

Research Press Conference 2021

News Release

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Sustainability Starts in Research

Presentations by

Dr. Melanie Maas-Brunner,
Member of the Board and Chief Technology Officer of BASF SE

The spoken word applies.

Dear ladies and gentlemen,

I wish you a warm welcome to this year's Research Press Conference. This is my first in the role of Chief Technology Officer. Of course, I would prefer to be meeting with you face to face here at BASF. But I am certain that our passion for research will come across on your screens as well.

[Slide 2: We live in a time of tremendous challenges ...]

The Earth's average temperature has already risen by 1.1 degrees Celsius compared to the pre-industrial era. We are quickly approaching 1.5 degrees Celsius. Global climate change is human-induced, states the Sixth IPCC Assessment Report. It is becoming increasingly clear: Climate change is the greatest challenge of the 21st century. Quick and decisive action is needed now. That is the only way to reach the goals of the Paris Agreement. There may still be a chance to avoid a 1.5 degree rise. This was the objective of the 26th UN Climate Change Conference in Glasgow. There were a lot of discussions. There were long and tough negotiations leading to the joint and binding resolutions.

We are aware of our responsibility. We at BASF support the Paris Agreement target of limiting global warming to less than 2 degrees Celsius.

The international community needs to address many issues simultaneously: climate protection, the use of limited resources and providing the growing global population with food, water and energy. **These are all tremendous challenges.**

[Slide 3: ... and we live in a time of groundbreaking innovations]

At the same time, we live in an age with many groundbreaking innovations.

The energy transformation is progressing faster and faster – thanks to technological advances in solar and wind energy generation as well as in the use of electrical energy. The per-kilowatt-hour costs of solar or wind electricity are falling, while there are very rapid improvements in battery technology, such as in electric vehicles.

Another field of research also puts me in an optimistic mood: quantum computing. It will launch a chain of disruptive innovations that will fundamentally change the chemical industry in the long term. We will be able to develop new products much faster. This technology makes it easier for us to model chemical reactions and molecular properties. And in future, we will also be able to better study larger

molecules. That is why BASF has joined the Qutac Consortium. Quantum technology is the way of the future. And we want to use this technology in industrial applications.

[Slide 4: Innovation is the key enabler for the sustainability transformation]

At BASF, innovations have always been the key to success. They enable us to transform our company.

For us, innovations begin in research and development. The know-how of our highly qualified staff is our most valuable resource and the foundation of our innovative strength.

We focus on developing sustainable solutions for our customers. To help them to reduce their carbon footprint, use resources more efficiently or manufacture products in a more eco-friendly way enabling a circular economy. This is how we safeguard our competitiveness in the long term. And make our contribution to society.

[Slide 5: We operate the industry-leading innovation platform]

We have a unique research and development landscape. Worldwide, we have around 10,000 employees working in research and development, many of whom are based in Ludwigshafen. We have continuously expanded our presence in the regions in recent years. This enables us to react faster to regional growth trends. We invest around €2 billion per year to develop new products, new fields of technology and competencies.

We generate annual sales of around €10 billion with products launched on the market in the past five years that stemmed from R&D activities.

[Slide 6: New setup to benefit our customers and support the transformation towards sustainability]

To secure long-term success, we must further strengthen our customer proximity and leverage the advantages of our Know-how Verbund. By this, I mean our technologies and the broad knowledge of our employees. To become even better, we will be reorganizing our global research activities next year.

Business-related research units which previously belonged to one of the three group research divisions will be embedded into the operating divisions. This will put them in an even better position to cater to the needs of our customers. Our aim is to further shorten the time to market for new products and to accelerate the company's organic growth.

Research activities that are relevant to several operating divisions will be bundled in a central research division headquartered in Ludwigshafen. This division will remain a global structure with a presence in all regions.

We are embedding the research units into the divisions so we can respond even better to the diverse needs of our customers. Many of our customer industries have very specific requirements, for example, in the automotive or personal care industries. New solutions from the laboratory and their application testing are very closely linked in these business areas. This integration will help us to react even more quickly to market trends because we will have one unit steering our innovation activities in these fast-moving markets.

The new global research division will be aligned with our focus areas. As a result, we will create synergies and a strong foundation for market trends. Developing new competencies is an ongoing task for us. For example, when it comes to further reducing our carbon footprint, developing concepts for biodegradable plastics, or using digital tools more effectively.

[Slide 7: Our purpose leads the way: We create chemistry for a sustainable future]

Ladies and gentlemen,

We are – and want to stay – the innovation leader in the market. I have told you how our organizational realignment will contribute to this.

Our corporate purpose – We create chemistry for a sustainable future – guides our actions. We don't just talk the talk, we walk the walk.

We have set ourselves an ambitious goal for 2030: We want to reduce our absolute CO₂ emissions by 25 percent compared to 2018 levels. And by 2050, we aim to achieve net zero emissions at BASF. These goals guide us. At the end of November, we announced that we are stepping up our efforts with a new project organization

and the establishment of a unit called “Net Zero Accelerator.” This powerful structure will support us in our transformation.

We have also set ourselves ambitious goals for our Circular Economy Program. By 2025, we want to process around 250,000 metric tons of recycled raw materials each year. And we aim to increase our sales of circular solutions to €17 billion by 2030. That is double the current figure.

An important steering instrument for our product portfolio is the Sustainable Solution Steering method, which is based on the sustainability performance of our products.

[Slide 8: Methane pyrolysis – process innovation to reduce CO₂ emissions]

Chemistry requires vast amounts of energy. This energy currently comes primarily from fossil fuels. We have continuously further developed our plants and processes and have nearly exhausted the potential for CO₂ reduction. We are reaching the technical limits. That is why we need completely new technologies and processes. One of these technologies is methane pyrolysis. It is the key technology for CO₂-free hydrogen in the coming decades.

At our Research Press Conference in 2019, we first told you about our research into splitting methane into carbon and hydrogen. At that time, we had just tested an entirely new reactor concept at lab scale. We talked about the challenges related to electrical heating.

We took the next major step in the pandemic year 2020/21: the construction and commissioning of our test plant in Ludwigshafen. This plant is now running in trial operations. This is a milestone for us. I want to say thanks to the very dedicated BASF team. They have done a fabulous job in challenging times!

There are now two challenges to overcome: The first is mastering the process technology – with the electrical heating and the use of novel materials with high temperature resistance in this reactor. The reactor can reach temperatures of up to 1,400 degrees Celsius. The second challenge is the right process control. This means finding out what the right operating window is for this reactor.

CO₂-neutral methane pyrolysis will make a contribution to sustainability and will be economically viable. We are convinced of this. And it will help to combat climate change. But until we get that far, we still have hard work to do and some hurdles to

overcome. Our next milestone will be the scaleup. We want to achieve industrial application before 2030.

[Slide 9: Gas fermentation for carbon-neutral and circular products]

Our climate is changing and one of the crucial questions is: Will it be possible to develop the urgently needed technologies to keep carbon, an important raw material, in circulation? The aim is to transform the carbon contained in industrial off-gases into valuable chemicals. Together with partners, we have already achieved a first success.

Today, industrial off-gases are primarily incinerated or thermally recovered to produce electricity and steam. In both cases, CO₂ is emitted. Our goal is to avoid these emissions and to recycle the main components of the off-gases so they can be used in chemical production. Our researchers have been working on this since 2018 with the American startup LanzaTech.

This year they made a breakthrough: With the help of special bacteria, they were able to produce n-Octanol for the first time from carbon monoxide and hydrogen. The alcohol n-Octanol is used in cosmetics, for example. Normally, microorganisms cannot produce n-Octanol because it is toxic to them. But with biotech methods, LanzaTech was able to program the organisms in such a way that they can produce and tolerate n-Octanol during gas fermentation.

In parallel, our researchers developed a process that enables n-Octanol to be continuously separated and purified. We have successfully put this into practice in the lab.

[Slide 10: New biodegradable chemistry – significant acceleration of development through digitalization and automation]

For a successful Green Deal, we want to and must achieve climate-neutral production in the future. But not only that. The E.U. goals will not be reachable without the chemical industry. Because we offer innovations for a more sustainable life.

I would like to give you one example from our research, in the area of biodegradable and bio-based materials. This is an example of innovative solutions that contribute to the Green Deal agenda.

The circular economy and sustainability are increasingly important, including for our customers. For example, in the detergents and formulators industry. That is why teams at BASF are working on the question of how to best combine strong cleaning performance and good environmental compatibility. The focus is on new ingredients made from bio-based raw materials, which can biodegrade at the end of their productive life cycles. This requires new approaches in research and development.

Together with academic partners, we are pursuing various projects to develop a fundamental understanding of how biodegradation processes occur under different conditions. To this end, we are synchronizing the results of laboratory and field research. With the additional integration of new digital tools as well as faster screening and test methods, we are able to reduce our development times and develop high-performance, environmentally sound ingredients. This is true not only for cleaning products, but also for cosmetics and industrial applications such as agrochemicals.

[Slide 11: Chemical industry as enabler for the reduction of CO₂ emissions in other sectors]

The chemical industry plays a central role in the transformation towards a climate-neutral society: One reason is because the industry currently emits relatively large amounts of CO₂.

Another reason is that its innovative products will be especially needed in the future. These include materials for solar cells and wind turbines, battery materials for e-mobility, insulation materials and robust materials that protect against increasingly extreme weather. Chemical products are also indispensable in other areas of daily life, for example, in pharmaceuticals or agriculture.

[Slide 12: The transformation of the automotive industry towards electric mobility is in full swing – with significant opportunities for BASF]

The automotive industry is undergoing a massive shift owing to the transformation of the powertrain and the transition from internal combustion engines to e-mobility.

We expect that by 2030 around 30 percent of all cars produced worldwide will be either fully electric vehicles or plug-in hybrids. This share will continue to increase significantly after 2030.

For BASF, this offers major opportunities because the chemical content per vehicle will increase substantially. We anticipate that it will rise by a factor of 2.5 in a fully electric vehicle as compared to a car with an internal combustion engine. The largest share of this added value will be in the battery.

This transformation is very important for our company because the automotive industry is our key customer industry. Around 20 percent of our Group's sales are currently associated with the automotive industry.

In recent decades, we have proven that we are a strong solution supplier for the automotive industry. And we want to continue to be.

[Slide 13: BASF innovations enable electric mobility in various applications]

The battery is the heart of every electric vehicle. We use an extensive toolbox of different methods to improve the performance, reliability and sustainability of batteries. This is important to our customers.

Plastics are indispensable in e-mobility. Plastics play a role in lightweight construction, heat conductivity, heat management and, of course, safety. The share of plastics will also increase amid the transition to fully electric powertrains.

In addition, BASF is developing new engine coolants. A battery electric vehicle will require roughly twice as much coolant as a car with an internal combustion engine. There is one particular challenge with electric vehicles: The formation of flammable hydrogen must be prevented in the event that coolant comes into contact with high-voltage battery components, as could happen in the case of an accident. Lowering the electrical conductivity of the coolant is the key to success here.

And one more important topic: corrosion protection. With the help of digital simulations, we have developed a cathodic dip coating tailored to the specifications of electric vehicles. It protects the car body from corrosion and at the same time helps to lower CO₂ emissions in production. This is good news for sustainable mobility.

Our researchers will tell you more about these topics later on in their presentations.

[Slide 14: Agriculture depends on innovations that protect the environment and address societal expectations]

Agriculture is one of the most innovative economic sectors. And it will undergo fundamental changes. Because the world will need to find a way to sustainably provide healthy and affordable food for 10 billion people. According to the Food and Agriculture Organization of the United Nations (FAO), farmers will have to produce more food in the next 30 years than in the entire history of humankind. To achieve this goal, productivity must rise by 50 percent.

Farmers have always worked with nature and in a dynamic environment. The social, economic, legal and especially the environmental challenges are constantly changing. Agriculture has to become CO₂-neutral in the future. And even today, farmers have to deal with the effects of climate change and increasingly extreme weather conditions. This is leading to a decline in the available arable land. At the same time, everyone has to work together to preserve – or better yet, increase – biodiversity. For more than 100 years, BASF has supported farmers in rising to all these challenges.

[Slide 15: From individual products to holistic system solutions – creating the best offer for our customers in agriculture]

BASF offers a broad portfolio of agricultural solutions. Early on, we were pioneers: Fertilizer only exists thanks to our invention of ammonia synthesis. Fertilizer has been one of the key pillars of global nutrition over the past century. And BASF has continuously evolved. Today we are a leading supplier of seeds and traits, seed treatment, biological and chemical crop protection as well as digital products and solutions.

We concentrate on crops that are cultivated by farmers around the world. To enable farmers to achieve optimal crop production, we combine products, technologies and services. With the right combination of existing and new technologies, we want to help farmers use available land more productively and encourage biodiversity at the same time. It is about finding the right balance for better yields. It is about producing more with less. With more targeted application and more efficient use of resources. And it is about combining the best products and technologies to achieve better yields.

This afternoon we will present three approaches illustrating how we pursue our research activities innovatively and with a focus on sustainability. We will start off with seeds. Hybrid wheat is one of our most innovative breeding programs. During

plant growth, the aim is to protect the plants and the yield. We will show you how we design our research processes to generate more sustainable solutions. Finally, we will show you how digitalization has made it to the fields. Digital technologies enable farmers to further increase their productivity and the efficiency of resources in their day-to-day work.

[Slide 16: BASF's R&D team is committed to helping our customers become more sustainable]

To conclude my speech, I would like to return to my opening statement: Tremendous challenges have to be mastered simultaneously. And time is of the essence. This means we must now boldly tackle the transformation of the economy and society, rely on innovations and be open to new technologies. This is the path we are taking. Resolutely and systematically. Research and development is the core of BASF. We have an incredible team. This makes me very optimistic.

And now I look forward to taking your questions.