovative features in new products
- Applying value analysis tools in the initial phase of the project (open design)
- Implementing performance metrics and assessing the importance of historical measurements
- Security concepts in the initial design stage

2 Designing for manufacturability

We need to be more flexible in the design process. Likewise, all levels of the technical office should make good use of analysis and simulation tools.

To support the design process (dimensional, conceptual, functional and manufacturing prototypes), it is critical the use of rapid prototyping technology, both virtual and real. It is important to create and implement customized tests when developing prototypes to validate the product early on.

From the outset, the design of every component and system must take various factors into account from the very first draft. For instance, we need to consider the specifics associated with distribution and logistics since they directly affect the final cost.

3 Applying new concepts

- **Innovation.** Setting up field-specific programs to promote and standardize innovation management and R&D&I projects.
- **Creativity.** Using creativity techniques.
- **Technology watch.** Creating freely accessible information centers. They would have detailed information on new technologies and how they are being used. In addition, they would offer opportunities for technologies that could possibly be developed in the future.

4 New technologies, processes and materials

The design team should have the maximum amount of information available concerning the product being developed. They need to know about current technologies, processes and materials. Ideally, the team should be made up of members from multiple fields.

5 Crossover trends

- Using sensor and actuator technologies to incorporate intelligence into the product
- Miniaturizing (microtechnologies / nanotechnologies)
- Modularizing the product and standardizing the modules by function and dimensions, chiefly specializing in the function

6 The environment / recyclability

From the very beginning environmental impact and eco-design should be considered. This means applying international standards in both product design and processes. These standards include criteria such as CO2 emissions per unit of measure.

In order to improve the management of a product throughout its life cycle, sustainability concepts should be applied early on. This will help maintain economic activity and positioning within the company.

Design Tools for Aid and Support

1 New simulation tools and concepts

It is true that CAD/CAM/CAE/PLM tools have improved and are now being widely used. However, we need to configure even more complex development and simulation environments. They should be able to represent a more precise final product that is closer to reality.

To design and implement new strategies and methods for attributes such as energy efficiency, reliability or weight, may help optimize the complete or partial design of vehicle models.

Likewise, tools that both design and simulate electric propulsion systems and related equipment should be developed. These tools would be introduced in the design phase in order to see how the components and systems behave.

2 Obtaining and reusing knowledge

Knowledge based engineering (KBE) collects the experience of technical experts and uses it in the design process. We should develop and implement software that uses KBE.

3 Processes and tools for support

We could greatly benefit from new tools for overall product and development management. They should use the concept of concurrent engineering in the product/process supply chain. In addition, they would collect information for maintainability and recycling.

Training

In this area, the priority is to define and implement new models of ongoing education. We should continuously offer training in crucial processes. Once staff members have achieved the status of specialist, they should be identified and recognized within the company.

Training should include all aspects related to production and design.

Sustainability

In order to improve the management of a product throughout its life cycle, sustainability concepts should be applied early on. This will help maintain economic activity and positioning within the company.

Copyright and patent rights

It would appear that R&D&I plays an increasingly definitive role in industry. Therefore, it is necessary to protect our design and know-how by patenting and registering them. Experience should allow us to identify the results and progress generated within the company. Then, we merely establish their possible value and protect them as part of the company's assets.

Applying new concepts and methodologies to get more out of copyrights and patent rights

- **Innovation.** To set up field-specific programs to promote and standardize innovation management and R&D&I projects.
- **Creativity.**To use creativity techniques.
- **Technology watch.** To create freely accessible information centers. They would have detailed information on new technologies and how they are being used. In addition, they would offer opportunities for technologies that could possibly be developed in the future.

PRODUCTION AND RECYCLING

In Spain, just as in Europe, the automotive industry will progressively move into the future as improvements are made in productivity and competitiveness. All signs indicate that this will mean an increase in mechanization and automation in factories. At the same time, this implies reducing the human element in the process. On average, fewer, more customized batches will be produced. This means more flexibility on production lines. Together with increasing environmental awareness, these factors will mark the evolution in production and product recycling.

New production processes

As mentioned previously in the design process, we need to make the most of creativity and applied technological know-how. When developing new production processes, these techniques to improve the differential advantage should be used. In this section we could also include: applying combined technologies, using solutions from one field in another field, and creating machines and complex systems to improve both productivity and working conditions.

In order to begin using new materials in mass production, numerous issues must be considered. In this respect, both design and production are important factors to keep in mind when developing new industrial processes. Furthermore, we must always take into account the criteria for final product competitiveness.

Manufacturing Intelligence is another interesting topic to think about in the production process. It can be included by using sensors and intelligent actuators. These elements, connected by wired or wireless networks to central processing computers, send signals or instructions. They should have enough available information and criteria in order to verify the quality of the process and the product. At the same time, they should also be able to guarantee working conditions for people nearby. Moreover, they should send data to the company's local and central offices.

New concepts in mass production

Opening a factory or new installation can be nearly problem-free. In order to achieve this, we should design a complete virtual model and simulate the manufacturing process. As a result, the facilities will be more competitive.

The general consensus is that we need to improve the flexibility and modularity of production lines by:

- increasing the productivity of the lines
- implementing interchangeable manufacturing modules
- standardizing all equipment, base parts, tools, etc

Certain areas in the process of automation require further investment. Some examples are high speed production machines, open architecture machine control, rapid tooling and KBE/KBS systems. By developing online tools, remote maintenance, and machine and equipment analysis, productivity will clearly increase.

Another innovative concept we should take into consideration is adapting current machinery. This could reduce the necessary investment by including flexible configurations in the new systems. In fact, a priority nowadays in technological research is finding ways to adapt our current machines.

Mass production of electric vehicles will be a reality in the near future. This means that we will have to bring our current production systems up to date. Likewise, they need to be viable in the new global context.

Simulating in the production process involves using modeling systems and computer verification to assess feasibility before production. By simulating, we will learn how to optimize changes, modify the layout or fine tune machines and equipment. Consequently, we'll obtain competitive advantages by increasing the flexibility and productivity of the installations.

Respect for the environment and sustainability

Protecting the environment is a top priority in the production process. The two main areas focused on to approach this topic are:

- **More environmentally friendly means of production.** To use our resources more efficiently. By reusing by-products (the remains of other processes) and establishing the end of the material cycle (circular economy), we can accomplish this goal. Furthermore, we should take into account current concepts of reducing environmental impact for designing production processes.

- **Waste management, elimination and minimization.** New technologies and processes to recycle and reuse materials will help to manage our waste more effectively. These include new assessment processes for waste and by-products that consider environmental, social and economic factors (convenience indicators).

Recycling and product remanufacturing

Several different factors lead to economic activity based on the assessment of waste material. First of all, more expensive materials may be worth reusing. Second, the different expected life of metallic and electronic components in the same system makes reusing some of them an interesting option. But reusing material is only one of the options. We can also remanufacture parts under warranty. This would mean that the final product is halfway between being new and used.

Recycling and dismantling facilities will need to develop effective information systems. These life-cycle-management systems should provide significant data about the use of each component.

Electric and hybrid vehicles offer a great array of possibilities in this area. Some of the systems and equipment they include have a high added value and a useful life that can outlast the vehicle itself.

First of all, we need to know the functional characteristics of each system. With this information, we can adapt the design to combine the intended usage with real capacity. Data such as how the system is used, its design and characteristics of its materials will make recycling and reusing easier.

Efficient production management

In order to efficiently manage production, we need detailed, real time information for monitoring assembly and production lines. But access to this information is not enough. We need to have expert systems installed on the lines. They should allow us to give instructions or control the process when it is below optimal. Development of these expert systems will guarantee a factory's competitiveness.

Other aspects related to production management are:

- **Agile planning and re-planning** in the case of any unexpected events, changes or difficulties. This implies having the appropriate tools and equipment. It also requires constant situation analysis of the factory and the ability to process real time information

- **Efficiently managing maintenance,** allowing for higher utilization rates and profitability of the means of production

- **Active quality control,** that guarantees the process works properly and the quality of the final product, all at a reasonable cost. This is a very important point, considering the repercussion it can have with customers

- **Maintenance and internal logistics systems**

Training the staff in production management is a key factor and affects all the above points.

External logistics

Nowadays production plants are located far from customers. The raw materials used to manufacture products also come from far away. Therefore, we must take into account the logistics of distribution. We need to consider the associated costs of distributing the final product. We also need to keep in mind the fleet that will distribute the product and the warehouses that will store it. The impact of these logistics justifies why we need to find better solutions.

When necessary, we should occasionally include unitary tracking systems to improve the traceability of high value items.

New concepts in Human-Machine Interaction (HMI)

Current manufacturing processes should evolve towards automation. For this to happen, humans and machines need to interact in a new way. Therefore, we must develop flexible programming concepts. They should be intuitive for the user and easily assimilated by the machine. Another objective is to create user friendly interfaces. Likewise, workstation designs that do not affect the occupational health of the staff are important. These new concepts will reduce processing times and achieve quicker start ups. The machines should have spatial awareness of the location of workers. This way we eliminate the risk of all possible accidents or injuries while reducing the necessary work space.

Quality control

We should incorporate online quality control systems in the safe, time efficient and flexible production installations we design. They should be able to control the quality of elements such as uniformity, dimensions, color or assembly parameters in the manufacturing process. Currently, some quality control must necessarily be carried out by humans. Therefore, we urgently need to develop new elements to meet the particular needs of each type of product and process. Sensor systems, computer vision and automation mechanisms are a few examples.

On-site training for manufacturing vehicles with new propulsion systems

The current concepts of automobile manufacturing need to change in order to produce new types of vehicles. These changes would be applicable to all levels of employees. There is a considerable difference between working with electric components and working with mechanical components. Therefore, the new product itself will determine the training needed, the risks implied, and the specific jobs required to manufacture it.

MATERIALS

Most progress related to materials stems from the need to make vehicles lighter without sacrificing functionality or performance. When thinking about new materials, we need to consider factors such as design, development and manufacturing. The processes associated with using new materials in automobiles are also noteworthy. The previous section discusses these processes in more detail. Some of the topics related to material technology are:

- **Lightweighting,** better design with less material
- **Recyclability** of both metals and non metals; includes recoverability, re-usability and processing
- **Improved performance** thanks to newly designed materials (sometimes coming from sectors such as aeronautics) that should be adapted for large scale automobile manufacturing
- **Development of nanomaterials** or particles that increase product life under optimal conditions

The processes of design and production require knowing about available materials and using them. The following priority areas have been established in this field:

New materials for advanced functions

New functions such as energy absorption, sound dampening, crash resistance, electromagnetic absorption or particle retention require the development of new materials. Some other advanced services that would benefit from these materials are inflammability, toxicity, recyclability and temperature weathering.

Other metals

The use of new high resistance steel and other metals such as magnesium or aluminum is becoming more widespread. This is because of lightweighting and improved performance. High resistance steel also requires new production processes to lower the costs associated with traditional methods.

New composite material and plastics

Valuable experience from industrial sectors such as aeronautics can help find applications for new materials. Likewise, R&D of specific processes can find uses for new lightweight materials, ceramics and fabric. In addition, it is important to do research on associated and optimized processes for each type of material.

Coatings and surface treatments

We should work on developing coatings and treated surfaces that improve: durability under extreme conditions, insulation, conductibility, resistance to dirt, and surface quality.

New joining systems

Using more and different materials means new possibilities to combine them into new complex combinations. These possibilities can be explored in conceptual design. In this case, the characteristics of the joining process are relevant. This is because the conditions can vary, but not only in the contact area. The post life treatment can also be drastically different for different materials after dismantling. We need to develop welding systems for metals, adhesive systems for joining parts made of different materials, and connections for mechanical parts. Quality control in joining systems must be is a key element in developing and standardizing new processes.

1. INTRODUCTION

By mobility, we not only mean the movement of vehicles, but also the mobility of other things such as people, goods, information and energy. Some of the parameters that should be applied to mobility are: safety (number of fatalities, injuries, etc.), sustainability (emissions, fuel consumption, etc.), efficiency (time and money spent) and comfort (quality of user experience). In Spain, figures show that per kilometer per day approximately 940 people travel by car and 764 million tons of goods are transported.

In order to adapt to new market demands, the concepts of mobility and transport for car and automotive parts manufacturers are undergoing a period of change. Economical cars, cars for the elderly and hybrid cars -as a step towards completely electric cars- are all evidence of these changes. These new car concepts will allow industry suppliers to sell technology for the vehicles even though much of the manufacturing process will take place abroad.

Likewise, an important objective and priority in the public policy of European countries must be to reduce traffic congestion. This will have great repercussions in the quality of life of European citizens and it will also lessen the environmental impact. By reducing the consumption of fossil fuels there will be fewer emissions. As a result, we are looking at not only the possibility of technological advances, but also changes that are essential for society as a whole.

In recent years there has been extensive development of intelligent transport systems (ITS), considered tools that contribute an added value. These systems, by using information and communications technology (ICT), have been suggested as the solution to mobility problems.

In order to more precisely deal with the needs of mobility, four principal subdivisions were created. The subdivisions outline the enormous differences that exist between the problems, the actors involved, possible solutions and the different fields of each subdivision.

The four areas are:

- Urban Traffic
- Interurban Traffic
- Public Transport
- Vehicles

2. PRIORITIES

URBAN TRAFFIC

New concepts in the comprehensive management of urban traffic

It is essential that we develop new ideas to manage urban traffic. In order to do so, we need to know the origin and destination of each vehicle individually in real time. By tracking each vehicle we would be able to transmit information (related to traffic, road work, etc.), suggestions (alternate routes), authorization (permission to enter certain parts of the city) or toll info (according to the type of vehicle, time of day or location.)

Multimodal navigation

Intermodality is a practice that can be used to find solutions for current urban mobility problems. In order for it to become more widespread, more applications need to be developed that allow the available options to be shown to the user. These applications could be used together with a GPS system in order to provide information or it could be shown on VMS (Variable-Message Signs) or other means available, depending on the city.

Improving detection technology

In order to improve vehicle detection on the road, new technologies need to be developed and existing ones need to be enhanced. Some of the current methods include capturing the digital footprint that different onboard devices leave behind as they pass by detection devices or the signal from the electronic toll collection (ETC) tags. Although these recent developments are setting the pace for the new concepts of detection, there is still an ample field that needs to be created, developed and perfected in order to provide precise, secure and reliable data.

Standardizing the procedures of data detection and collection

Nowadays there is a vast amount of data obtained from ITS on Spanish highways. However, these data are too diverse to be used for making comparisons or carrying out studies. The procedures of data detection and collection need to be regulated. By standardizing these procedures, both could be simultaneously and jointly processed, thereby leading to measures that encourage improved mobility.

Data fusion

In order to more efficiently manage urban traffic, it is essential that the data obtained from different cities across Spain be combined. By doing so, it would be possible to obtain very useful information and statistics for handling traffic.

Manage urban delivery vehicles

Managing the so-called "last mile" is a main priority for the traffic control centers of our cities. And rightly so, given that delivery vehicles are a great nuisance to mobility in an urban environment. A common example of this is a delivery truck blocking a street, cutting off traffic. Despite the nuisance to mobility, distributers must supply merchandise to businesses in the city and therefore, new procedures are urgently needed to distribute goods, and more generally, to handle urban delivery traffic.

Enforcement

Another priority on the urban level is to develop systems that make it easier to comply with regulations and fine those who do not comply with them. The term "enforcement," frequently used on a global scale, includes these and other efforts to avoid the accidents and casualties that occur each year in our cities.

Reserved parking and automatic payment

In order for parking management to be automatic, we need to develop tools or systems that would allow the administrator of public parking to control reservations and automatic payment of any place on any street in the city. By developing the necessary technology and applications, parking efficiency would increase and thus traffic would considerably be reduced in some areas.

Communications technology in urban areas (cooperative systems)

It is important to develop technology for safe and efficient communication between infrastructures and vehicles so that all data required by cooperative systems would be provided and received.

INTERURBAN TRAFFIC

Updated data bases on emissions

Currently there is some dispersion or uncertainty in data on the emissions produced by vehicles in Spain. In order to set goals in this area, first we would need to develop the tools to measure, generate and maintain data bases with up-to-date information on emissions.

New methodologies for interurban traffic management

It is important to keep in mind the analysis of certain factors such as emissions or energy consumption when developing new methods for traffic management. These methods, such as variable speed limits or using the shoulder as an auxiliary lane, could significantly increase the sustainability and efficiency of mobility in intercity areas.

Communication technology in interurban creas (cooperative systems)

The cooperative services of the future will send and receive data between vehicles and infrastructures in intercity settings. In order for this to happen, the technology needs to be developed that will allow secure and efficient communication from the infrastructure to the vehicles. This point is also covered in the previous section on urban traffic; however, since the problems in this area differ greatly in each of the two settings, the solutions should also be different.

Pay-Per-Use and efficient driving

An inevitable goal for the future of transportation is cleaner mobility. One of the ways to achieve this goal is by developing tools and systems that lead us towards this objective, such as offering drivers pay-per-use vehicles and fees based on good driving. These measures are meant to raise driver awareness, for instance, demonstrating to them that how they drive is directly proportionate to emissions and the wear and tear of the vehicle, or that being an efficient driver means paying a lower rate. Another method is pay-per-kilometer, which reduces avoidable use of the vehicle, consequently producing fewer emissions.

Enforcement in interurban areas

Another priority in interurban areas is developing effective enforcement systems. On highways in Spain these include all efforts to encourage following Spanish road traffic and safety regulations in order to avoid accidents and fatalities.

Electronic license plate

An electronic license plate is an electronic device that has the same features as a traditional plate (it can be recognized by current image or video detection systems.) In addition, it offers other characteristics that would allow added electronic monitoring. These possible improvements would strengthen many traffic management and enforcement applications.

New detection systems

As mentioned earlier in the section on urban areas, we need to develop new technology and improve existing technology to optimize the detection of vehicles in interurban traffic. Currently some of the areas being worked on are digital footprint and electronic toll collection (ETC) tag detection, as well as other related concepts.

PUBLIC TRANSPORTATION

User information systems

The top priority in public transport is improving user information systems. We should keep in mind that this factor plays an important role in determining whether public transport is used, or at least if using it will be a positive experience. While it is true that current user information systems offer very detailed information, they need to continue growing to encourage further use. The main areas in need of innovation are:

- Real time information
- Ambient intelligence: Providing automatic relevant information that passengers might be interested in based on their location in a certain place at a certain time
- Services associated with the information provided to the user (travel ticket sales and reservations, parking, tickets for cultural events…)

Integrating traffic management and public transport

By coordinating road traffic management and public transport, both would be more efficient, although priority should be given to the latter.

Intermodality

The aim of this fundamental issue is to create a framework that guarantees the integration of all forms of public transportation while making the modal change easy. In order to achieve this goal, sufficient resources must be used both in the development of infrastructures and route planning as well as in user information systems that provide data on other means of transportation.

Persons with reduced mobility

A safe and comfortable travel experience needs to be assured to individuals with reduced mobility. Therefore it is important that infrastructures and systems are developed to provide access to all types of public transportation for these users. Once they are on board, the necessary steps should be taken to guarantee sufficient safety and comfort to these passengers throughout their journey.

Ergonomics

Ergonomics applied to public transport is one of the most basic factors in providing passengers with the necessary comfort in any situation. Thus it is vital to study biological and technological data that can be applied to improving conditions for travelers on any form of public transportation.

Security

Investment needs to be made in developing tools and systems that increase security on public transport. By making it safer for people and their belongings, as well as assuring the security of infrastructures and transport vehicles, users are guaranteed a friendlier travel experience.

New forms of public transportation

New solutions are currently being discussed that may improve mobility by encouraging the use of public transportation. There are very promising "new" concepts such as car sharing, which allows someone to use a vehicle that another person has finished using and will not use again in a specific amount of time. This and other new concepts in public transportation would reduce the number of cars on the road in a city at any given time.

Bicycles as a form of public transportation

We need to introduce the bicycle as an "acceptable" form of public transportation in Spanish cities. In order to do so, there are many factors that need to be improved and complex problems to be faced. Some examples are the interoperability of systems, the localization of bikes, predictive algorithms to optimize return flows or payment systems (whether or not the service will be compatible with tickets for other forms of public transport, whether it will have a specific card or can be paid for directly by a credit or debit card, whether or not it will accept mobile phone payment, etc.).

Simplifying and integrating the payment of public transport

One way to further simplify the use of public transportation is to combine different tickets into one. This system allows the passenger to have a single travel card or pass that can be used to buy rides on all the forms of public transportation that participate in this payment system.

VEHICLES

Smart grid

Obtaining energy for an electric vehicle (EV) should be as easy as filling up the tank at a service station nowadays. There should be no obstacles to using different facilities, suppliers, prices or types of charging station. The batteries of EVs can be included as absorbers of the fluctuating stream of electricity from renewable energy sources, thereby optimizing the output of the entire system. This means that the energy flow should be bi-directional, from the electrical grid to the vehicle and vice versa, and with the assistance of advanced control devices that adjust the incoming and outgoing state of charge (SOC), analyzing the charge level.

V2V and V2I communication

The objective of this technology is to provide safe and efficient communication with the infrastructure as well as with other vehicles. It should be able to supply and receive all the data that cooperative services may require. This calls for communication design, together with independent platforms and standardization.

Vehicle-Driver interaction

Intelligent information systems that prioritize information are another mobility objective. Their functions include identifying the driver and his or her behavior. We will also see new concepts and technology in voice control, touch control, visibility, etc.

Passenger identification technology

This technology would identify the number of passengers in the vehicle as well as their characteristics, thereby allowing the vehicle to communicate pertinent data to the traffic control center for mobility management. In addition, the vehicle could change its own adjustable parameters to the passenger characteristics (weight, age, etc).

Onboard technology for identifying loads

This new concept would identify all the possible information about the loads a vehicle is going to carry. This would help develop tools to handle the load in the most efficient way.

New concepts of a vehicle

We need new concepts for developing cleaner and quieter vehicles for package delivery and night-time services, besides designing multifunctional vehicles for passengers and goods. (One example is the Segway).

New vehicles and the challenge of an aging population

Low birth rates and a longer life expectancy are going to imply a change in the makeup of the population. In the future, a large percentage of the population will be made up of highly-active elderly people. These changes imply a necessary adaptation of vehicles in order to accommodate elderly drivers by adding advanced driver assistance systems (ADAS). The ADAS will assure these individuals a safe and comfortable driving experience.

Regulation and standardization

Currently there is a growing need to advance in the rules and regulations in the field of electric and hybrid vehicles. These regulations would guarantee the necessary security levels and the conditions for standardization that would facilitate use on an international level with little to no technical barriers. We need to determine security standards related to energy storage, onboard use and charging for electric and hybrid vehicles, their parts and their systems, not to mention security standards for the facilities that supply electric energy to vehicles.

1. INTRODUCTION

The goals of the working group "R&D&I Promotion" are:

- To help establish close strategic collaboration between companies, technology centers and universities, so as to coordinate their R&D efforts in the automotive sector and other fields related to the platform
- To identify the requirements of the sector in order to strengthen its technological advantage
- To inform governments of the needs, difficulties and challenges that the sectors represented in the platform are facing in order to maintain both the current know-how and the resources necessary to guarantee strategic positioning

In the year 2011, the situation analysis is the same as it was when the platform was created:

Spain

- Spanish companies need to increase their competitiveness to improve their positioning in the market
- Relocation and the problems that arise
- The important role of automotive components industry
- Extensive Research traditionally carried out on an individual level, with a lack of collaboration in the field
- Insufficient leadership in R&D&I by private companies

Europe

- 7th European Framework Programme generates a low participation rate, even though it has improved in recent years

Global

- Environmental needs
- Sustainability
- Global environment

Nevertheless, the economic situation is yet another obstacle for automotive R&D due to the financing difficulties faced by the sector.

In the year 2010 there was a change in the way the Ministry of Science and Innovation distributed resources within the National R&D&I Plan. Market-oriented projects showing industrial leadership took precedence over applied research and experimental development. This policy represents a turning point in regards to the objectives of previous years, when the development of large, strategic and singular projects was also endorsed. Likewise, in the past public resources were used to fund advances made in technology centers and public research organizations using unique technologies that would later be transferred to private companies, not to mention the projects lead by the industry. If some of the initiatives that originated within the framework of the platform are not contemplated in the current Innovation Plan, it is because they could not meet the requirements for obtaining public financing.

Many of the priorities established in the 2007 Agenda are still in force today. In some cases, steps have been taken to meet the established needs and achieve the proposed objectives. After analyzing the results, the working group has revised these priorities and reformulated them in order to achieve the goals set out.

2. PRIORITIES

DISSEMINATING TECHNOLOGICAL INFORMATION AND COMPETENCIES

Identifying new ways to transmit available technological know-how

In the past several years numerous data bases have been created to reflect different situations at a particular point in time. This is due to the fact that initially no plans were made to keep them up to date, and it has not been possible to assign anyone to do so. One of the reasons is that each university and technology center is solely responsible for the promotion and dissemination of its knowledge and unique projects. Therefore we need to identify the possible channels and mechanisms used for spreading information. Once this has been accomplished, we can make the know-how located in the data bases of technology centers, universities and public research organizations available to platform members and other interested entities, who would then update the information on their own.

The proposal at hand is to create a software tool linked to the Platform's website.

Defining information needs. Quality of information

In order to avoid an information overload, we should consider the quality of the information (foresight studies, info on emerging technologies, the legal and regulatory framework that affects the sector, etc.) and make an effort to carefully define our real information needs.

The proposal at hand is to add a page of links to the platform's website. It would mention the content and relevant information provided by platform members with the aim of creating an automated mechanism for disseminating technological information. This information would be pertinent to the sectors represented in the platform, including the studies carried out by centers specializing in technology surveillance.

Promoting the internationalization of spanish technology centers

A considerable effort has been made on behalf of the platform to encourage the internationalization of Spanish technology centers through joint projects between the centers and foreign experts, both in Spain and abroad. At present we need to find new ways to maintain the diffusion of their competencies through the platform.

All of this relevant information should be available in the European association that includes all the technology centers, the European Automotive Research Partners Association (EARPA), and in the European Association of Automotive Suppliers (CLEPA).

STRENGTHENING THE R&D STRUCTURE IN THE SECTOR

Promoting the culture of innovation in the private sector

In order to promote a culture of innovation, we need to support R&D&I management and start up plans for innovation in private companies. This can be done by encouraging strategic thought with the help of technology centers and the Spanish University Offices for the Transfer of Research Results (OTRIs). The innovation strategies of private companies depend on National R&D&I Plans, whose ability to provide funding is currently uncertain. This makes it difficult to elaborate long term plans (2012-2017).

Supporting collaborative efforts between the private sector, R&D organizations and Cross-Sectoral institutions

Several important aspects have been identified in this area:

- To create forums within the platform's working groups that include member participation, so as to encourage innovation in the platform's interest areas (defined within the other four working groups).
- To endorse the creation of technological associations and/or partnership agreements between the private sector, technology centers and universities to serve as the basis for creating a deep-rooted technological R&D culture in Spain and to extend funding possibilities in order to not only create but also maintain long term collaboration.
- To promote collaboration with other related sectors that offer a strong technological positioning, such as ICT, infrastructure or electric companies.

Backing the formation of projects that arise from innovative ideas

When the aforementioned forums and working groups give birth to innovative ideas that lead to the initiation of new projects, the platform supports these projects (M2F label) in order to obtain funding from the proper entities, on both a national and international scale. By participating in international projects, companies will increase their global visibility and the internationalization of their technology.

Information and advice about national, european and international funding

We need to inform and advise the organizations involved in the platform on tax incentives for R&D&I as they are published, as well as on the different types of support for R&D&I activities on all levels: nationally (i.e.: National R&D&I Plan), in Europe (7th Framework Programme, Competitiveness and Innovation Framework Programme -CIP) and internationally (multilateral programs managed by the Center for Industrial Technological Development - CDTI). Information about programs, calls for proposals and other opportunities will continue to be made available through the International Automotive Innovation Unit and in sessions presented at conferences organized by the platform.

Working with governments on policies and tools for supporting R&D&I

It is important to make recommendations to local, regional and national governments to define policies, propose priorities and identify tools that support R&D&I. These tools should be relevant to the projects from the sectors represented in the platform and their needs. They should also facilitate training within companies for developing and creating products and processes that are up to par with international standards. In order to accomplish this goal, the proper channels should be used, such as the National R&D&I Plan, researcher exchange programs or coordination of the network of technology performers.

We also aim to work with the government on creating a comprehensive plan that incorporates the needs and unique qualities of the Spanish automotive sector, its know-how and capabilities. This plan should also include the relevant characteristics of universities and technology centers, the European strategic research agendas and the strategies unique to the National R&D&I Plan. The intention of this plan would be to assure the convergence of national and European programs, guarantee that the sector was capable of meeting international standards and define its future prospects.

Measures to set up parent company R&D centers

Vehicle manufacturers and multinational automotive component companies could promote Spain as a destination for the development of products and technology (for specific competences and niche markets).

TRAINING

Analysis of available training offer, identification of shortcomings and content necessary to cover sector needs

We need to establish the appropriate training the sector requires in order to advance along with the progress being made in automobile technology. In order to do so, we should analyze the training that is currently available as well as identify the areas that are not covered (for technicians, managers and operators) and the content necessary to fulfill the needs of the sector. These needs will be marked by new developments in technology, such as ICT, mechatronics, new materials, ecodesign, new products and production technology. Other important aspects are promoting R&D&I management and maintaining an awareness of the priorities of each new National R&D&I Plan that affects the platform.

Working with governments on training needs

By recommending that the Ministry of Education and the Regional Governments in Spain revise and update the official curriculum in education, we will be working towards covering the training needs of the field. We would encourage them to include specific content related to new technology in the sector in Master's and Doctoral degree programs, as well as in high level vocational training. Signing agreements between universities in Spain and universities in countries where companies represented in the platform have an international presence is yet another essential objective. In this case, the intention is to facilitate the training of local experts so they can be hired by these companies, thereby supporting the globalization of Spanish companies.

Announcing training activities

We should help spread information about training activities organized by platform members, as well as the training needs they establish, in order to create the necessary framework for supply and demand.

Promoting the exchange of professionals between universities, technology centers and private companies, and the training of graduates of automotive development centers

It's crucial to create ties that guarantee close relations between universities and the industry in terms of training, specialization, internships, senior year projects and doctoral programs. The exchange of professionals with universities, technology centers and private companies is equally important. Universities should work hard to spark interest in research and development, in innovation and in R&D&I management by creating the pertinent study programs. This way, incentives would be established that would make professional careers in R&D&I in the automotive sector attractive and therefore consolidate research teams in technology centers and private companies and attract talent to the sector.

STANDARDIZATION

Strengthening participation in standardization activities related to the sectors involved in the platform

Platform members must actively participate in the development, analysis, monitoring and dissemination of the standards in their field in order to guarantee that research and development activities are geared towards future market demands from the outset.

Disseminating working groups on standardization

5. ANNEX: M2F PLATFORM MEMBERS

ACUSTTEL
AEDIVE
AENA
AMETIC
AIICA
AIMEN
AIMME
AIMPLÁS
AIN
AMES
ANÁLISIS-DSC
ANDALTEC
ANFAC
ARRÁN AUTOMOCIÓN
ASCAMM
AT4 WIRELESS
AVELE
AYUNTAMIENTO DE GRANOLLERS
AYUNTAMIENTO DE HOSPITALET
AZTERLAN
BAYSYSTEMS IBERIA
BESEL
CALMELL
CEIT
CEMUSA
CENTRO TECNOLÓGICO DE COMPONENTES
CENTRO TECNOLÓGICO DE TELECOMUNICACIONES DE CATALUÑA – CTTC
CENTRO ZARAGOZA
CETEMMSA
CIDAUT
CIE AUTOMOTIVE
CITEAN
COTEPSY
CT INGENIEROS
CTAG
CTAG-IDIADA

CTM CENTRE TECNOLOGIC
ECO-MOTION
EDERTEK S COOP
ESM
ETRA I+D
EXIDE TECHNOLOGIES
FAURECIA INTERIOR SYSTEMS
FEMP
FICOSA INTERNATIONAL
FITSA
FRANCISCO ALBERO
FUNDACIÓN CETENA
FUNDACIÓN CSIC
FUNIBER
GESTAMP
GH ELECTROTERMIA
GMV SISTEMAS
GOMAVIAL
GRUPO ANTOLÍN
GRUPO CEGASA
GRUPO COPO
GRUPO SCA
GUARDIA CIVIL
HI-IBERIA
HOSPITAL UNIV. 12 DE OCTUBRE
IBV
IDEKO
IDIADA
IKERLAN
INABENSA
INDUSTRIAS PUIGJANER
INGEINNOVA
INSTITUTO TECNOLÓGICO DE ARAGÓN
INTA
ITE
ITI
ITS ESPAÑA
KLARIUS
KONIKER
LEAR

LEITAT
LITEC (TECNOEBRO)
LUREDERRA
MAIER TECHNOLOGY CENTRE S COOP
MITYC
MMM
MONDRAGÓN AUTOMOCIÓN S. COOP.
MOVIQUITY
MP TUBOS DE GOMA
NIT
NÚCLEO
POLICÍA LOCAL DE ZARAGOZA
PRODINTEC
PROMETEO
RACC
ROBERT BOSCH
SAFT
SAINT GOBAIN CRISTALERÍA
SEAT
SERNAUTO
SICE
SIDENOR I+D
SIEMENS
TECNALIA
TECNOLÓGICO FUNDACIÓN DEUSTO
TEKIA
TEKNIA
TEKNIKER
TELEFÓNICA I+D
TELVENT
TENNECO
UNIV. POLITÉCNICA DE CATALUÑA
UNIV. POLITÉCNICA DE CATALUÑA - CENIT
UNIV. POLITÉCNICA DE CATALUÑA - CITCEA
UNIV. POLITÉCNICA DE CATALUÑA - CSIC
UNIV. POLITÉCNICA DE MADRID
UNIV. POLITÉCNICA DE MADRID - GATV
UNIV. POLITÉCNICA DE MADRID- INSIA
UNIV. POLITÉCNICA DE VALENCIA - CMT Motores Térmicos
UNIV. POLITÉCNICA DE VALENCIA – CRIA

UNIV. POLITÉCNICA DE VALENCIA – Instituto ITEAM
UNIVERSIDAD CARLOS III
UNIVERSIDAD CARLOS III - ISVA
UNIVERSIDAD DE ALCALÁ - Dpto. Electrónica
UNIVERSIDAD DE BARCELONA - Fundación Bosch Gimpera
UNIVERSIDAD DE BURGOS
UNIVERSIDAD DE MÁLAGA-ESCUELA INGENIEROS INDUSTRIALES
UNIVERSIDAD DE MÁLAGA-GRUPO DE INGENIERÍA MECÁNICA
UNIVERSIDAD DE MONDRAGÓN
UNIVERSIDAD DE SEVILLA - Ingeniería e Infraestructura de Transportes
UNIVERSIDAD DE VALENCIA - INTRAS
UNIVERSIDAD DE VALLADOLID
UNIVERSIDAD DE ZARAGOZA
UNIVERSIDAD DE ZARAGOZA - CIRCE
UNIVERSIDAD DE ZARAGOZA - OTRI
UNIVERSIDAD JAUME I
UNIVERSIDAD REY JUAN CARLOS
UNIVERSIDAD ROVIRA I VIRGILI
YOHKON