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## Interview

### “Reducing Emissions to Zero”

From October 22 – 27, the FISITA 2006 World Automotive Congress will take place in Yokohama, Japan. One of the major topics discussed at the Congress will be the future direction of automotive powertrain technology. Daniel M. Hancock, FISITA President 2004-2006 and Vice President of GM Powertrain Engineering Operations, talks about the changes resulting from alternative fuels and advanced powertrain technologies.

**FISITA’s mission has always been to advance the technological development of the automobile. Can you give us a brief overview about the latest trends concerning alternative fuels and powertrain technologies?**

Automakers continue to stretch to develop vehicles that offer lower emissions, higher fuel economy and do this at a price that the customer is willing to pay. As different regional requirements exist, a broad portfolio of powertrain technology solutions is needed. There really isn’t a single silver bullet that satisfies all customers’ needs.

In the fields of fuel economy, performance and reduced emissions, advanced internal combustion engines and transmissions are continuing to be further refined and optimized. Examples of powertrain technologies that are available today include cylinder deactivation, cam phasing, charging, port deactivation, direct injection, diesel particulate filters, six-speed transmissions, and more. The combination with electrical power paths is leading to the development of various hybrid systems to satisfy customers’ needs. Going forward, those of us in the powertrain industry will build on these technologies and add additional technologies to provide even further fuel economy and emissions improvements.

Alternative fuels such as E85 ethanol, biodiesel, natural gas, and liquefied petroleum gas are available in the market today. As FISITA’s goals for emissions reduction and diversification of our global energy supply become more ambitious, it will lead to further development of additional alternative fuels.

In the long term, with the availability of a hydrogen economy, electrical propulsion systems powered by a fuel cell using hydrogen will be the ultimate solution. Significant technology developments are underway in order to achieve this goal.



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**At the moment there is a strong desire for clean Diesel engines on the European market, whereas US customers clearly prefer hybrid vehicles. What - in your opinion – will be the leading technology in Europe and the USA in the near future?**

The optimum propulsion system will vary depending on the vehicle application and the drive schedule of the vehicle. There are effective technologies to improve fuel economy and performance and reduce emissions for both diesels and hybrids as well as for gasoline engines.

Diesel engines have become fun-to-drive, high torque powertrain solutions in Europe. Combined with their outstanding efficiency and the taxation of the fuel, this has led to the diesel being the flagship powertrain in many European applications with an overall market penetration of about 50 percent. To comply with future emission standards, the complexity of the diesel powertrain needs to be further increased. While this will drive increased cost, the future market share for diesel engines in Europe is likely to remain significant.

In the US, where the exhaust emissions standards are more stringent and the gasoline engine is by far the dominant propulsion for passenger vehicles, hybridization of the powertrain is a very reasonable approach. Diesels have found good acceptance in the full-size, heavy duty pickup truck market.

I think that the market share of diesel and hybrid powertrains will both increase on a global basis. The dominance of one or the other technology in any given market will depend on how the requirements in the regions evolve. Again, there is no silver bullet; we expect these technologies to coexist in the market for some time.

**Toyota and Honda advance the development of Hybrid vehicles. In which way does this engagement affect the Asian market? How will this influence the strategy of European vehicle manufacturers?**

Toyota and Honda were both fast in introducing hybrid technology. However, a number of companies are very active in implementing their own hybrid strategies. BMW, Daimler Chrysler and GM combined forces to develop a two-mode hybrid – consisting of two electric motors plus one internal combustion engine – for cars, trucks and other vehicles. Today, almost all manufacturers are working on the introduction of hybrid systems in their respective markets.



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**Because emission-control legislations in Asia, Europe and USA differ in their focus, it is difficult for automobile manufacturers to develop “clean” powertrains for the global market. Do you see a chance to agree on a worldwide standard for these restrictions?**

Harmonization of testing methodologies could offer some benefits in terms of reduced costs to prove that vehicles meet various standards, while still allowing government flexibility to respond to their local needs. Global powertrains and global vehicle platforms offer manufacturers the opportunity to achieve economies of scale across larger volumes with the ability to customize for the demands of the local market - whether regulatory or customer-focused. All this helps to make cleaner, safer vehicles more affordable to the customer.

**As a neutral, non-governmental organisation, will FISITA participate in defining the main direction of automotive powertrain R&D?**

FISITA is working on a global basis and is providing the appropriate communication platforms with the FISITA Congress and leading experts from around the world to discuss the developments within the automotive industry. We will also continue to initiate ongoing technical discussions. At the FISITA 2006 World Automotive Congress we have over 40 technical sessions devoted to powertrain issues. In all, more than 170 global experts will be making presentations concerned with the optimization of existing SI engines, CI engines and transmission systems - as well as advancing the state-of-the-art in hybrid and alternative powertrains. FISITA's global network of societies means that we're uniquely positioned to bring the world's experts together in order to share knowledge and advance the debate around future powertrain solutions.

**Regarding environmental, production and safety aspects: Do hydrogen combustion engines offer more or less opportunities compared to fuel-cell systems?**

Hydrogen can be used as an energy carrier to operate the internal combustion engine. However, to make it a viable option in the market place, the hydrogen infrastructure needs to be developed and the hydrogen storage in the vehicle to be optimized. With the use of hydrogen in internal combustion engines, manufacturers are able to use the existing technology for internal combustion engines. This offers a short term advantage. The fuel cell technology requires significant changes but also offers greater opportunities. Advantages of the fuel cell system are higher efficiency and the possibility to do the power distribution in the vehicle electrically. This will enable new improved vehicle concepts such as by-wire chassis systems.



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**Has the fuel-cell, from your point of view, the potential to replace internal combustion engines in the long term?**

Our vision in the long term is to reduce vehicle emissions to zero, and at the same time increase fuel efficiency significantly. The hydrogen fuel cell offers the best strategy for reducing our dependence on petroleum and eliminating CO<sub>2</sub> emissions. But in the meantime, and for a long time after the introduction of fuel cell vehicles – we expect many different powertrain solutions and fuels such as gasoline, ethanol, natural gas, diesel, and bio-diesel to play major roles co-existing in the marketplace for a significant period of time.

**Current alternatives to conventional petrol and diesel are Liquefied Petroleum Gas (LPG), Compressed Natural Gas (CNG) and bio fuels. Which of these can be recommended in terms of environmental-friendliness, usability, meaning fuelling and range, availability and economics?**

LPG and CNG as fossil fuels are available in Europe. CNG from biomass is also a clean energy strategy that is becoming increasingly available in Europe. When the vehicle is optimized to run on gas as the preferred mode, compression ratio and other parameters can be adjusted for improved efficiency. One example is the mono-fuel versions offered by Opel. In the long run, it makes sense to increase the use of renewable fuels. Bio-Diesel and ethanol are also very important energy carriers. We need to work on the efficiency of the processes to produce these fuels, and we need to improve the yield in the fuel production. Overall, we look to governments to put in place positive policy frameworks. This encourages the research, development and commercialization of even more environmentally friendly second generation biofuels like hydrogen, methanol, ethanol, dimethyl ether (DME) and Biomass-to-Liquids (BTL). The political engagement should be reflected in the tax structure for the fuels and vehicles as well as in a widespread distribution network for these fuels.

The preferred fuels in the different regions will depend on the available processes for the production of the fuel. We will continue to see diesel-like and gasoline-like fuels. This is why FISITA will push the further development of both the diesel and the gasoline engines.



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Founded in Paris in 1948, FISITA (the Fédération Internationale des Sociétés d'Ingenieurs des Techniques de l'Automobile / International Federation of Automotive Engineering Societies) is the world body representing over 144,000 automotive engineers. FISITA brings together the national automotive engineering societies in 38 countries to disseminate and share leading-edge technical knowledge in order to improve automotive transportation for the benefit of mankind. FISITA is a non-profit educational and scientific organisation dedicated to promoting advances in automotive technology which save lives, protect the environment and conserve natural resources.

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