ST. PETERSBURG INTERNATIONAL ECONOMIC FORUM

JUNE 16–18, 2011

AUTOMOTIVES AND THE FUTURE OF MOBILITY

Expanding Technology Horizons

JUNE 18, 2011 — 10:00–11:30, Pavilion 3, Amphitheatre

St. Petersburg, Russia

2011

For decades, the automotive industry has been investing in massive global platforms for design and manufacturing. However, new forms of alternative-energy and hybrid vehicles – from battery, natural gas, hydrogen and others – are challenging the industry to ‘think local’.

Moderator:

Mikhail Kovalchuk, Director, Kurchatov Institute National Research Centre

Panelists:

Andrei Biryukov, General Manager, YO-AUTO Ltd

Hubert Hoedl, Vice-President, Sales and Marketing, Magna International Europe AG

Andreas Renschler, Member of the Management Board, Daimler AG

Miguel Sebastian, Minister of Industry, Tourism and Trade of Spain

Front row participants:

Tohru Hashimoto, President, Mitsubishi Motor R&D Europe

Frank Henning, Deputy Director, Director Polymer Engineering, Fraunhofer ICT

Ewald Kreid, Partner and Managing Director, The Boston Consulting Group

Walter J.T.H. Luijten, General Manager, NONOX BV

Anatoly Paliy, First Deputy General Director, Gazprom Gazenergoset

Kirill Tomastchuk, Chairman of the Board of Directors, Elton

M. Kovalchuk:

Good morning colleagues. The St. Petersburg International Economic Forum is nearing its end and we are now opening its final day. We will discuss automotives and the future of mobility. I would first of all like to introduce the participants in our discussion today. To the left of me is Miguel Sebastian, Minister of Industry, Tourism and Trade of Spain. Next we have Andreas Renschler, Member of the Management Board of Daimler and Head of the Daimler Trucks Division. On the end we have Hubert Hoedl, Vice-President of Sales and Marketing at Magna International Europe.

To my right, we have Andrei Biryukov, General Manager of YO-AUTO, and Anatoly Paliy, First Deputy General Director, Gazprom Gazenergoset.

I would like to say a few words about the planned structure of today's discussion. After a brief introduction from me, each of these panelists will make a 5–7 minute presentation focussed on various aspects of automotive use and development. After this, each of the invited guests sitting in the front row will also have the opportunity to say a few words. I will introduce them as we go. Next, I would say in about 50 minutes, we will open the floor to general discussion.

First of all, allow me to introduce myself. My name is Mikhail Kovalchuk. I am the Director of the Kurchatov Institute National Research Centre. I am a physicist, and I must say that when I was first invited to lead this discussion, I found it a little strange. At first I simply declined the invitation because I did not think this subject was relevant to my area of expertise, to what I know and do. However, as I found out more about it, I realised that automobile development is in fact an issue with much more wide-ranging and global relevance than it is given credit for. Therefore, by way of an introduction, I would like to say a few words, starting by drawing your attention to the following fact: we have been saying for

a long time now that our energy resources are finite; that our oil and gas will run out. We have been discussing this issue for decades, and indeed, it is true that the Earth's reserves are limited. That we now have a major crisis of civilization on our hands is, to me, absolutely obvious. The only question is, when will we reach this critical point? In 10 years' time? 20, 50 perhaps?

When we discuss the possible consequences of this crisis and how we might deal with them, we are in fact discussing the consequences of something much more significant, something on which I would now like to say a few words. When I was a teenager almost 60 years ago (well, 50 actually, or 45 to be exact), I got hold of a book by Vercors. He was a French writer famous for writing the fascinating novel *Le Silence de la Mer*: *The Silence of the Sea*. Intrigued, I then happened to find a second book of his, called *Quota*. This book said that after the war, the 'golden billion' introduced a new economic model of expanding both production and consumption. A system of resource consumption was put forward which basically consisted of the following: produce something, buy it, throw it away, and then produce the same thing again. This book, written decades ago, said that if this model applied only to the golden billion, then the Earth's natural resources would never run out. It also said, however, that if another country, such as India, also started to use the same model, then there would be a collapse of resources. Therefore, now that countries like India and China, which together make up almost half of the world's population, have also started to use this model, the system has indeed, as predicted, approached collapse. Indeed, if we continue according to the original linear post-war model and paradigm, civilization will be forced to return to a primitive existence, going back to the basics of fire, keeping livestock and arable farming etc.

I would like to say a few words about what exactly is happening and why. You see, nature has existed in perfect harmony with itself for many billions of years.

We however started to develop a technosphere and build our world on the basis of technology. The technosphere we created totally went against the natural order of things, because at its foundation was the simplistic notion that we should take what we can from nature, no matter what the cost. The technosphere we created was utterly at odds with nature: this is the true nature of the crisis which mankind is now facing.

In Russia we once had a great academic, a geologist by profession, Academician Vernadsky. Although he did not, strictly speaking, come up with the idea of the noosphere, he certainly took the concept to a new level. He made the very significant claim that that the biosphere (that is, geology, biological life and nature) was being displaced by a new stage in evolutionary development; being transformed by the intellectual, cognitive processes of the social human into what was called the noosphere. He identified the importance of the role of human thought, consciousness, creative cognitive activity and social existence itself in developing our understanding of the world around us beyond the concept of the biosphere. In other words, nature, society and human consciousness were bound together by one concept – the noosphere. The technosphere, a word also mentioned by Vernadsky, also came to be a part of this concept, but only in the 1930s and 1940s, when the extremely powerful technosphere we now have was only in embryonic form then, and its influence at that time on the noosphere was extremely small.

Our technosphere is at odds with everything else in existence, and the task that faces mankind on a global scale is to make the technosphere an organic part of nature. This is how the noosphere must develop.

What is most important right now? Why are we discussing automobiles?

If we continue to live as we have done up to now, we will, in the next few decades, inexorably return to a primitive level of existence. It is possible,

however, to return to life according to the natural order while still preserving everything that human civilization has achieved.

The common bird is an excellent example. It lives its life, flies around (without needing a runway like a plane, by the way), sees a fish and then goes and catches it. It lives its life, eats its food and drinks what it needs to drink: it does a whole host of things, and only with the help of energy from the sun. Nature has existed harmoniously for almost 14 billion years. We therefore already have a source of thermonuclear energy. Thermonuclear fusion is already happening in the Sun. Thanks to photosynthesis in a green leaf, all of nature has survived for billions of years. What do we do? In order to provide ourselves with energy, we create all these huge monstrous factories and giant companies.

I will give you a simple example. We want to till a field and collect a harvest. What do we need to do to achieve this? We need to extract ores and minerals from the ground, melt them down and turn them into machines, combine harvesters, tractors and cars. We then need to drill for oil and build oil refineries to convert the crude oil into petrol. Only after we have done all of that, using up a huge amount of natural resources and creating a vast quantity of waste, can we till the field and collect the harvest. No one is tilling the next field along though. It is just a watery meadow, nothing but water and sun. However, that field yields just as much harvest as perhaps it would do if we had tilled it. Mankind only has one option – to become a part of nature by turning to bionics.

I will now explain what I am talking about. Mankind started to make progress in this regard many decades ago. Without any knowledge of how photosynthesis worked in a green leaf, we took a piece of semiconductor crystal and created solar energy. We actually created the technology to create energy the way nature does. Now 100 years have passed, and solar cells are very efficient and

can provide hundreds of kilowatts, even in space, where it is the basic source of energy. We also use nuclear power stations to produce many megawatts.

Our problem is that whenever we are trying to harness solar energy using natural technology, we have to use machines, devices (primarily automobiles) and factories, which need nuclear power stations to provide them with energy. Therefore, our key task is to create a machine that uses energy in as natural a way as possible. This is because nature is the most economical and environmentally friendly energy consumer there is. As far as we are concerned, the automobile (and automobile manufacturing) is now the biggest destroyer of natural resources and the biggest pollutant on Earth. Therefore if we begin our task of creating a machine that uses energy in an economical and environmentally friendly way by focussing on the automobile industry, then I believe that the prospects for mankind will be a lot brighter than they have seemed up to now. I think today's discussion provides us with an opportunity to try to find a way of putting the automobile manufacturing industry on a new track which will open up an entirely new perspective for civilization. Scientists are already it in laboratories, working on NBIC-convergence: NBIC is an acronym, standing for Nanotechnology, Biotechnology, Information Technology and Cognitive Science.

That is all I wanted to say, and in doing so I wanted to explain why I, a physicist, am sitting before you today chairing a discussion on the future of the automobile manufacturing industry. I would like start off with my colleague Andreas Renschler, someone who deals with the automobile manufacturing industry rather more than I do. I would be delighted if you would say a few words about how you view the development of this industry. I now hand over to you.

A. Renschler:

Thank you very much. No, I do not have a presentation. I will do it verbally. I would like to start by saying that I believe technology can also be part of the solution in the future. I am not a big fan of painting a picture where we will see the end of the world very soon because of emissions and energy.

I want to give you one example. In 1910, there was a big discussion in Paris about emissions. You may wonder what kind of emissions. There was a statement from the mayor of Paris back then, where he said "We will kill Paris with emissions from horses. Either we find a solution, or Paris will be in chaos." Technology came, and I think together we found solutions there.

Now, there is a big issue when you look at emissions and energy. The problem is not that we have cars. The problem is with the emissions. So indeed, what kind of future technology do we need to find lower emissions overall, and to find a better energy mix in the world?

The issue we are facing as car manufacturers overall is that there is no silver bullet. There is no one solution that fits all. We need a wide range of technologies. My colleagues talked a little bit before about it. When I hear that we think that all cars in 20 years will be powered by electricity, with batteries, that is totally wrong. It makes no sense.

Batteries are important to technology, but that is not where it should be. There will be a lot of things happening in the future. But such cars, for example, are very important in urban areas, no doubt, and they can generate mobility in big cities. If you want to drive longer distances, this kind of energy, electric-powered energy by battery, makes no sense. We still need auto solutions.

It could be an improved internal combustion engine. They will play a big role based on green technology with a better overall energy level. I think they will still also play a major role in the next couple of years and decades.

Then we have the fuel cell, as one of the issues, as we saw Daimler drive around the world with several fuel cell cars. That could be a solution. Natural gas is also a very important one, specifically for big engines and big trucks. It could be a solution. Hybrid in certain fields, specifically in city buses.

So, the wide range of technology that will bring us to a better emissions situation and a better energy mix, I think, is slowly coming together, they are in development, and they will come to the customer, I would say, sooner rather than later.

But if we believe that we have to invest in further mobility, because all the wealth of humans also comes with mobility, then we have to also look at infrastructure.

This is because in some political discussions, I sometimes have the feeling that the situation will be solved. But without an existing infrastructure, we have nothing. Now what we need, first of all, is to invest in a certain infrastructure. There are very innovative solutions: instead of building an underground system, you can use rapid bus transport. That means longer buses along different routes, but you have to make the investment.

And so this is a combination of further technological improvements, and on the other hand, the willingness of the government to invest in this kind of infrastructure. And by the way, if you look at electric-powered cars, without further improvement of infrastructure, we will not be able to do it anyway.

So as I said in the beginning, there is no silver bullet solution. But there are a lot of different areas where we can generate solutions for the future.

One thing I forgot to mention is the so-called BTL, biogasoline or biodiesel. I think it is also a very important part in the overall situation—not made out of food—instead there are certain further steps that we can take to produce

biodiesel, for example, out of waste or other things. And I would say this could also be—in a couple of years—a very, very good base for a solution.

So to sum up, I believe in technology, and technology will be part of the future because without technology, we will lose mobility and we will lose wealth for humankind. Thank you.

M. Kovalchuk:

Thank you very much. It is certainly clear that any development connected with investing in infrastructure, no way, and this is especially very important for post-Soviet people who do not understand deeply the importance of infrastructure.

M. Sebastian:

Well, thank you, Mikhail, for your invitation. And thank you for this round table. This is really important because we need debate and we need international coordination at some point in time to improve the electric vehicle that we might talk about in the future.

You are a physicist. I am an economist, so I am going to talk about economics. And we think that the electric vehicle is a good alternative for four reasons.

The first is the environmental dimension, not only carbon emissions but also other pollution emissions: noise, waste, and so on. The second dimension is the industrial technological dimension. The auto industry needs to innovate, and the electric vehicle is a good opportunity for innovation. Here I do not only include the carmakers, but also the components, the battery, the charging industry, even the ripper industry.

The third dimension is the ICT. The electric vehicle is going to bring about a huge development of both smart grids, smart meters, and the ICT integration in an electrical system, which is going to be very good for efficiency and

consumers. And the fourth dimension is energy. Of course, this is our favourite dimension. Energy.

It is not only a matter of oil dependence, which is very important for some countries like Spain. In Spain, we do not have oil. We do not have gas. We do not have coal. But we have a lot of sand, a lot of wind, and we can improve our balance of payments with renewable energy and with electric vehicles.

But it is not only a matter of oil dependence. It is also a matter of energy management, which is what I want to put the focus on now. When we talk about energy management, we mean matching supply and demand of electricity, basically. Because in Spain, we have 32–33% average electricity generation that is renewable, so far. In the year 2020, it will be 40%. However, we do not have the renewable electricity at our disposal whenever we want. That is why the electric vehicle is a good ally of renewables, especially in a country like Spain where we do not have grid connections.

Our friendly neighbours are good, but they do not give us any electrical grid connections. So in a sense, Spain is an electrical island. So we need a backup technology for renewable energy. And the electric vehicle could be a substitute for this backup technology if people plug in their cars during off-peak times, at night. That is why we think the electric vehicle is a very, very good ally of renewable energy, and of our plans to deploy more wind and more affordable technology in our country.

But the electric vehicle is also a good friend of nuclear power, because with nuclear plants, you can switch them on and off during the day. They have a fixed supply of electricity. And electric vehicles, again, if you plug them in at night, they are going to ease the demand for electricity, and therefore they are going to make the nuclear supply more efficient.

M. Kovalchuk:

This is especially important for France.

M. Sebastian:

For France and for other countries. So, electric vehicles are not only suitable for countries that have decided to use renewable energies, but also for countries that are betting on nuclear energy. In Spain, for example, we have 21–22 million vehicles, but we can add up to 7 million electric vehicles without spending an extra euro in infrastructure. How? We charge them at night.

For us, the crucial thing is not only the price of batteries and the price of the vehicle, but to make it easy for people to charge their cars during the night. For that, we need to harmonize the recharging technology, and that is why we are asking the major car manufacturers, Germany and France, to come to an agreement, so that we can have a single charging technology.

Secondly, in order to have cheap electricity at night, we have launched a new electricity tariff from 01:00 am to 07:00 am in Spain, which is particularly cheap. And thirdly, to have infrastructure technology in the houses, which is a challenge in Spain, because most of the people in cities live in apartments. So we not only need it in garages, but we also need it in the streets, and we need support from the cities.

I know that some people in the oil industry and some people in the biofuel industry are a little bit reluctant about electric vehicles. But I think that is a short-term view. We need to make both the oil industry and the biofuel industry into the friends of the electric vehicle, because this is not only an energy, environmental, industrial, and ICT opportunity, a microeconomic opportunity; it is also a question of macroeconomic opportunity. And this will be my last point.

Spain is a country that has an important external deficit. We do not have a public debt problem. If we are in any kind of trouble today, it is because we have a lot of private debt that comes from a huge external deficit.

Now, most of our current external deficit is energy. So even if we import one electric vehicle, our balance of payments improves because of all the savings of the lifetime oil consumption of the electric car, because we have a lot of renewable and nuclear in our electrical mix.

That means that if you here in the audience are planning to sell electric vehicles in Spain, which were produced in other countries, you are welcome. And the government is going to give money to consumers to buy your products. So it is good news for you.

But we would like to produce them in Spain. So if you are planning to invest in Spain to produce electric vehicles, you are more than welcome, because the Spanish government is not only going to support consumers in buying your cars, but it is also going to support you if you invest in R&D and other incentives to produce electric vehicles in Spain.

So you are welcome, but above all, the electric vehicle is welcome in Spain. Thank you.

M. Kovalchuk:

Thank you very much. I think everybody understands this important slogan.

M. Kovalchuk:

I would like to highlight one important point. While explaining that we need to develop all forms of technology, Dr. Renschler used the example of horse manure in Paris. I know a similar thing happened in New York. New technology was developed and the manure problem disappeared. Now Spain has announced

that it welcomes the production and use of electric cars. This is a second point of view. It is now my great pleasure to hand over to Hubert Hoedl, the Vice-President of Sales and Marketing at Magna International Europe.

H. Hoedl:

Good morning ladies and gentlemen. Just a remark for the organizers, I will follow the procedure of my fellow panelists. I will not use the slides which I brought along. Maybe just a couple of sentences about our company, because we are not such a well-known brand as the one Mr. Renschler is representing here today.

We at Magna are one of the global tier-1 suppliers to the auto industry, with revenues of approximately USD 25 billion in sales last year. We employ more than 100,000 people worldwide in approximately 300 operations and engineering centres. Our scope of product and services is quite widespread. An easy explanation could be that we deal with everything, just not with rubber products and not with glass products.

Regarding the future of the auto industry and the technologies they are in, to a certain extent, I also share the opinion of Mr. Renschler that there will not be just one technology and one solution for the future. The good thing is that the demand for individual mobility certainly will increase in the coming years and decades. So, we are not that far away from more than 100 million light vehicles being produced annually, but our opinion is that the pure electric vehicle content in this context will be fairly limited, maybe less than 1% of the total production and consumption. Slightly different is our forecast with regards to the hybrid electric vehicle, that could reach a share of maybe 3% to 5% by 2020.

Regarding fuel availability and technical solutions, of course, there are several alternatives which people are working on, but for the next few decades there is

no doubt also from our point of view that the internal combustion engine is by far the most important propulsion concept.

With regard to what has been said before regarding the alternatives in fuels and cars, it is worthwhile to mention that, in this context certainly, new players will join the stage, and it is for sure on the tier-1 or tier-2 level for companies like ourselves or others, but to a certain extent this is of course also the opportunity for new OEMs to enter the stage. And I am sure that Mr. Biryukov will later on share his vision with all of us.

What can Magna provide in the context of electric vehicles or hybrid electric vehicles? We are a well-known engineering source for OEMs, being able to develop complete vehicles on their behalf if required. We deal with certain systems and modules, and of course also on the component level, we are a reliable source.

And as regards new technologies and new materials, we will probably hear more about that later on in the day, but the combination of, for example, composite materials to be used for the manufacturing of storage systems within a car is probably one attractive solution where we could make some contributions.

M. Kovalchuk:

Thank you very much.

M. Kovalchuk:

I would now like to ask Andrei Biryukov, General Manager of YO-AUTO, to say a few words.

A. Biryukov:

Good morning, ladies and gentlemen. I would like to start off by making an unambiguous statement about what the car of the future should be like. Why? Because we are a new, modern company, we have made a decision to get involved in this business and have conducted extremely detailed research on how dependent today's world is on cars, both for better and for worse.

In one way we are at a bit of a disadvantage compared with today's giants of the automobile industry, as regards both their existing technological capabilities and their global presence on the market. However, in our view we can in fact turn these issues to our advantage, because we are not burdened by technology we have already committed ourselves to, and can therefore stand back and take a wider view of whatever technology is available, both now and in the future. Also, when we are developing a new product, we—unlike all large car companies—are not burdened by any sort of 100-year-old ideology which would be very expensive to depart from. Indeed, large car companies are condemned to doing everything—tweaking and improving each parameter—in small steps.

The trend of new designs in any sector, including automobile manufacture, is to create revolutionary products which can really compete, in our case, with the classic automobile. In trying to achieve this, our aim is not to compete with any particular company at all. Our goal is a little different, I would say, more global: we want to compete with the classic automobile.

We think that the traditional automobile has so many problems and is so inefficient that it will soon fade into obscurity. Our job is to think about the cars of tomorrow. Discussions about what is going to replace the classic automobile—electric cars or hybrids—are in fact extremely important, indeed I would say, absolutely crucial. This is because if we choose wrongly, we will only prolong the life of the classic automobile with all its faults and its shortcomings.

I am absolutely convinced that the electric car, in its current form, will not be hugely significant and will not be the alternative we are looking for. What are my reasons for thinking this? It is not true to say that electric cars are environmentally friendly, because in order to produce electrical energy, in the majority of cases we have to burn hydrocarbons anyway. Electric cars thus actually harm our environment a lot more than modern engines used by the most advanced car manufacturers. On top of this, automobile manufacturing regulations are stricter than those in the energy sector. This factor is absolutely crucial.

In addition to the environment, we must also always consider the economic factor. I must disagree with our colleague, the Minister of Spain, who said that electric cars are economically viable. They are not, because in order to support the infrastructure needed, we would not have to supply plugs alone, we would also need electrical lines, electrical substations, and a cable network. In total, it costs a huge amount of money even to maintain the levels of electrical energy production we have at the moment, and to actually increase them would cost even more.

For instance, one million cars would need about 50 gigawatts of capacity. In 2010, Russia increased its capacity by just over one gigawatt. Also, one kilowatt now costs more than EUR 1,000, or in the atomic energy sector, all of EUR 3,000–4,000. This does not even take into account the infrastructure needed, which costs about the same amount again. Therefore if we count up how much money we would need to spend to develop this project, it would take us more than the rest of our lives to break even. Of course, an economic plan like this is a dead end.

The car which YO-AUTO plans to build cannot be called a hybrid in the normal sense of the word. The 'Yo Car' is a car which you drive on electricity. On board

there is a power generating system and accumulator, which stores the kinetic energy normally wasted under braking or stopping at lights. This is what is known as an energy recovery system. Even so, we do still plan for an electric car. This means that it will have a colossal demand on a new energy source. We maintain that this is really the energy sector's problem, and one that must be dealt with as soon as possible. It is very difficult to solve, and we really do not know how much it will cost. Where the money will be found to even support new energy projects, let alone develop them, we simply do not know.

So, it falls to electrically-powered cars to make the demand for totally new energy sources a priority area. What should these new sources be? What will the fuel be: petrol, diesel or gas?

Our view is that the key fuel over the next 50 years will be natural gas – environmentally it is much friendlier, and it is becoming more efficient than other, more traditional fuels. If we look at the infrastructure needed for the gas sector and that which we have for traditional fuels, we can clearly see that the whole system is utterly inefficient. Our constant refrain and basic aim in this project is to eliminate inefficiency in all its forms. We do not work in the interests of any oil lobby groups, nor of any metallurgy companies who have monopolized the chassis manufacturing sector, nor of any other business corporations. We work in the interests of mankind and the environment.

We must respond to such a challenge: the automobile as we know it must change, we should use better, reusable materials, the cost price of automobile production should be reduced to a minimum, fuel should be environmentally friendly and new sources of energy (whose discovery will be necessitated by the advent of electrically powered cars) will be locally based, and therefore will solve one of the biggest problems in the energy sector by removing the need for electrical energy transmission. Ultimately, the sheer weight of all these issues will

allow the technical specialists that each and every company has on its staff—from car-manufacturing giants to small engineering firms—to join in solving this problem. We must not be afraid of making bold decisions.

Indeed, we should, I think, tell ourselves that this will happen very soon, very soon indeed. Only then can we make a difference, protect our world and, ultimately, give us and our children a chance of survival on this planet.

I would just like to mention briefly that we have chosen to use composite materials for 100% of our cars. We will, I believe, be the first to do so. In this area we are working very closely with Magna International, who are giving us a great deal of support on the project. The material we will use will be polypropylene, which is, as you know, the first material actually made from refining natural gas. We maintain that our new car will not only run mainly on gas, but will in fact be made from it!

That is the key point I wanted to make during today's discussion. It encapsulates the nature of our project, which I hope will be completed, with the help of all our partners, very quickly. It also confirms that our words are not empty: this project is very real. Thank you.

M. Kovalchuk:

Mr. Biryukov, thank you very much. I would now like to hand over to our last panelist, Anatoly Paliy, First Deputy General Director at Gazprom Gazenergoset. You, I believe, will be speaking about that very same gas which Andrei Biryukov concluded with.

A. Paliy:

As it happens, my report is actually a logical continuation of Mr. Biryukov's. Put up my slideshow please.

Good morning, ladies and gentlemen. I will be talking (briefly, I hope) about the current condition of gas engine fuel and about its future prospects. We also are absolutely categorical in our conviction that gas is the most realistic and effective alternative to traditional types of engine fuel. The future of the automobile lies in economical, efficient and environmentally friendly hybrid engines that work on gas. First of all, I will briefly clarify the different types of fuel gas we have available, so that everyone understands how, for example, LPG is different from methane.

There are three types of gas fuel: LPG, CNG and LNG. I will just say a brief a word about each of them.

LPG stands for liquefied petroleum gas. It is made up of a mixture of propane and butane and is obtained from the by-products of oil and gas wells. It is worth highlighting here that LPG is a product of the refining process, just like petrol and diesel. Its advantages over petrol and diesel include its lower price and its lower emissions.

CNG is compressed natural gas (methane). Its main advantage is that it is about 25–30% cheaper than its main competitor, LPG. Its atmospheric emissions are also considerably lower.

LNG is liquefied natural gas. It is a colourless and odourless cryogenic liquid that is half as dense as water. Its boiling point is -162°C.

It would seem that judging by cost, damage to the environment and automobile lifetime, the best type of fuel is methane in either CNG or LNG form. However, one must take into account two further, key advantages that LNG (liquefied natural gas) enjoys over CNG as a possible motor fuel, namely that its containers are lighter and it allows the car to go further without needing to refuel.

Put simply, if LPG and CNG are the fuels of today, then LNG is the fuel of the future – the very near future at that.

I will now briefly talk about how the process of expanding the use of gas as an engine fuel in Russia. First of all, I would like to highlight the tightening up of regulations for automotive transport with regards to the environment, as well as the rise in oil prices, and the unclear, unsteady state of the oil products market. How can it be that in a country with so much oil, like Russia, several petrol stations in certain regions may have no petrol for two or three months, or petrol prices can rise to RUB 50 per litre? It is also worth noting that for Russia, gas is a strategic material. Our country has huge reserves of natural gas.

If that is really true, then what is holding back the market for gas-powered automobiles in the Russian Federation? I have identified four basic factors which are stopping the market from developing, but I will only talk in more detail about the one that seems to me to be most important. Car manufacturers, legal bodies and people on the street, all of whom are ready to convert their cars to gas, all point to a lack of infrastructure for gas retail. I think many of the people sitting here today would also be glad to switch to gas if there was the requisite infrastructure and level of service and maintenance facilities in place. Put simply, we do not have many gas filling stations.

What is hindering the development of this gas infrastructure? The biggest problem is the inadequacy of the legal and technical regulatory framework which controls all aspects of such a project, from planning, assembly, construction and operating gas engine fuel facilities, and also transportation, storage and usage, and the technical requirements and up-to-date safety requirements. I will give you a brief example: the fire safety gap, in other words the minimum safe distance needed between a flammable object and other buildings and structures, is many times larger in the Russian Federation than it is in the EU.

What needs to be done to help the market for gas engine fuel develop? Firstly, a law on the use of gas engine fuel, which has been struggling through the

process of ratification for about 12 years already, must be adopted. We also need to do something else, something that, although unpopular, I still want to say a few words about – we need to offer the gas market tax incentives. Why is this necessary? We need to increase the demand for gas and gas-powered automobiles, and we need to increase the supply of gas and the necessary infrastructure. In order to increase supply, we need to increase investment. We need to introduce tax breaks on profits from investment in companies offering gas engine fuel. It is also necessary to offer tax breaks on property and land to make these investments more effective.

By way of a conclusion I would like to briefly mention a project we are undertaking at the moment in St. Petersburg, in the Leningrad Region. This project, the first of its kind in Russia, is to create a new, modern, energy-efficient facility for the medium-scale liquefaction of natural gas. Its planned capacity is 50,000 tons per year, which will be enough to allow us to switch the entire municipal public transport system in St. Petersburg over to LNG. A bit of data for you: at the moment in St. Petersburg there are 10,000 buses, of which only 20 run on gas. We can therefore see exactly how much potential this project has.

We are working in a number of areas to achieve our goal of creating a new LNG market in Russia. These areas include the development and use of LNG as an engine fuel for automobile and water transport, the conversion of industrial heating companies, communities and electrical power stations to gas.

To sum up: if these projects are to be realised, we need to take a complex and comprehensive approach, with investors, federal and regional authorities as well as consumers all working together. Using natural gas as a fuel will allow us to reduce significantly how much we spend on electrical heating systems, to reduce the cost price of transportation of both goods and people and to reduce the unit cost of fuel. Most importantly, however, it will allow us to reduce harmful

emissions in cities, improve our environment and raise our citizens' quality of life. Thank you.

M. Kovalchuk:

Thank you. Miguel Sebastian wanted to say something. Go ahead.

M. Sebastian:

Thank you very much, Mr. Chairman. This round table is very interesting because it shows what is going on around the world, which is, in a sense, the other way around. Usually, governments are neutral and risk averse, and the private sector is less neutral, less risk averse. And here it is the other way around; the private sector representatives are quite neutral, moderate, and the only representative from the government, which is myself, is clearly not neutral and quite risky.

We are not neutral for a lot of reasons. Firstly, independence – we are not neutral because we spend EUR 50 billion on our oil bill every year in Spain. That is more than what we get from the tourist sector. And every time the oil barrel goes up by EUR 10, we spend an additional EUR 6 billion on our oil bill, which means all our public R&D investment. Only ten euros extra on the price of a barrel – that is why we are not neutral. So we are not going to support gas-driven cars because we are as dependent on oil as on gas.

We are not neutral in hydrogen because the electrical technology is already available and is more efficient, given that we have a lot of electricity which is wasted at night, because there is no demand for it at night.

Thirdly, we are not neutral with regards hybrid cars. We are not going to support hybrid cars unless they are plug-in hybrids. For the same reasons, we need, we want, people to plug the cars in by night. So, we will only support pure electrical and plug-in hybrids, but not simple hybrid cars.

We do know this is a bet in the long run. That is why we are 'risky'. We know that we cannot go too fast. Demand and supply have to move in parallel. If we go too fast in supply and demand, we will get into trouble. But if we do not move, we will also get into trouble, because we are all agreed that in the long run, exhaustible resources, gas and oil, will become more and more expensive; and in the long run, renewable energy will become cheaper and cheaper, because of technological advancements. So, we know that this is a bet in the long run, but we need to start from here.

Finally, regarding the range debate, how many of you in this audience drive your car for more than 100–120 kilometres a day? Probably two or three times a year at most. If you travel 200–300 kilometres, you will not take your car, probably. You will get a plane or train or whatever.

This is not only a personal feeling. This is a statistic. Ninety percent of Spanish consumers use their cars for less than 100 kilometres per day. So the range issue is not an issue, so far. But the anxiety for a battery deployment, that is an issue. That is why we need to invest in the infrastructure for recharging, and we need the cars to be user-friendly for the consumer, because no matter how much support there is from government—in our case, basically France, Spain, and other European countries—the electric vehicle will be a success if, and only if, the consumer wants it. Thank you very much.

M. Kovalchuk:

Thank you. But I just would like to remark that these short driving distances are not the same everywhere. For instance, for Russia, it is not very appropriate, because according to the scale of the country, we have much bigger distances, on average. I mean, it is clear that is a local problem. The issue is there, but nevertheless it is quite a special situation.

Now, I would like to ask other participants, those who are sitting in the first row, to contribute to our discussion. First of all, I would like to ask Tohru Hashimoto, President of Mitsubishi Motors R&D Europe, to say a few words.
Please remember, we are short of time because we have just 20 minutes for everyone, because after that, everything will be finished and other meeting will move us out. Okay, go ahead.

T. Hashimoto:

Thank you very much for giving me such a precious opportunity to talk about our EV, I-MiEV. I would like to mention about our EV, I-MiEV but I would like to make this story short. So I would like to skip some slides. Please follow me.
Now, I would like to talk about the background of EV development but I would like to give you some of the advantages of an EV. So, I would like to skip some slides.
This slide shows the comparison of CO2 emissions. According to our investigation, under Japan 10–15 driving mode conditions, as you can see, the electric vehicle has the best performance.
The next slide shows, in terms of total energy efficiency, this is our well-to-wheel energy basis. Also in Japan 10–15 mode, the electric vehicle is the best.
This is the slideshow of the disaster in Japan, as you may know. After the disaster, fuel such as gasoline needed for automobiles became extremely difficult to obtain in the disaster areas. Over 100 I-MiEVs were deployed to the disaster areas, and they played a great supporting role, as they are utilized as transport for doctors between evacuation centres in areas where electricity was restored. The great flexibility of energy contributed to the rehabilitation in the disaster areas. I would like to talk about the trend of the EV.

Countries around the world are actively pushing ahead with the introduction of electric vehicles, as shown in this chart. In Japan, the Ministry of Economy, Trade, and Industry also announced the next generation Vehicle Strategy 2010, last April. The goals seen in the chart were announced within that programme, assuming the government's proactive measures to promote popularization such as subsidies and the tax benefits will continue.

I would like to skip this slide. This slide mentions how the EU employed very stringent CO2 emissions targets.

And this slide shows our Mitsubishi Group, Environmental Vision 2020. There are three numeric targets in the initiative, as shown in the slide. To achieve an environmental initiative, EV plays a very important role.

Mitsubishi has an exciting product plan to actualize our target for Environmental Vision 2020. To be specific, we will launch the minicab MiEV, a commercial mini-EV, in Japan by the end of this year. And then as you see here, where we will launch a total of eight different new EVs by the 2015 fiscal year, worldwide.

Mitsubishi Motors has a history of over 40 years of EV development. From early on, we have believed in the lithium ion battery as the key technology for a practical EV. Our decades of research have started to pay off. We finally found a way to make safe, light, and efficient lithium ion batteries.

This was our time to decide on the mass production of the I-MiEV. I-MiEV – I is the model name of the best model in the programme; MiEV stands for Mitsubishi Innovative Electric Vehicle. Before mass production, we conducted a lot of tests, as shown in this picture. And not only that, we also tested it across the world in actual use – in the UK, Germany, and so on.

At Mitsubishi, we selected the following 15 countries as our primary markets. We are currently working to expand the market in the Central and Eastern European countries.

Here is a case study: Norway has been a very successful market for I-MiEV. I-MiEV is holding its position as the top-selling model in its segment. We believe that the incentives and the privileges that the Norwegian government provides are causing this success. The privileges include tax and VAT exemption, toll road fee exemption, access to bus lanes, free parking, concession charges, and so on.
Many countries are employing unique tax incentives and subsidies, as shown in this slide. I will not go into it in depth.
In Japan, Kyoto Prefecture and Kyoto City each purchased up to five I-MiEVs. They are rented to the public on weekends, through a car-sharing programme.
In Nagasaki Prefecture, in the southern part of Japan, the local government is undertaking a variety of activities, aiming to be listed as a World Heritage site. As Nagasaki's Goto Islands are speckled with numerous Christian relics, including churches, they would like to protect the scenery and preserve the environment of Goto Island, like St. Petersburg. Nagasaki Prefecture is going forward with its own Nagasaki EV and PHV Town concept. We are also a participant in this project, and there are a total of 100 I-MiEVs that have already been introduced to the Goto Islands as rental cars and taxis.
This is CHAdeMO Association, proceeding with quick charging. As you can see, this slide shows some examples of the quick charging system.
Lastly, I would like to touch upon future society, such as our V2X. This is what will make up a smart grid or smart community, in which the supply and the demand of electricity are smartly controlled by IT. Within this framework, it is expected that the vehicle will take a major role in strategy, as a means for electricity storage, in other words, as a large battery with wheels. This is our pilot plan, the V2X Project. Thank you very much for your attention.

M. Kovalchuk:

Thank you very much. I would like to ask Walter Luijten, General Manager of NONOX Group, to say a few words.

W. Luijten:

Okay, ladies and gentlemen, I am most probably the representative of the smallest company here in this room. We have about ten employees, but that does not mean that we are not special.

The point is, I completely agree with Mr. Renschler and Mr. Hoedl that we cannot forget about the internal combustion engine. The internal combustion engine will last for a very long time, still from now and into the future. Why? Because we have invested a lot, and there are so many cars, you cannot just delete it and replace it with electric cars or whatever. And that is apart from the fact that, as Mr. Renschler said, electric cars will solve a local problem. No more, no less.

What we did—and our company was founded in 1996—we were studying to find a method to solve the problem where we have to choose all the time between energy or ecology. And we came to the conclusion that it simply came down to the point that we have to improve engine efficiency. That is what we did.

Apart from that, in terms of ecology, we have to look for the best fuel, and we found out that it is methane. Methane is a very, very sympathetic car fuel, because it has a high knocking air border, and an engine feels fine when it is fuelled by methane. Apart from that, methane resources in the world are even greater than oil. And also for the future—we have natural gas, of course—but there is something else. We have methane hydrates in the ocean and the resources of these hydrates are so great, that they will last for hundreds of years.

And I can tell you that we hope that this energy, this amount of methane, if it does not become available, or is not used as fuel, in a very short time, then in that case, we have a very big problem in the world, we suspect CO2 or greenhouse gas problems.

But anyway, just to emphasize that methane, initially, natural gas as we have it now, but later when the hydrates and shale gas for instance, what we have been talking about over the last three years, becomes available, then you have such huge resources of methane that it will last for a very long time, and you can drive for many, many, many – even hundreds of years, perhaps, on this fuel.

So this is what we did, we developed a throttle-free, low-control system, just to improve the efficiency of engines. All engines, auto engines and diesel engines, we can make them run to an efficiency level—in particular, auto engines—of 40% or even more. And that makes them as efficient as the diesel engine and as we all know, the diesel engine is the most efficient we have now on the market.

We completed this development in 2001, and what happened after that? Nothing, because nobody was that seriously involved in ecology, but everybody was making money with diesel and their other stuff. Now, the world has changed and everybody is looking at energy and ecology. And now, people are also coming to us, just a little company, these are smart guys, and they're saying, "Hey, listen, let us work together."

And that is what my message for this conference is, methane—initially, natural gas, and later methane—is, in my view, the fuel of the future. And what I would like to say to the big companies in this room: there are many, many small companies that have the top technology available. I always say, in fact, everything is available. The only thing we need is to work together. That is what I wanted to say. Thank you.

M. Kovalchuk:

Thank you very much. As our allotted time is coming to an end, I would like to ask our last speaker to say a few words. We have spoken a great deal about electric automobiles and the question of electrical energy accumulator technology seems to me to be very important. I now ask Kirill Tomastchuk, Chairman of the Board of Directors at Elton, to have his say.

K. Tomastchuk:

Good morning, ladies and gentlemen. Since 1994 our company has been working on advanced electrochemical energy sources. Indeed, 10 years ago, in conjunction with Ohio University, we came up with a hybrid bus which is still running to this day in Cleveland. Today we are keeping tabs on new trends in the automotive industry and planning our next moves.

We think that the automobile of the future, for both private and public use, is one that, be it hybrid or non-hybrid, will be electrically driven. However, looking at the next 10 to 15 years, you would have to say that the trend is definitely towards hybrid cars. There are three basic reasons why.

The first is the lack of infrastructure needed for purely electric cars. Even now, when there are really very few electric cars in use in the United States, there is still a problem with infrastructure. They cannot be charged overnight, because the necessary infrastructure is not in place.

The second reason is technological. The problem is the energy source: as yet, we cannot make an electric car which is everything that consumers have come to expect a car to be. It may come down to its short range, its high price or maybe the fact that it does not work in all climatic conditions. This is a big problem.

The third problem is the issue of consumer quality. We carry out surveys and I, personally, am happy to drive a micro-hybrid which stops at the traffic lights,

switches off and restarts. I am not, however, prepared to charge up my car for four hours at night. What if I suddenly need to go somewhere? This is also a big problem. People will have to get used to such issues, as well as get used to the higher price. This will no doubt take a fairly long time.

This is why we think that over the next 10–15 years, the future is hybrid vehicles which do not compromise on consumer quality and are not significantly more expensive than standard, traditional models. In the future, if infrastructural problems are addressed (as of course they will be), if technological issues are resolved, then, in all probability, electrically powered cars will form a significant part of the market. Thank you very much.

M. Kovalchuk:

Thank you very much. Unfortunately our time is really running out. I think we have come to the end of our discussion, and so I will, if I may, having listened to all of today's speakers, make a few concluding remarks of my own. Firstly, it is abundantly clear that the automotive industry, one of the pillars of today's economy, is in a global crisis. Therefore the aim of our discussion today was truly to save the automotive industry and the automobile, which is so crucial to all our lives, by taking it to a new level both economically and environmentally.

However, we do need to add some caveats. For example, there already exists an infrastructure for oil and petrol, both in terms of producing it as a fuel and providing it to the consumer. Also, in any case, manufacturing the actual car uses up a huge amount of metal and other valuable materials. The aim of current attempts to make vehicles and automobiles more efficient is to go some way towards reducing the effect of these existing problems. By creating the hybrid, we are making the automobile more environmentally friendly, while not making unrealistic demands on existing infrastructures. The electric car already

exists and will continue to develop, but this requires huge investment and will not solve the energy problem, because the electricity still needs to be produced; a process that is very harmful to the environment.

It is also obvious that every nation has its own problems and its own ways of approaching the issue. This was brought home to me during the course of today's discussion. For example, what our Spanish minister said was extremely important: Spain has no oil or gas. They are forced, in practice, to pin their hopes on the electric car and the lucid rationale behind this has been made clear to us. I will try, on the basis of what we have heard today, to define what I believe should happen in Russia.

The first nuclear power station in the world was built in Obninsk by Igor Kurchatov, the founder of our institute, and this formed the foundation of the world's nuclear power industry. Today we are continuing to work on improving nuclear power facilities, but alongside this we are also devoting a great deal of time and resources to alternative energy sources. We have a large subdivision working on bioenergetics and biofuels, researching possibilities such as generating fuel from algae. We also work on solar and hydrogen energy – in short, we are researching all forms of alternative energy sources. And of course what will be progress will be technology. However, as I see it, for Russia the real solution is gas.

Let us recap on what we have heard. Firstly, gas, unlike crude oil, does not need to be refined in order for it to be used as engine fuel. Say, for example, you have extracted some gas and some oil. Once you have the oil, you still have to refine it through cracking, which uses up a huge amount of energy, and you still have to build huge factories to get the engine fuel you need. All you need to do with gas to use it as an automobile fuel is simply extract it. You then either compress it or liquefy it, which can be done locally quickly and very easily. Now that you

have engine fuel, you can save on oil, which you can then refine as much as you like, making chemical products, which are actually a lot more valuable than oil.

Secondly, gas is a totally environmentally friendly substance. We in Russia are now discussing adopting the next set of European emissions standards. This will be very difficult, requiring a great deal of expenditure. Using gas will not only immediately bring us into line with these European standards, saving us years and years of time, but also will improve the environment immeasurably. It gives off none of the emissions that petrol-based fuel does. In a word, it allows us to be totally environmentally friendly without spending any extra money.

The third point which struck me as particularly promising, having never thought about it before, was the possibility of—as our colleagues said—manufacturing car bodies from polypropylene. This is the first stage of gas refinement and is extremely cheap. If you produce polypropylene and fortify it with the sort of composite carbon fibre used for aircraft, then you can use it to make automobiles. Indeed, using gas in this way could be a major breakthrough in the development of automotive transport.

It seems to me that in the coming years, the existing infrastructure will actively support internal combustion engines in diesel- and petrol-powered automobiles. That much is obvious. However, in view of current economic conditions and the tightening environmental regulations, the electric car will definitely come into its own sooner or later. Many countries, most of all Russia, seem to be entering a time of great opportunities. What kind of opportunities?

We are a gas power; that is well known. We now have all the necessary technology in place to make full use of our gas, and with the right government policy and the appropriate technical regulation of the development of localised gas networks, we can easily convert existing petrol engines to compressed or liquefied gas. Also, judging by the progress of diesel engines, I believe we can

even mix methane with diesel. If we do take this step, make all automobiles gas-powered and start to make car bodywork from refined gas, then we can be the trailblazers of the automobile manufacturing industry.

On the world stage Russia has lagged behind somewhat in automotive transport development, but now, thanks to the cooperation and participation of western companies, practically all the major world players have a presence on the Russian market. However, talking about ourselves, we really can make a real breakthrough, a breakthrough fundamentally based on gas.

One might say that one of the slogans of Russia's development in the coming years is that Russia is an environmentally friendly, hi-tech superpower. This is because of our efforts to make all our automotive transport gas-powered and to reconceptualize the automobile manufacturing industry as an industry that uses gas not only as a fuel, but also as a construction material.

I think we have come to the end of our allotted time and therefore we are forced to conclude our discussion. Thank you, I would like to take this opportunity to thank all our participants.

Thank you very much for all your contributions.

Thank you very much.