



Media Information

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Member of the Board of Management of BMW AG, Development

Technology Workshops 2017

Unterschleissheim

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*Klaus Fröhlich, Member of the Board of Management of BMW AG,
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Ladies and Gentlemen,

Welcome to our Autonomous Driving Campus!

Today, we would like to give you an insight into our latest development activities.

You'll see that we are already in the midst of implementing what we announced with our Strategy NUMBER ONE > NEXT one and a half years ago.

Since 2007, we have grown to a new level, thanks to Strategy Number ONE.

With this strategy, we put our BMW EfficientDynamics technology package and, even more importantly, BMW i on the road – our comprehensive concept for trendsetting, sustainable mobility. And with Drive, Park and Charge NOW, we have developed the right services to go along with it.

Strategy Number ONE has been a success.

And its 2016 revision – Number ONE > NEXT – has added the right new topics, namely digitalization, autonomous driving and the far-reaching roll-out of e-mobility.

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The new strategy is already being implemented and will once again secure our competitive edge.

These accomplishments have always been rooted in our development activities and our great innovative strength.

We also apply new approaches to make sure that we can reach our targets.

For instance, when we started to implement the revised strategy in 2016, we immediately realigned our organizational setup in research & development.

In doing so, we focus on our two top priorities:

Digitalization,

which includes the extension of connectivity, the application of artificial intelligence, and the development of autonomously driving premium vehicles.

Drive technology,

with EfficientDynamics NEXT for the combustion engines, and the development of semi- and fully electrified vehicles with battery and fuel cell technologies.

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Our driving force of these numerous trendsetting technologies is iNEXT, which is enabling the entire company and all brands to deal with these issues of the future.

That way, innovations and technologies are growing together into a futuristic exterior and interior design.

In 2021, when the BMW iNEXT is scheduled to hit the roads, it will have integrated all our strategic innovation topics for the mobility of tomorrow.

First off, let me tell you more about where we stand in terms of drive technology.

The trend toward e-mobility is irreversible. But fact is too that the market penetration will happen in different ways – and especially at different paces – around the world.

Global markets and customers will continue to demand very different forms of drivetrains for a long time to come.

The increasing challenge for the automotive industry in this scenario is to meet these demands with globally uniform technologies and still comply with the differing legislative requirements.

Let me give you three examples:

In Europe, a CO₂ target of 95g/km from 2020 forward has been set for vehicle fleets. Nevertheless, plenty of heterogeneous – and somewhat competing – country-specific regulations continue to exist.

In China, the market is almost entirely dominated by national legislation; and in the U.S., electro-mobility is primarily a thing of the West and East Coast. There, we have the ZEV mandate for the manufacturers. With gallon prices below \$ 3 the US customer is still very performance oriented.

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Overall, political stakeholders are having a huge impact on legislation right now, and often enough, their decisions do not consider the boundaries of what is technically feasible or the time required. Therefore, technology decisions and developments must often be made long before the actual laws are passed.

This is why, back in 2010, we were the only OEM worldwide who decided to offer all types of drives in all vehicle segments from the next decade on, and to do so depending on market demands: state-of-the-art, efficient, clean combustion engines; plug-in hybrids starting in 2015; and fully electric, battery-powered drives from 2021 onward.

But you will need to be a cost and performance leader for e-drives to prevail in this market.

This is why we are investing tremendous amounts into having full flexibility and apply a 360-degree approach to our e-mobility development.

Consequently, we have developed the best core competence and value creation for e-drives among competitors.

And this will continue to remain a top priority.

A few days ago, for instance, we laid the foundation stone for our new Center of Excellence for Battery Cells, in which we will be investing more than 200 million euros.

When it comes to e-drives, power electronics and battery systems – we always go for an in-house development with build-to-print expertise or in-house production, in other words: full technical system penetration.

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And since 2013, we have gradually qualified the vehicle plants to handle e-drives in order to respond to the customer demand.

This way, we have established the ideal technological framework for us:

- Purely battery-powered vehicles will see a comprehensive, large-scale roll-out and reach driving ranges of up to 700 km.
- Plug-in hybrids – or Power PHEVs – with about 150 kW will set new standards in terms of driving pleasure and a range of up to 100 km.
- And combustion engines will also set standards once again with their 48-volt recuperation systems and further great reductions in emissions.

We ensure our full ability to act with extremely flexible architectures and modular systems.

In the future, our new vehicle architectures and highly flexible vehicle plants will allow us to decide quickly which model to produce at which quantity and which drive to fit.

You might remember that we are also the only OEM who already in 2010 made the decision to integrate the PHEV in all our rear-wheel and front-wheel drive architectures, or CLAR and FAAR as we call them.

As we continued to advance these two architectures, and having managed to more than double the stored energy content, we have recently also performed the qualification for the BEV integration.

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So, we will have flexible vehicle architectures on the one hand and modular systems for drivetrains on the other.

This setup gives us an unparalleled level of flexibility in a global context.

The now fifth generation of our e-drives will launch in 2021, with the BMW iNext.

We are talking about a scalable modular system here, which means that the technology can also be fitted in models that will have been launched by then.

In other words, at this point, we will be able to semi- or fully electrify any model, depending on market demand.

These efforts are already paying off today:

- With our third model generation, we are one of the world's top providers of electrified vehicles.
- And our BMW brand already has three times the market share among e-drives in Europe than it has among combustion engines.
- Today, we are offering 9 electrified vehicles and will be delivering more than 100,000 units to customers this year alone.
- But our model initiative will really take off with the MINI BEV, the fully electric BMW X3, the BMW iNEXT and the BMW i Vision Dynamics – so that by 2025, our line-up will comprise 25 fully or semi-electrified models, 12 thereof fully electric.

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To summarize:

- For us, electro-mobility is the new normal.
- We are going to electrify all brands.
- By doing so, we will have the most comprehensive offering in the competitive environment –
- while maintaining full flexibility and without any further need for solitary platforms.

This is how we will become Number ONE also in the area of premium e-mobility – ahead of established and new competitors.

But enough about that for the time being. Let's move on to my second topic of the day, autonomous driving and artificial intelligence.

In the chart behind me, you can see our milestones in the development of autonomous driving over the past ten years.

You see that we started to work on autonomous driving solutions very early on when some companies – who are testing their 'auto-pilots' in road traffic today – were still in their infancy.

What we can do very well, without any outside support, is motion control, the design and management of the vehicle via the drive, chassis, brakes, and the entire sensor and systems integration – actually, this is one of our core competences.

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For everything else, we have partnered up with the best in their fields: Intel, Mobileye, Delphi, Conti, Magna and FCA. Together with these strong partners, we are developing solutions right here on the campus.

Autonomous vehicles will fundamentally change the function of cars and how we use them.

For us, the focus is always on the customer benefit.

We will always let the customer decide in which mode to drive.

Because it's not sheer driving pleasure if you don't have a choice.

A large number of BMW models – from the BMW 7 Series to the entire fleet – are at various degrees already equipped with semi-automated assistance systems.

These features enhance our customers' safety and comfort on a daily basis.

Today, our cars do not only offer lane-keeping and cruise assist up to 60 km/h, but already since 2015 up to 210 km/h on the autobahn.

But it wouldn't be right now to take it step by step, making the arduous way from the low second level to the third.

Due to the system leaps, the additional requirements in terms of redundancy, computing power and connectivity for fully automated driving, we will be able to fully master level 5 right from the outset in 2021. From then on, we will be able to offer automation solutions worldwide in a flexible range of level 3 to level 5 – depending on customer demands and the respective legal framework.

Just like the modular systems that you already know from our e-mobility solutions.

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However, until we reach that level, we will still have to achieve some significant technological breakthroughs.

Contrary to some self-declared marketing experts, I consider autonomous driving a huge challenge.

Autonomous vehicles must be fully connected.

In this field, we have already done the groundwork:

Today, over 10 million BMWs from series production are fitted with an embedded SIM card – more than at any other carmaker.

But on top of that, we also need a high-speed 5G network with data rates of up to 10 gigabits/second and high availability.

Plus, free access to an HD real-time map.

This is why we have joined a group of companies to acquire the world's largest map service, [HERE](#).

In a second step, we will now industrialize state-of-the-art sensor technologies for the environment model and intelligent on-board features.

At present, we are developing a comprehensive sensor cluster consisting of cameras, radars and laser scanners, which is coupled with an artificial intelligence system to generate an environment model via data fusion.

This is a cooperation project with industry leaders Intel and Mobileye.

Both companies have staff directly here on campus, which allows us to work on the future of mobility together in a new style of agile teamwork.

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The challenges involved in safe autonomous driving are enormous.

Just to give you an example: our entire company currently requires a data volume of 60 petabytes. Very soon, and due to the amounts of data from autonomous vehicles, our previous demand will rise to approximately 500 petabytes. This is about nothing less than replacing human perception and the human brain's ability to think and make decisions by an artificial intelligent system.

To master this massive undertaking, we are establishing cross-industry collaborations.

But there's another aspect we can't neglect: safety-relevant systems will not be a USP in the long term. There will have to be the highest level of technology around the world.

This is why more and more OEMs und TIER-1s are joining our open platform, making it the leading centre of excellence for autonomous driving.

While the future of the automotive industry will also depend on external conditions and the regulatory frameworks, I am convinced that our strategic foresight and expertise in building alliances will be equally important.

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This is why our aspiration is very clear:

We want to be a leader also in matters of autonomous driving.

We pursue this goal with consistency and are systematically creating the necessary framework.

Before I conclude, I'd like to mention one more crucial point: The opportunities of digitalization and autonomous driving will also bring about new possibilities of using the vehicle interior and the respective user interfaces.

Consequently, the standards regarding the interior and the user experience will increase exponentially.

Seamless integration into our customers' lives is the buzzword of the day. And the demands are high: the integration must be customized, understand needs and wishes, and offer true customer value. And it's a given that usability will have to be comfortable and intelligent. So, in the future, sheer driving pleasure will be defined by an additional dimension: the possibility to make good use of the time in the car by relaxing or spending it with others.

Again, our intention is to set new trends.

This is why our aspiration is to redefine the interior experience.

We will show you in greater detail what that may entail in 2018.

That much for my presentation of our technology initiative based on our Strategy NUMBER ONE > NEXT.