EUROPEAN COMMISSION
ENTERPRISE AND INDUSTRY DIRECTORATE-GENERAL

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European strategy on clean and energy efficient vehicles

Synthesis of stakeholder comments

On the basis of the Work Programme for 2010 the European Commission has foreseen to publish a Communication on green vehicles setting out a comprehensive strategy for clean and energy efficient vehicles that will maximise the decarbonisation potential in road transport.

In order to prepare this Communication the European Commission has invited stakeholders to several public hearings and distributed a questionnaire.
The stakeholders were asked to make written contributions to the European Commission on the basis of the questionnaire.
The Communication on clean and energy efficient vehicles will be drafted on the basis of the summary of answers to the questionnaire provided by stakeholders.

We hereby present a summary of written contributions addressed to the European Commission to form the basis of the Communication on the European strategy for clean and energy efficient vehicles. The answers of the stakeholders are sorted by question formulated in the questionnaire by the European Commission.

Question 1: Should the vision agreed in the CARS 21 mid-term review be now adjusted (i.e. 2020 perspective of improved combustion engine's market dominance combined with growing market penetration of electric and hydrogen vehicles and hybridisation conceived as bridging technology and 2050 perspective of transport decarbonisation)

Mid-term review

There is a majority of stakeholders convinced that the CARS21 mid-term review vision could be maintained, especially owing to the fact that the internal combustion engine would remain the dominant propulsion technology.
Those stakeholders who would like to maintain the vision of the CARS 21 mid-term review think it is highly unlikely to see more than 10 % of the market occupied by electrical vehicles (EVs) be they PEV (plug-in electrical vehicles), BEVs (battery electrical vehicles), HEV (hydro-electrical vehicles) or FHEV (fuel-cell hydro-electrical vehicle).

In favour of current vision of mid-term review:

ACEA points out that car manufacturers are facing the cumulative costs of regulations, and the additional activities necessary to contribute to sustainable transport mobility.
Furthermore bearing in mind the effects of the economic crisis, the vision of the CARS 21 mid-term review has become all the more ambitious.

According to CLEPA evidence from the last years suggest that ICE technology has been able to achieve better results in CO_2 reduction than could be initially expected. Hence there is a strong opinion from certain stakeholders that the potential savings from driving ICE technology forward appears to be very promising.

EUCAR points out that on long-range distance travel there is so far no alternative to the internal combustion engine and hybrids are likely to fill-in some of that ground as of 2020. According to EUCAR **hydrogen and pure electrical vehicles will only penetrate markets at the earliest by 2030**. Manufactures are however already exploring the improvements of ICE, hybrids, alternative fuels, hydrogen and battery-electric vehicles in parallel.

According to Renault from today's economic perspective combined with increased public concern for climate change issues, reflected in the EU climate package, the car industry is now facing increased pressure for sectoral reorganisation in order to maintain its competitiveness in the decades to come.

Better Place however mentions a report by which **17% of vehicles would be EVs by 2020.** Therefore the vision of the CARS 21 Mid-Term Report should be adapted accordingly to growing market penetration by EVs. Evidence for this includes the increased display of EV models since the Paris Motor Show 2008, and the difficulty for government and society to deal with sudden increases in oil and gasoline prices.

In favour of changing vision of mid-term review:

Other stakeholders argue that the vision of the CARS 21 mid-term review needs to change now to allow a rapid boost to R&D to remove obstacles to battery technology. Furthermore they ask for government measures such as standardisation of batteries or whole-vehicle type approval as well as facilitating investment in charging infrastructure for batteries and hydrogen. A rapid boost is also necessary in the area of power grids – aiming at so-called smart grids – to establish technological, reliable and safe charging and billing of electrical vehicles. According to Better Place smart grids reduce CO_2 by charging EVs intelligently and at the same time making it easy for EV owners to charge vehicles during off-peak hours.
Greenpeace suggests a review of the CARS 21 mid-term review as emissions by automotive vehicles should not exceed 80g CO_2/km by 2020 and not exceed 50 g CO^2/km.

The European Association for Battery Electric Vehicles considered that the vision needs to be adjusted to account for the future car market. This market would consist of a mix between BEVs for urban use and EREVs for long distance use.

The European Metalworkers' Federation (EMF) considers that the current economic crisis would mark a stronger drive towards renewable technologies and that the CARS 21 mid-term review should therefore be modified.

Perspective 2050

Few stakeholders looked towards the situation in road transport from a 2050 perspective.

For the 2050 perspective of transport ERTRAC underlines that demand for fossil fuels would maintain its levels, while being constantly complemented by renewable energy resources in the transport sector. Increased urban transport would result in a rise towards greater electrification and the use of smart grids. Societal changes, such an increased urban and at the same time elderly population would result in a more comfortable mobility ensured by inland tri-modal transport (rail, road, water) of which the first two would draw heavily on an increased electrification.
Other stakeholders point out that full electric vehicles would be fully commercial by 2050.

Transport and Energy believes that by 2050 decarbonisation of transport should reach at least 80%. Interim targets would be necessary every ten years in order to fulfil this overall objective.

Question 2: What is the potential of different clean automotive propulsion technologies (improved fuel efficiency, hybridisation and alternative powertrains) for contributing to decarbonisation objective in short medium and long term?

There is a strong opinion that the ICE (internal combustion engine) will remain dominant until 2020, not the least due to the remaining potential of improvements.
Technological advances such as engine downsizing, transmission improvements, variable valve timing, homogeneous gasoline direct injection will enable certain automobile manufacturers, such as Renault, to reduce CO^2 emissions up to 30%, still in the 2015 time-frame.

Suggestions in favour of ICE:

Among these possible improvements, one should mention weight-reduction, while the challenge here is not to trade-off these innovations against reduced safety in the vehicle.
The cost of further improving ICE technology will however continue to rise, as this technology is already highly developed, with most progress still lying in the area of fuel efficiency.
There is a large variety of alternative technologies and fuels available. It needs to be noted that a large majority of stakeholders continue to be in favour of a technologically neutral position and that no commitment to any single option should be taken prematurely.

Beyond engine improvements one could also state aerodynamics, tyre-rolling resistance, electric power steering and other potential technologies to add to CO_2 reductions such as heat recovery, the installation of photo-voltaic panels etc.

Suggestions against ICE:

Some stakeholders believed that stronger reductions in decarbonisation could be envisaged.

The Basque government consideres petrol engines to have a residual improvement potential of 20% and diesel engines of 10%.

Transport and Environment believes that a focus of improving ICE-vehicles should be on light-weighting and engine-downsizing. In view of the emission target of 95g CO^2/km appearing to be a realistic target, the reduction potential was still considerable.

Available alternative fuels

Biofuels are seen as a long-term solution by some stakeholders. On first generation bio-fuels there is a clear reservation that the EU first of all needs to agree on a sustainability criteria. Second generation biofuels are generally welcomed as a viable alternative fuel. However these types of fuels would still require stronger investment and research in order to realise this long-term option.
The overall acceptance of already available alternative fuels such as CNG, LPG and biogas depends on the willingness of distributors to install adequate infrastructures.

Ebio points out that it would further the acceptance of biofuels, if European norms were established next to the already existent E5 norm. **Engines should be capable of allowing the use of ethanol blends beyond E10, even up to E80.**
FIA considered that second-generation biofuels as propulsion technologies will be able to cover 20% of all vehicles.

According to NGVA, CNG is a better bridging solution than other biofuels, as it can also be produced from urban waste to forestry biomass and due it molecular structure it could also be used in urban heavy transport. CNG, especially biomethane, can be both used to power engines but also to provide energy to the natural gas grid. **By 2030, based on studies, biomethane could provide 15% of the EU energy base.** In terms of infrastructure, pipelines and biomass plantations would be needed alongside each other.
Green Corridors, transports networks using a fleet of vehicles run on renewables would be an interesting future perspective and would contribute to CO_2 reduction.
Greenpeace however believes that there is only a limited amount of sustainable biomass available and that a shift from fossil fuels to biofuels is not viable.

Hybrids

Hybrids are seen as the bridging technology between the ICE and FCEV and BEV. **There is however still some potential for in the medium to long-term of a reduction of 35 to 50%** compared to current emission levels. In conjunction with Better Place, Renault committed to put EVs with switchable batteries to the test in Israel and Denmark by 2015. For now the incentive for developing further in hybrid technology is the fact that a full hybrid would allow a higher range in terms of distance than current battery-powered vehicles. For instance currently there is improvement on the transition from full- and mild hybrids towards lithium-ion battery technologies. Better Place also points out that **ICE-technology was nevertheless reaching their limits** and that the difference between highly-efficient hybrid gasoline or diesel vehicles compared to an EV was marginal.

According to Honda it is in particular electric powertrain design and on-board electricity management, which are key to hybrids as a bridging solution towards a truly electrical vehicle. If hybrids are made more affordable to the public, EVs will also garner stronger acceptance by consumers in the future. Honda puts forward its investment in solar cell development.
NGVA however considers hybridisation to have been an expensive technology to date, which has not kept its promises.
The Dutch Ministry of Transport points out that **battery standardisation was not a priority in the short-term** and that development in technology should be allowed to mature before rushing ahead.

Hydrogen

Hydrogen-electrified vehicles are likely to see a limited market-share in the short term. ACEA believes that all problems of hydrogen electrification cannot be solved right away and that the ultimate success of the technology would first and foremost depend on the acceptance by the customer.

The right way forward would be to take government, industry and science institutes onboard, and coordinate development in this area to successfully bring these to the market.

CLEPA sees hydrogen so far as inefficient, owing to the problem of energy storage.

NGVA however considers the **mix of hydrogen and natural gas as a viable option especially for use in buses and trucks.** Hydrogen production, storage, compression and logistics should be continued to be explored. Overall hydrogen/CNG mixes still provide the same power as natural gas on its own. EHA considers that CO^2 reductions can be achieved on CNG vehicles without having to make expensive modifications to the engine. Type Approval of hydrogen powered vehicles should include a reference to CNG/H2 mixtures.

EHA considers that short term action on hydrogen refuelling infrastructure is a large pre-requisite for the roll-out of HEVs. **In the current Review of IPPC Directive a larger storage of hydrogen should be allowed in order to make functioning of refuelling stations possible**.

Battery-electric vehicles

Some stakeholders think that electrical vehicles and their different types of propulsion models (BEVs, EREVs or PHEVs) are likely to see a limited market-share in the short term vehicles in the market.
As opposed to hydrogen-electrified vehicles**, EVs are likely to be a real alternative in urban transport, in particular in congested areas** due to limited range used in this context by the vehicles.
Other stakeholders are more optimistic energy efficiency of EVs especially when taking power generation into account. Other stakeholders raise safety concerns over EVs, batteries and power generation.

<u>Continued ICE-dominance:</u>

According to ACEA, in the perspective of 2020, due its limited range, the **EV however will not supplant the ICE, which in the case of long-distance travel so far has no alternative**.
Better Place points that EVs market penetration will increase more drastically until 2020. Hydrogen and Fuel Cell vehicle technology was however not advancing fast enough, and EVs would quickly outgrow these as the only viable solution for sustainable mobility.

<u>Battery development and power generation:</u>

According to other stakeholders however improvements on **ICE are too limited and that tests with plug-in hybrids could already reach emission levels of 42 g CO^2/km, which is less than half of the required 95 g CO^2/km.** Moreover a PHEV using a down-sized Li-Ion battery could already achieve the same range and driving comfort as an ICE. This type of battery would also cancel out the currently expensive full battery.
Furthermore a BEV powered by coal, has still lower CO^2 emissions on a well-to-tailpipe basis than a comparable gasoline powered vehicle. The hypothesis that BEV's only transfers the problem of high-carbon emissions elsewhere is therefore not valid.

Better Place seconds this position and explains that even marginal energy production, meaning hours during the day when demand is highest, in the late afternoon and early evening, powering an EV would still be as emission-friendly as the most efficient ICE cars. **The average mix of energy production, including renewable and fossil energy resources, outside of peak hours would push the emissions of an EV to levels 40-60% lower than those of an ICE vehicle.** A fair assessment between these two types of vehicles would need to take average electricity outputs into account.
Nevertheless in the longer term the described PHEVs or eventually BEV's should be powered by energy generated from renewable energies. Due to the intermittence of solar and wind power the vehicles can serve as a storage buffer.

Safety:

According to ORGALIME the first technological solutions to allow a two-way switch, EVs also being able to store energy and giving it back to the grid will be available by next year.
To enhance safety in the future, it may be a good idea to develop intelligent plugs, which can be switched on and off, in reverse mode and remotely.

Again, if a BEV or a PHEV would run on renewables, the gap in terms of CO^2 emissions between a gasoline powered engine and the vehicle described above would grow even further.
However the best management of so-called **smart grids**, making the best use of renewable energies and powering the entire grid at given times still need to be defined.
ORGALIME also points out that a lot has been said about infrastructure changes as a pre-requisite for the introduction of EVs, however these **new vehicles require less maintenance, no oil changes, air filters or emission tests.**

Fuel cell vehicles:

Fuel-cell technology is still considered to be waiting for its breakthrough in a 2030 perspective. The current hydrogen generated process is estimated to achieve a reduction in CO^2 emissions by 40 %. Depending on the development of renewable energy resources to produce hydrogen, this may well reach 100 % in the future. The 2030 perspective is not specified in particular.

Daimler mentions it had started small-scale production of a fuel cell vehicle (200 B F-Cell) and that a number of automobile manufacturers are already looking at bringing Fuel Cell vehicles to the market by 2015.
Daimler further points out **that Fuel Cell vehicles were more sustainable than HEVs**, because the latter also had to deal with NO_X emissions, while fuel cell vehicles were truly zero-emission cars. Another advantage of the fuel-cell vehicle was its driving range of 400 km compared to a BEV, where driving range so far were only between 100 – 200 km.
Honda also plans Fuel Cell electric vehicles as the final zero emission vehicle. For this the company plans to create a solar-powered refuelling infrastructure.

What is the decarbonisation potential of the complementary measures in the short, medium and long term (e.g. guidelines for eco-driving, application of Intelligent Transport Systems) and how reliable are these potentials.

Stakeholders generally support a wide range of complementary measures. However there is disagreement about the actual impact of complementary measures on CO^2 reduction. There is also some concern that complementary measures may divert the attention from achievable technological engine improvements.

Integrated Approach:

The **Integrated Approach** is often quoted by stakeholders as a means of lowering CO^2 emissions, while achieving a **good cost-to-society ratio**. This addresses complementary measures to CO^2 reduction outside of powertrain improvements.

Other stakeholders such as T&E and Greenpeace disagree with the idea of using the Integrated Approach, as it diverts the potential of improvements in ICE and EV-technology towards these complementary measures.

ITS:

EUCAR points out that **different ITS systems and infrastructure measures are following different, sometimes contrary goals**. Therefore the real scope of ITS and specific needed to be analysed carefully. Honda mentions that traffic management tools had already proven their ecological value and should be continued to be supported.

Greenpeace however considers that automobile manufacturers should concentrate on supply and uptake of clean and energy efficient vehicles. **Other measures such as eco-driving and ITS should not be considered**. They should definitely not replace energy-efficiency improvements in vehicles.

Infrastructure measures/Services:

Transport & Environment believes that speed limits for vans should be set at 100 km/h. Intelligent speed limitation and use of gear-shift indicators would allow additional cuts in CO^2 emissions.
Eco-driving, traffic management, use of sustainable biofuels measures to improve road infrastructure and an increasing role for ITS need to be seen as a path towards reducing CO^2 emissions, and hereby complementing improvements in propulsion technologies.

The Basque government considers that public transport services should become a more serious priority. Sustainability in transport should also be **considered to be achieved through coercive measures**.

Technology/Eco-Driving:

ACEA has called to maintain 'the fair assessment of the likely CO^2 reduction' as it is outlined in the CARS21 Mid-term Report.
The Japanese government currently estimates infrastructure measures to help to reduce CO^2 by 12% in its current programme.

FIA points out that gear-shift indicators (GSI) can help to reduce fuel consumption to a large extent, but that the market would remain limited. **Eco-driving would be able to reduce fuel consumption between 15 - 25% on a short-term basis.** Over the period of one year fuel consumption would only be reduced by 4 - 8%.

Question 3: What are the implications of new propulsion technologies in a lifecycle analysis perspective as regards vehicles, and in a well-to wheel perspective as regards energy supply chains?

The importance of a full-life cycle analysis in a view to new propulsion technologies is generally recognised by stakeholders. The definition of where the "well" in well-to-wheel starts differs however. Moreover a more nuanced approach is taken to explain the shared responsibility of energy-efficient and sustainable production.
Certain stakeholders concentrate more strongly on power generation, while others look at grid management and its impact on the life-cycle analysis.

Well-to-wheel calculations:

ACEA for instance states that the life cycle already begins with the extraction of the raw materials and takes a closer look at the production processes used by primary industries, i.e. at the moment that raw materials are produced. In this sense material and energy suppliers need to be obliged to take environmental impacts stronger into account. Alternative fuels and new innovations mean that fuel and electricity providers need to be ready to create the necessary infrastructure.
On the other hand given the overall complexity of well-to-wheel calculations and processes, ACEA points out that one could not opt for one particular technology, which fared far better than other alternative fuels or propulsion systems.

Bosch conveys the point that a well-to wheel approach needs to focus mainly on the question of the sources of electricity generation. Electric mobility would need to go hand in hand with emissions reductions. Stating the German energy mix as an example, **an EV today would still have an emission rate of 120g CO^2/km on a well-to-wheel basis**, meaning that there are ICE-vehicles available today already with less emissions than an EV.

Renault explains that already today it is estimated that an EV is twice as efficient as an ICE from a well-to-wheel perspective and that this is likely to be reduced to a third by 2030, depending on developments of electric grids and the source of their power generation.

EHA points out that a WTW analysis revealed that renewable energies from wind, solar or nuclear energy through water electrolysis could power vehicles with zero emissions. Fuel Cell vehicles powered by hydrogen, **if hydrogen was produced by natural gas achieved half the emissions of an equivalent ICE-vehicle**. A fuel cell vehicle powered by hydrogen drawing on the actual European mix of energy achieved better results than a BEV drawing energy from natural gas on a WTW perspective.

ERTRAC states that taking into account today's **EU-27 power-mix** accounts sets the emissions for an **EV in range between 85 to 105g of CO^2**, while for an ICE it is today between 145 to 215g CO^2.

Transport and Environment points out that applying a life-cycle analysis still did not cancel out the fact that the in use-phase of a car strongly outweighs the impact of the manufacturing and the end-of-life phase.

Infrastructure/End-of-life batteries:

Honda mentions its Solar Hydrogen Stations, which were already compatible with smart grid, using off-peak electricity.

Orgalime points out that recycling methods and disposal of batteries for EVs still need to take shape and that a separate policy was necessary as compared to other types of batteries. EV batteries will be heavier and include a larger variety of chemicals than conventional batteries covered under disposal regimes.

Power grids:

Eurelectric considers the current grid structure capable for connecting a large amount of EVs, but that an intelligent connection between car and grid, in terms of cost-efficiency would still need to be developed.

According to Better Place, over time power grids would continuously increase their percentage of energy generation from renewables, as **power grids would adjust to the limits of 2020 cap**.
Better Place points out that the targets of electricity production per country would need to be reviewed by taking into account future average and marginal (peak-time) electricity production. Many CO^2 reduction plans use 2020 targets on the basis of today's electricity production, which puts the EV at a disadvantage.

Other:

ETRA points out that in the beginning of 2009, a recharge of a 200-watt electrical bicycle cost 172 times as little as an ICE-vehicle travelling the same distance. Even when the battery was charged with coal, on a 100 km-trip, on a well-to-wheel basis this would account for only 0,3 kg of CO^2 for the total distance. As opposed to EV batteries, batteries used by bicycles are already covered under the WEEE Directive.

The Committee of the Regions recommends making R&D funding available, which has already been allocated to the Green Car Initiative to every step of the lifecycle.

What are the reserve implications in introducing innovative propulsion technologies?

Some stakeholders underline the need for the EU to create and maintain a **level playing field for market access to third countries**. Free market access would need to be ensured by doing away with duties, quotas or all kinds of non-tariff barriers.

ACEA points out that in the long-term the EU would need to establish a more comprehensive raw materials strategy in order to avoid negative impacts for European industry.

Better Place states a study of the University of California stating that by 2030 oil imports would shrink by 3.7 million barrels per day.

Turning to infrastructure development, Better Place thinks that **charging infrastructures should be in place first, to enable a wide introduction of EVs**. It should also become more convenient to switch depleted batteries to extend range.
Lithium supply for batteries according to US Department of Energy would remain abundant and would only reach its peak by 2035. By 2035 EVs would have penetrated the market place widely, at which point recycling technologies of lithium batteries could meet shrinking supplies. However recycling infrastructure would need to be improved.
There should be no concern about lithium reserves as **commercialised exports are already existen**t from Chile and Argentina, and these two countries would cover the given period.

FIA believes that due to the scarcity of minerals used in batteries, after a short hype for BEVs, this type of technology would be phased out.

Question 4: What are the state of play and the future scenarios of technological developments in alternative powertrains (electric and hydrogen) and their market penetration?

Opinions and choice of topics on this point vary highly between stakeholders.
Certain stakeholders discuss costs of creation or integration of new infrastructures, while others considered the potential and the pace of market penetration of alternative energies and alternative fuels. There was also debate on the practicality and choice for charging modes, billing and metering of electricity to EVs.

Market potential/outlook for alternative propulsion systems/alternative fuels:

According to many stakeholders it is realistic to assume that the market-share of EVs is likely to be around 3 to 10% by 2020 to 2025.

ACEA considers **full scale introduction of hydrogen vehicles will only be possible in the long-term**. There are for now at an early experimental stage. Moreover affordability, technological ability, available infrastructure, standardisation and customer acceptance are the main issues for success for any other form of alternative fuel or alternative propulsion technologies.

Honda points out that in the short-term BEVs could be made more attractive through the possibility of making quick charging or battery swaps available to enable long-distance travel with BEVs. Hydrogen however appears to be best long-term solution bearing in mind that there is quick refuelling possibility, pending the equivalent infrastructure, and no battery swap necessary.

Bosch considers 9% of vehicles will be either hybrid, EV or PHEV by 2020.
The actual future technology would lie with fuel cells. In the coming years, in which ICE technology would still play the leading role, Bosch proposes to do more to promote also diesel technology world-wide, as well as the eco-technologies.

Other stakeholders pointed out that a major risk to the **introduction of a full electric vehicle is 11,000 US-dollars at its initial level**. This means that the battery itself accounts for 75% of the vehicle. On the other hand the battery for a smaller hybrid-engine would only cost 100 US-dollars. Furthermore in terms of the vehicle purchase price, the overall savings of an EV or hybrid, considering the annual rate of savings to be 2100 US-dollars, compared to a conventional ICE-powered vehicle could be compensated within 4 years.

World Auto Steel points out that sustainability so far was limited to the area of tailpipe emissions, while other sectors contributing to a vehicle's life cycle were disregarded. A complete well-to-wheel analysis was therefore necessary to avoid any potential increases in other sequences of the life-cycle. Paradoxically, if a complete life-cycle analysis was not applied a zero amount of tail emissions may lead other industry to become actually less sustainable.

The European Association for Battery Electrical Vehicles mentions that market penetration of pure EVs will be rather slow and difficult to estimate. BEVs on the other hand would be

operational for commuter markets, EREVs were already in place to penetrate the family car markets.

Further developments towards raising this percentage according to Transport and Environment believes that CO^2 targets should be the overall objective for the policy of the Commission and that a discussion of the variety of available technologies should not be the major focus of discussion.

Recharging infrastructure:

EHA considers that BEVs will continue to be expensive over a ten-year period. **Recharging infrastructures for BEVs of 50kW or 100kW are the main obstacle**. It would therefore be more interesting to roll-out fuel cell vehicles in the short term.
Fuel cell vehicles also have a better performance in terms of production and distribution capacity. Despite energy losses in hydrogen-fuel cell vehicles, the price of batteries for BEVs still makes the fuel-cell vehicle more cost-efficient.
Moreover the introduction of hydrogen service stations would not be as complicated as anticipated. As has been the case with CNG and LPG, the existing service stations, **hydrogen dispensing systems could be deployed here as well**. The investment cost per vehicle for installing infrastructure is estimated at 1700 Euros today, predicted to fall to 1000 Euros in 2020. In this time-frame the cost for hydrogen to the end-user is not much higher than is the case today for gasoline.

CECRA points out that a battery recharge station would cost a total of at least 800,000 Euros while the average cost of a fuel gas station would only amount to 60,000 Euros.

EMF suggests that the **EV could not simply replace the ICE-vehicle or the hybrid**. Especially in rural areas without access to recharging infrastructure and due to lack of public transportation the ICE-vehicle would remain indispensable.

Charging modes:

Stakeholders concerned with the price of electricity and therefore with the price of charging the battery of a vehicle, point out that any operation should be done during off-peak hours. The reason is that during these hours, **at night-time, electricity is usually drawn from renewable energy resources.**
EDF also points out that making best use of such available resources would limit necessary investment and that customers would need to be encouraged not to use charging points during off-peak hours. Furthermore charging spots should be best installed in office depots and at home, as cars spend 90% of their time in parking spaces**.** Fast charging of vehicles, during peak-hours would also be possible, but would incur higher costs.
Indeed Better Place thinks that European drivers were likely to hook their cars to recharging infrastructures during peak hours.
As a future system EVs may also be able to find the most adjacent parking point with charging capability in order to make mobility even more efficient and clean.
Better Place points out that if the **grids were intelligently managed, no new distribution system of energy was necessary**.

For Eurelectric standards remain the main tool to enable mass commercialisation of EVs.

EHA mentions that hydrogen should be researched in a way to be able to store and buffer energy from off-shore wind parks and to balance grids. This should be considered as part of the programme for the **Joint Undertaking for Fuel Cells and Hydrogen**.

Billing/Metering:

EDF finds that another argument for home and office charging is the fact that it makes billing more cost-effective**.** It is a means of including parking cost in the bill and not separating the two.
The way the information is transmitted from the vehicle via the charge spot to the information system should be hands-on, easy to use and interoperable for the entire EU. It should already be up and running to take smart grids and smart metering into account.
Eurelectric points out that smart meters and smart grids need to be developed first in order to allow security of supply for the mass market. ICT solutions need to be in place to put in place procedures and protocols and privacy rules and laws would need to allow grid operators of being able to monitor battery capacities.

According to the German solar energy associations a truly smart billing system would mean that the logistic solution would be built into the vehicles themselves. Arguments in favour of this method are that they simplify billing, ensure data protection while being **transparent to the consumer** at the same time, and in turn this simplified taxation.
Using different charge spots will make it difficult for a customer to keep track of small payments made, and multiple bills from several energy providers reduce transparency.
Moreover one need to install smart meters everywhere, meaning an upgrade of every single power socket. Having the smart meter installed in the car means that existing infrastructures do not have to replaced or updated
Better Place underlined that networks standards should make **interoperability** possible and that non-discriminatory access should be possible to all networks.

On-board logistics would allow also using existing technology. GPS systems could be upgraded in order to communicate metering information.

What are the major risks and opportunities associated for different stakeholders?

Attention by stakeholders again diverges on several issues here. Some are concerned about the risk of loss of markets and competitiveness if the switch towards EVs is not done properly. Certain stakeholders scrutinise the adaptation of energy supplies and grids, while safety of electrical devices and installations is a concern to others.

Transition of industry/markets & competitiveness:

According to ACEA the move towards new technologies can be seen as a challenge as well as an opportunity. With a constructive policy framework, the European automotive industry could take over manufacturing leadership, which would also have a positive impact on competitiveness and employment.

The risk is that for the moment it is the automotive industry, which takes a **high-risk on investment without a clear idea on return**. Without demand by customers for vehicles with new technologies, there will be no return on investment. This is likely to happen, if there is no sufficient infrastructure in place for EVs, which make it impractical to own such a car. This risk is likely to come from insufficient or a lack of standardisation.
Furthermore if overall energy production fails to make a switch towards renewables, there is likely to be a lack of potential for CO^2 savings overall, and therefore the overall goal of the switch towards new technologies would be missed as well. **Without CO^2 emissions reduction there is a little hope for market uptake**, which is necessary to uphold profitability and employment for industry and affordability for customers.

The challenge of cutting greenhouse gases (GHG) and pollutant emissions, increasing energy efficiency, and lowering noise and solving congestion problems need to be taken on, not simply reduced to improving ICEs by the automobile companies. The risk is not simply non-compliance by missing emission targets, but also **running into market-barriers and a loss of competitiveness**. One example is that in order to meet the challenge of rising fuel costs, automotive companies need to take electrification on board.
Finally EU member states were likely to put in place varying regulations, which could easily result in market disruptions. Differences with international markets could furthermore disrupt cost-efficient exports of EVs.

CIVD points out that engines of caravans could not be downsized and that alternative powertrains could not replace this problem either. As passenger cars also prove to be less efficient as towing vehicles in the future, the touring caravan industry would face a downturn.

Power grids and safety:

ORGALIME points out that there are safety risks linked to the action of hooking up an EV to an electric power-grid. Users of EVs would be confronted with much higher rates of electricity than is the case with other household appliances. As EVs are also capable of storing electricity, consumers would also need to learn how to reverse flows, which bears an additional security risk, especially when the wrong plug is connected. Other risks can come from damaged cables or from objects in the plug. CECRA called for a **uniformity of safety norms** especially for load system installations.
It was therefore necessary to find a process between an ongoing development and manufacturing process of batteries and plugs for vehicles on the one hand and standardisation to insure coherence across electricity grids and borders.
ORGALIME proposes that there should be a clear unmistakable system by which the plug on the one side and the cord and the connector on the other can be easily distinguished.
Because safety in an electrical power-grid and safety in a vehicle are two very different categories harmonisation throughout the EU-27 should occur as soon as possible.

On electricity grid management ORGALIME proposes that the best of managing the loads is to reinforce the electrical distribution grids. During certain times of the year these innovative grids should be able to balance out higher demand.

The German solar energy associations points out that a major risk to successful smart grid application would come from the fact that only the owner of the infrastructure would reap the economic benefit, profiting from stable grids and cost-efficient regulation of the power-load.

The EV-owner, however, would have economic cost due to low battery life and reduced range of the vehicles.

What will be the economic, societal, employment and environmental impacts brought by these developments?

Stakeholders generally agree that new vehicles, infrastructures and devices also demand the aftermarket to adapt and to adapt training of personnel having repaired ICEs, while now having to switch to battery-powered vehicles.

ORGALIME points to the need of providing proper training to garage technicians for handling electrical vehicles, as the type of repairs and the safety measures differ strongly from those used in ICE vehicles. It would be necessary to provide funds for education for this particular work-force to reach at least the level of electrician.
Looking at metering and charging of electricity to EVs, any cost incurred by the consumer, should be visible immediately.

CECRA suggests that development of alternative technologies would not lead to a gap between the manufacturer and the aftermarket operator. The aftermarket operators would remain neutral in terms of technology. However one would need to take into account **strains on the supply chain for electrical resources**, as this would remain on a just-in-time basis.
New needs for developing skills and training in the areas of sales, after sales and staff/mechanics qualifications are obligatory to prepare for the business model of the EV.
This also implies that new **financing incentives for training** were needed to fill gaps skills gaps to new professions such as a Specialist for High-Voltage Systems in Vehicles.
It would nevertheless require a certain amount of EVs on the market in order to make it worthwhile for the aftermarket to undergo a large re-education of its working staff towards EV and hybrids. Further development of ICE-technology is therefore recommended.

EMF expects that because not all workers in the manufacturer's and aftermarket industry could adapt to new technologies, part of these subsequently move towards other industry sectors. This type of job mobility and transformation of careers should be encouraged through policy.

Other:

Better Place mentions a report by the American Lung Association, which estimates a reduction in health costs by 2.2 billion US-dollars per year for the introduction of EVs in the place of ICE-vehicles. Better Place further states that according to the University of California by 2030 EVs would create 350,000 new jobs, reduce emissions up to 62% of 2005 levels.

Question 5: How can a trade-off situation be avoided where electrifying the power train would reduce or reverse improvements made in conventional technologies in the framework of existing and upcoming legislation on the CO^2 emissions of road vehicles?

There is a large variety of issues identified by different stakeholders as possible trade-offs for the future development of the electric vehicle ranging from R&D to super-credits to taxation.

Competition and cost-effectiveness remain the drivers of the European car industry. The car industry is the largest investor in R&D on emission-reducing technologies. It is therefore necessary that other stakeholders also take their responsibility to enable emission reductions. Especially due to the large amounts of funds spent on R&D, the European automobile industry faces **cumulative costs** from regulation and the **shortage of financial resources** needed for the roll-out of new technologies.

EUCAR points out that results of research should not drive the automotive sector towards a specific technological solution and neutrality should be maintained. Instead the priorities in terms of research should be established as either environmental, economic, societal or safety-related. One should also be prepared that some of the technologies discussed will not succeed in the marketplace.

FIA believes that a trade-off could be avoided by adopting an Integrated Approach of taking into account technical and emission related parameters.

Honda points out the manufacturers are required by law to invest heavily in CO^2 reduction anyway. Therefore the regulations should not be too stringent on advanced technologies, as to push manufacturers away from the potential of ICE technologies.

EHA proposes to introduce quotas, as is the case in Italy today for **CNG/H2 mixtures in buses** to promote clean and fuel efficient vehicles. The revamping of the Energy Taxation

The European Association for Battery Electrical Vehicles simply states that a trade-off could be avoided by purely concentrating on EV technology.

CLEPA considers that a trade-off situation between ICE and EV technology development can best be avoided by intelligent taxation.

Better Place mentions **EU 20/20/20 climate goals** that the EV is an imperative solution in this respect to reverse negative effects of climate change.

The Basque government mentions the complexity of life cycle analyses and the impact on the calculation of emissions on a well-to-wheel basis. As strong variations exist between member states, an effective method of calculation should be found.

Greenpeace considers super-credits for car manufacturers who sell BEVs as a trade-off. Each BEV sold would allow the same manufacturer to sell another vehicle on an ICE-basis with emissions totalling at 260 g CO^2/km. This scheme should therefore be scrapped.
Transport and Environment also points that super-credits translate into the more you sell EVs the more oil be used and CO^2 emitted.

Question 6: What actions should be taken at regional/national/European or international level to promote technology development and market uptake of alternative power trains (electricity/hydrogen)?

Stakeholders generally agree on the need for stronger regulation and standardisation to create coherence in the market place and to set an encouraging scene for investment. There are several examples of ideas for more efficient Research and Development and debate on how to best achieve the most efficient and rapid development of the market place via taxation.

Regulation:

According to ACEA the Commission and the EU as a whole support the move towards alternative technologies however this also means that there is a need to be supportive with an action plan towards the automobile industry's efforts to remain competitive in alternative power train technology and fuel efficiency.
It should be noted that governments in **China, the US and Japan have made significant efforts in supporting their domestic industry**. The purchase for Hybrids, for instance is subsidised by the US government.
Better Place claims a more proactive top-down approach in order to prevent technology leadership on EVs passing on to China. Technical difficulties should be removed and national demand-side measures should ensure greater market penetration.
National policies on EVs need to be introduced in a coherent way and that an all-European framework is needed. **Overall 1 billion Euros have already been invested EU-wide**, but without a common strategy other countries and regions would take the lead.
However there are already encouraging national policies in place. In certain member states, every newly constructed building should also be able to provide for charging points, so that users of EVs can hook up there car during prolonged parking periods and week-ends.

Research & Development:

According to ACEA impact assessment and early stakeholder consultations should be maintained. These should include cost-effectiveness and realistic market assessments and sound objectives. This should eventually aim at providing a technologically neutral approach while maintaining affordability of future vehicles. Again the use of the Integrated Approach should achieve environmental objectives with little societal cost.

Other stakeholders point out that the problem of the higher upfront cost to be paid by the customers needs to be met with government incentives in order to allow market penetration.
Bosch on the other hand points out that using R&D was a better way of achieving long-term success, rather than relying on short-term subsidies. However European suppliers and manufacturers, who carry the effort of innovating the industry should not deal with an increase of taxes.

CLEPA points out that many issues of congestion, road infrastructure and mobility are regional issues and therefore regional governments and regional funding should be considered. **Standardisation and efforts in R&D should be dealt with at EU-level, while environmental regulations and the sustainable and fair use of energy resources should be dealt with at an international level.**

EHA states the example of the European Regions and Municipalities Partnership for hydrogen and fuel cells, which has enabled the establishment of markets, demonstrations of fuel cell applications and funding. In their words this could be improved even further by reviewing by offering market access to local actors to global markets, by harmonising local authorisation requirements, and by identifying key stakeholders of new industrial value chains.
Moreover local budgets should be allowed to meet the timeline of EU calls for proposals. So far these two elements have not been synchronised sufficiently.
On an EU level the **EU Clean and Energy Vehicle Platform** should be acting in a clearing process in order to facilitate communities in integrating zero emission vehicles into fleets.
In terms of infrastructure **TEN-T programme** and the **European Energy Recovery Package** should enable the construction of pipeline networks and hydrogen distribution.

In terms of R&D funding administrative burden should be eased, while fiscal incentives should enable charging infrastructures and the use of public parking spaces for energy-efficient vehicles for the same purpose. Better Place also mentioned the possibility of bus lanes available to EVs. ACEA mentions the example of battery cost being in the area of 6,000 – 16,000 Euros, which can outprice a certain number of customers already. Useful financing tools and bodies to improve this situation through targeted R&D funding from EU Framework Programmes and loans from the EIB.

According to EUCAR the cooperation on R&D between automotive manufacturers and suppliers can be done at a pre-competitive stage, where the technological basis is a shared good. It is at this point that funding is currently available under the **Seventh Framework Programme for Research** and the **Green Car Initiative**. The investment risk for companies is covered by 50%. This substantial and effective support for collaborative automotive research should continue at a sufficient level. Road transport and automotive research should also have a priority place in the Eighth Framework Programme for Research. As a recommendation there is still significant **administrative burden** in the current Framework Programme, which could be improved.

Taxation:

Other stakeholders propose that in the EU there is room for tax incentives to remove barriers towards easier market access. These fiscal measures could encompass tax exemptions for the purchase of EVs or hybrids as well as taxation for CO^2 emissions for more CO^2 intensive vehicles entering cities. Moreover **free recharges for EVs** could garner stronger public support as well as creating zones only accessible to zero-emission vehicles. These measures could also launch a drive towards more rapid fleet renewal.

Better Place also supports favourable energy taxation frameworks.
Greenpeace believes that CO^2 taxation needs to be accompanied by raising public awareness on CO^2 through labelling in advertising and vehicle showrooms. Increasing petrol prices by 10% could lead to a 4% decrease in fuel used per kilometre.

Standardisation:

Concerning safety regulations, ORGALIME points out the current level of safety achieved today would need to be maintained after the introduction of electrical vehicles.
Regarding standardisation, global standards based on EV-charging should be reached quickly through **ISO/IEC joint working groups**. Charging modes, plugs and sockets, metering and payments for electricity from power grids should be dealt with separately.
Reaching standards whilst bearing competitiveness in mind will be significant for European industry. In a word specifications of the infrastructure established and the requirements of the electricity grid should not govern the standards for charging.
EDF in this respect points towards the **Unified European Plug**, which needs to be economic, accepted in all European countries and, which satisfies all safety regulations.
The European Association for Battery Electrical Vehicles points out that charging with local standard plugs should still remain an option. The equipment, car and battery manufacturers involved in EVs technology should continue to benefit from incentives on R&D and plant development.
Beyond battery and vehicle safety, specific crash tests for EVs should also be introduced.

On load management of energy grids communication charging systems' capabilities should be standardised in order to allow for a first step towards smart grids and efficient electricity grid management.

Transport and Environment points to a necessary stronger top-down approach especially on standardisation to prevent power market players to define these among themselves.
Better Place welcomed the European Commission's decision for **mandating CEN/CENELEC EV standards**. Binding international standards for plugs and connecters between vehicles should be introduced.
Government should regulate consumer issues such as data security, privacy and roaming prices. All levels of government should enable deployment of EV infrastructures, without creating any obstacles to internal market. Favourable deployment of charging spots should be encouraged.

The European Investment Bank stated that 70% of current funds were dedicated to improving ICE-technology while 30% were supporting incremental hybrid and full-electric powertrains.

The Dutch Ministry of Transport reminds stakeholders that any national scheme of funding under state aid provisions would have to comply with regulations set by the internal market.

Written contributions were included from the following stakeholders:

ACEA	-	European Automobile Manufacturers' Association
BEE	-	Bundesverband Erneuerbare Energien e.V.
DGS	-	Deutsche Gesellschaft für Sonnenenergie e.V.
bsm	-	Bundesverband Solare Mobilität e.V.
CECRA	-	European Council for Motor Trades and Repairs
CIVD	-	Caravaning Industrieverband
CLEPA	-	European Association of Automotive Suppliers
EDF	-	Eléctricté de France
EHA	-	European Hydrogen Association
EMF	-	European Metal Workers' Federation
ERTRAC	-	European Road Transport Research Advisory Council
ETRA	-	European Two-wheel Retailers' Association
EUCAR	-	European Council for Automotive R&D
FIA	-	Fédération Internationale de l'Automobile
NGVA Europe	-	Natural Gas Association Europe
T&E	-	Transport and Environment

Basque Government

Better Place

Bosch

European Committee of the Regions

Daimler

European Bioethanol Association

European Investment Bank

European Association for Battery Electric Vehicles

Greenpeace

Honda

New Energy World IG

Orgalime

Renault-Nissan

World Auto Steel