Dr Yasuhiro Daisho

Thank you, Chairman. Good afternoon, everyone. It is my pleasure to be here to talk about advanced technologies for environmentally friendly vehicles, looking at the year 2010 and beyond.

First, let me explain the requirements of environmentally friendly vehicles and fuels. First of all, efficient vehicle performance, safety and durability are essential besides low emission and high efficiency characteristics. Economical issues are also important from the viewpoint of commercialization and the wise use of EFVs.

In the long run, we have to partly use sustainable and affordable alternative fuels. These three are complaining of diesels noise getting into the ears, smoke into the eyes and distinct smell into their noses.

So the United States and Japan are preparing more stringent NOX and PM emissions regulations for heavy-duty diesel vehicles, as shown in this slide. In Japan, we are discussing how stringent standards should be effective for heavy-duty diesels around 2010, predicting the future air quality in big cities in Japan and taking into account the future technology progress as well. Of course, we are so much interested in the U.S. standard in 2010.

To significantly reduce both diesel, NOX and PM, combined systems are now being developed, including air quality control, high pressure injections, exhaust gas recirculation and after-treatment systems. Electronics enable such multiple injection scheme to control combustion and the emissions and to assist the use of after-treatment systems.

As shown here, there are so many possible combinations of after-treatment measures to be optimized. The regenerative DPF is a key technology to efficiently reduce PM and remove filtered PM. Eventually, urea selective catalytic reduction or lean NOX trap must be applied together with the use of DPF.

There are some problems with DPFs to be solved. Filter regeneration must be ensured at low speed and load in urban driving mode. In Japan, this is a very serious problem in Koji city area. And cost reduction is a big issue. In addition, ash free lubricating oil and some of free fuel are both necessary for sufficient filtration efficiency and durability.

Now, Japanese automakers are developing both SCR and LNT systems, comparing them in terms of NOX reduction, combustion performance, durability, overall cost and convenience as well. This year's performance of LNT system has been so much improved and is now very close to that of SCR. However, fuel

consumption penalty caused by providing fuel to the catalyst must be minimized. By contrast, SCR systems require infrastructure to supply urea water solution.

Speaking of low emission technology for gasoline vehicles automakers have succeeded in considerably reducing emissions by using very precise emission control systems, as shown in the slide. And we'll be able to achieve almost zero emissions in the very near future. This slide compares Japanese ultra low emission level with California's super-ultra emission levels. As you can see, they are both very close to their emissions.

Speaking of the fuel oil economy improvement technology, there are a lot of measures associated with engines and the vehicle – direct injection, hybridization, electronic control and light weight are key technologies. Utilizing combined effect of such measures is very important to improve overall efficiency.

This slide shows examples of direct injection gasoline engines developed and commercialized in Japan. As I will mention later, sulfur-free gasoline is necessary for such engines in order to help the use of NOX reduction catalysts, which are necessary in place of the three-way catalyst because it doesn't work under lean burn conditions. Diesel and gasoline passenger cars are compared in terms of NOX and CO emissions in

this slide. Obviously, NOX must be reduced in diesels while fuel economy has to be improved in gasoline cars, utilizing measures I mentioned earlier.

As shown in this slide, in Japan gasoline and diesel fuel both having the sulfur content of lower than 10 PPM will be supplied locally, starting in 2005, and on a nationwide basis in 2007 and 2008, respectively. Such sulfur reduction is very useful to reduce not only the deterioration of after-treatment systems, but also fuel consumption penalty for both diesel and gasoline vehicles.

In summary, the combination of the three key technologies, including combustion after treatment and the fuel technologies, must be optimized to simultaneously improve emissions and fuel efficiency in both diesel and gasoline vehicles. Each key technology includes challenges utilizing advanced parts, devices, and materials shown in this slide.

As Mr. Nakayama mentioned earlier, the Japanese government has announced an action plan to encourage Japanese automakers to develop advanced technologies, including fuel cell vehicles and super clean diesel, hybrid systems and DME engines for heavy-duty applications.

Two years ago, based on the action plan, our technical committee determined such specific technical target for next generation vehicles. I am involved in this

committee. To achieve such a target, the Ministry of Land Infrastructure and Transport started an R&D program to develop next generation, heavy-duty trucks and buses, as shown in this table.

Let me show you some examples from them. This is a super clean diesel engine. This is an advance city's type hybrid transit bus. These are trucks, as I misspelled, not "track" but a "truck" fueled with DME and compressed natural gas.

As you can see, hybridization and after-treatment technologies are very useful to reduce emissions as well as to improve efficiency. I don't touch so much upon the fuel cell vehicle technology because Dr. Lloyd has already talked about it, and other panelists will mention it.

So let me briefly explain what we should do to eventually commercialize such vehicles for the purpose of reducing oil dependency and global warming. We need continued technical and policy efforts to improve fuel cell vehicles by carefully comparing with conventional vehicles in the real world, spending at least 20 to 30 years. However, we should note time flies.

We also have to discuss what fuel mix will be appropriate for co-existing conventional and advanced vehicles, taking into account the use of alternative fuels, such as natural gas, bio-fuels and renewables, apart from oil.

This slide shows the future growth of oil demand, the growth will be enhanced by the developing and motorizing countries. We will suffer from a serious shortage of oil in the near future if we don't take any measures to reduce oil consumption in advance. This is a conceptual picture indicating what will be more important associated with environment and energy as a function of time.

We will be able to develop advanced a low or zero emission technology, overcoming the regional air pollution problems by the year 2010. Japan imports almost 100 percent of oil from abroad and consumes almost 40 percent of it for transportation. So in the very long run, we will have to do more to reduce oil dependency and global warming as well.

Let me conclude my talk by showing this slide. Experts from different sectors have to closely collaborate on R&D and policy making on the international basis to implement environmental friendly vehicles.

Thank you for your attention.