150 years of BASF

Our innovations have influenced how we live today. But what will society need tomorrow?

In our anniversary year, we are guided by three major questions of the future:

What will the cities of the future look like?

Where will the energy we need come from?

How can everyone have access to healthy food?

At BASF, we are working on answers. Find out more on the following pages.

Cover photo and page 1:
In the laboratory at the BASF subsidiary Deutsche Nanoschicht GmbH, we conduct research on the next generation of superconducting tapes. These are based on metal strips to which a superconductive coating is applied. Superconductors transfer electricity at almost zero loss, which translates into huge savings potential in the generation and transport of electricity.
What will the cities of the future look like?

Cities draw people seeking work, prosperity and culture. The year 2008 marked the first time that more people worldwide were living in metropolitan areas than in the country. Estimates suggest that, in 2050, over 70% of the world’s population will call cities home.

But how will our cities look and sound in the future, what will it be like to live there? How can more and more people find living space and quality of life? How can we create intelligent transportation systems? And will there be enough resources, such as water, for everyone?
We at BASF have been working on answers to these questions for 150 years: by identifying the needs of our customers and partners, exploring the as-yet undiscovered, and making innovations available to as many people as possible.

Examples include the special concrete admixtures used to construct the world’s tallest buildings or an earthquake-proof tunnel under the sea. Or thermal and acoustic insulation materials that make riding the subway more comfortable. Or membranes that allow saltwater to be transformed into drinking water.

Shaping the London skyline:
“The Shard” was inaugurated in 2012. The futuristic building’s glass façade is about the size of 8 football fields. On the inside, visitors can ride 44 elevators.
Big cities the world over are facing enormous challenges. With urban populations constantly growing, living and work space need to be found for more and more people. And yet space is limited. That’s why the trend is to build upwards – as demonstrated by skyscrapers like London’s The Shard. Completed in 2012, the building’s 310 meters are only topped in Europe by the Mercury City Tower in Moscow. Taller still is the Burj Khalifa: with its more than 160 stories, it stretches 800 meters into the skies over Dubai, making it the tallest building in the world.

BASF’s products assist in construction. The Shard, for example, employed a specially developed blend of BASF’s MasterGlenium® Sky concrete admixture: Construction projects of this sort require particularly fluid concrete that can be easily pumped up great heights. MasterGlenium® Sky also helps concrete dry quickly, so that building can proceed without too long of a pause. MasterGlenium® super-plasticizers not only improve the construction properties of concrete, they also lessen its environmental impact. For example, slag or fly ash can replace some of the cement, avoiding the carbon emissions released by the energy-intensive cement production process.

With more than 8 million inhabitants, New York is the most populous city in the United States. Living space is extremely scarce, not to mention expensive. That’s why creative solutions are in demand – especially in the densely populated center. 432 Park Avenue is not only a swank address. It is also the name of a spectacular building being erected in the heart of Manhattan: a new skyscraper that will stand on an area measuring only 28 by 28 meters. The residential building will rise 426 meters into the air. Helping accomplish this feat is BASF’s Green Sense® concrete technology, which was also used in the construction of the One World Trade Center in New York. Green Sense® concrete technology is a BASF performance package that manufacturers can use to improve their concrete in terms of durability, processing characteristics, longevity and environmental impact.

“Things have to move quickly in cities like London. The entire foundation slab for The Shard was poured on a single weekend, because causing traffic snarl-ups with the construction vehicles was out of the question.”

Brian Williams,
Sales Manager, BASF’s Construction Chemicals division
In the heart of Manhattan:
Opened in November 2014, the One World Trade Center is a record-breaker. It is simultaneously the tallest building in the Western Hemisphere and one of the most environmentally friendly of its size. Its features include a recycling system for rainwater.

28 by 28 meters: This is how small the area is on which 432 Park Avenue is being built. Once completed, it will be among the tallest residential buildings in the world.

Follow the skyscraper’s construction online at 432parkavenue.com
Urban life is criss-crossed by many different forms of transportation. Streets, rails, tunnels – these are the veins and arteries of a city. Commuters especially rely on fast, dependable connections. In Istanbul, for example, the Marmaray Tunnel running under the Bosphorus Strait makes it possible for a train to go from Europe to Asia in only 4 minutes. The underwater tunnel is therefore not only an environmentally friendly alternative to the busy Bosphorus Bridge highway, it also saves time, along with reducing traffic noise and exhaust emissions in this megacity. BASF’s expertise and solutions were called for here, as well: For example, a special injection foam to prevent water ingress and a concrete formulation to earthquake-proof the tunnel both contributed to its construction.

Commuters on their way to work in the Canadian city of Montreal have also enjoyed a nicer ride since the beginning of 2014, when new subway cars featuring special thermal and acoustic insulation were introduced. The Bombardier-made cars have ceilings equipped with BASF’s Basotect® melamine resin foam. By 2018, 468 of these new cars are expected to be in circulation, making noisy and uncomfortable subway rides a thing of the past.

“Constructing the Marmaray Tunnel was a huge challenge: Its deepest section lies 56 meters below the water’s surface. Also, the tunnel must withstand up to a magnitude 9 earthquake on the Richter scale.”

Suat Seven, Regional Manager, BASF’s Construction Chemicals division
Thirsty cities

Cities demand great quantities of resources, like water. And yet much of the existing water supply infrastructure in congested urban areas is already being stretched to its limit. Places where many people share close quarters are places that require countless liters of water every day for drinking, cooking, washing, hygiene and industry. How can we quench the thirst of cities?

Over 70% of the Earth’s surface is covered in water – most of it saltwater. Desalinating seawater makes this valuable resource available for consumption. One such plant is located in the Spanish El Prat de Llobregat. It supplies drinking water to around a quarter of the population in the greater Barcelona area. And in Nungua, about 12 kilometers from the Ghanaian capital of Accra, desalination will soon be able to provide drinking water to roughly half a million people.

Potable water is a scarce commodity on Cyprus, too. Water scarcity can at times mean drastic restrictions for the island’s inhabitants: It has happened that, during periods of drought, the water supply was reduced to 36 hours per week. Here, too, people now count on seawater desalination. Famagusta, Cyprus, uses the ultrafiltration technology of inge GmbH, a subsidiary of BASF. Membranes made from Ultrason® high-performance plastic prepare the seawater for desalination by intercepting undesirable particles like sand, clay, algae, and even pathogens.

Seawater desalination is an opportunity for coastal cities around the world to secure their long-term supply of water. According to the forecasts of sector specialists Global Water Intelligence, three times more people will meet their water needs through desalination technologies in 2030 than do so today.

“We produce around 7,000 cubic meters of potable water for Famagusta daily. If water means life, then we’re giving this city life.”

Aydin Celikbas, Desalination Plant Manager in Famagusta, Cyprus

For more information, see the film “The New Source” at basf.com/the_new_source
Where will the energy we need come from?

Our lives are inconceivable without energy – we need it in industry as much as at home. Energy keeps our houses cool in summer and warm in winter, lets us cover great distances in an electric car and allows us to go online with our laptops and tablets at any time.

Demand for energy is growing by the day. By 2050, humanity will need two to three times more energy than it does now, but fossil resources are finite. How can we use it more efficiently? How can we store and transport energy with minimal losses in the process? And how can we expand electricity generation from renewables in a cost-effective manner?
We at BASF have been working on answers to these questions for 150 years: by recognizing future trends early on, keeping our research on the cutting edge and finding flexible solutions for society and the environment.

Examples include technologies that enable houses to secure their own energy supply and the nearly loss-free transmission of electricity. Or a material that ensures optimal voltage in laptops, or battery materials for electric cars. Or technologies that increase the effectiveness of wind and solar power plants.

The online generation:
Everyday life without laptops, tablets and smartphones is almost unthinkable nowadays. We are increasingly dependent on energy that is readily and reliably available wherever we go.
The power of sun and wind

They represent renewable energy and generate electricity from natural resources: solar and wind power plants. BASF’s expertise goes into many of these facilities in order to improve their efficiency and longevity. Our Seluris® technology, for example, is engineered along the entire solar cell value chain. From cutting and etching to texturing, doping and cleaning, Seluris® processing chemicals contribute toward increasing solar cells’ performance – such as by cleaning the surface of solar wafers so as to minimize the occurrence of flaws.

“We with our salts and the knowledge of how to use them at high temperatures, we help solar thermal power plants generate electricity even more efficiently.”

Dr. Kerstin Dünnwald, Head of Business Management for Inorganic Chemicals in BASF’s Monomers division

We are also developing new solutions for solar thermal power plants: In September 2014, for example, we started up a pilot plant together with Novatec Solar in southern Spain that uses molten salt instead of thermal oils as a heat transfer medium. The benefit: Inorganic salts allow operating temperatures to be raised to more than 500 degrees Celsius, which increases electricity yield. BASF is the world's leading supplier of synthetically produced sodium nitrate for solar thermal power plants.

Wind turbines need to run safely and efficiently over a period of at least 20 years. During that time, they are exposed to enormous weather-related stress factors, such as rain, hail, snow and ultraviolet rays. The strain on a rotor blade is extreme: The tips reach top speeds of 300 kilometers per hour, rotating at a height of around 90 meters in the air. Under these conditions, things like raindrops can turn into tiny bullets. Such speeds also mean enormous pressure on the tips of the blades, which can bend by over a meter.

Hardy on the high seas:
The offshore windpark West of Duddon Sands has stood in the middle of the Irish Sea since October 2014. It produces enough electricity to supply around 280,000 households every year.
Houses need energy: for light and electrical appliances, for heating and air conditioning. Developments like the "passive house" have already significantly improved energy management in modern buildings. And yet we can even go a step further: Buildings can actually become power plants. Together with Swansea University in Wales, along with other partners in industry, BASF is involved in a special project: SPECIFIC (Sustainable Product Engineering Center for Innovative Functional Industrial Coatings). SPECIFIC tackles the question of how buildings can, for example, transform incident sunlight into heat or electricity. The team of over 120 scientists, technicians and engineers is developing special roof and façade coatings to address this very issue. BASF supports their work on topics like energy storage, and provides its expertise in photovoltaics along with coatings that give off light and heat.

The insides of many modern rotor blades consist of glass and carbon-fiber mats soaked with and bonded by our Baxxodur® epoxy systems. As a core material, the polyethylene terephthalate (PET) foam Kerdyn® stabilizes rotor blades in conditions of structural and dynamic stress. MasterFlow® mortar solidly bonds tower and foundation – and quickly, too: The mortar hardens rapidly even in inclement weather and at very low temperatures, which helps wind parks to be built faster and therefore more cost-effectively, both onshore and off.

Buildings as power plants

Houses need energy: for light and electrical appliances, for heating and air conditioning. Developments like the "passive house" have already significantly improved energy management in modern buildings. And yet we can even go a step further: Buildings can actually become power plants.

“Smart surface coatings for steel and glass have the potential to generate enough heat and electricity to independently power a building throughout the entire year.”

Kevin Bygate, Chief Executive Officer of SPECIFIC
The electricity transmission of the future

When electricity is transmitted over conventional copper conductors, a portion of the electrical energy is always lost in the form of heat. High-temperature superconductors, on the other hand, can transport considerably higher amounts of electricity. Even at temperatures above the boiling point of liquid nitrogen (~196 degrees Celsius), they transmit electricity with almost zero loss, enabling major savings potential in the generation and transport of electricity. Superconductor cables can improve electricity infrastructure in dense urban centers and large industrial sites. Possible applications are in current limiters and transformers for public power grids, and electricity cables for supply networks within cities.

Even generators and electric motors can be made more compact and energy efficient. Superconductor technology enables, for example, better use of renewable energies with wind and water power generators.

The BASF subsidiary Deutsche Nanoschicht GmbH has developed an innovative technique for producing superconductors in a more efficient and environmentally friendly manner. A joint laboratory with the Karlsruhe Institute of Technology is scheduled to open in 2015 with the goal of further optimizing superconducting tapes.

Electric drive comes standard: The BMW i3 is the first mass-produced electric car of the BMW Group. Its 170-horsepower electric engine has a range of around 190 kilometers.

Real bundles of energy

Electricity is also taking on an increasingly significant role in the field of mobility. Estimates suggest that around 1.2 billion cars will be on the road in 2020 – a good 300 million more than now – most of which in congested urban areas. And yet big cities today are already suffering from smog and noise pollution. That’s why cityscapes of the future will feature more and more electric cars – with high-performance batteries at their core. BASF develops and produces cathode materials and electrolyte formulations for lithium-ion batteries, helping vehicles get as far as possible on a single charge.

“New materials for high-tech lithium-ion batteries are the key to the electromobility of tomorrow.”

Dr. Michael Krausa, Managing Director, Kompetenznetzwerk Lithium-Ionen-Batterien
We work together with strong partners to make this happen. In the collaborative Alpha-Laion project, we are developing new high-energy batteries for electric vehicles with companies like Bosch and Daimler. We also operate a joint laboratory with the Karlsruhe Institute of Technology that works on new battery materials. In addition, we are furthering research on lithium-ion batteries and cathode materials at research labs in Amagasaki, Japan, and Beachwood, Ohio, as well as in Ludwigshafen, Germany. BASF is also involved in the International Electrochemistry and Batteries Research Network and in the Lithium-Ion Battery Competence Network in Berlin.

Furthermore, we research additional materials to advance electromobility: For example, we supported BMW in developing several components of the BMW i3, the BMW Group’s first fully electric mass-produced vehicle. BASF’s plastics are built into automotive parts such as the body, seats and roof construction.

For the last three years, we and Volkswagen have presented the Science Award Electrochemistry to researchers around the world in order to support their work on electromobility. The 2014 prize winner, Professor Vanessa Wood, developed a new imaging analysis method that helps improve the performance of lithium-ion batteries.

Professor Vanessa Wood, Swiss Federal Institute of Technology Zurich, Department of Information Technology and Electrical Engineering, Switzerland

“Our new visualization methods help researchers to optimize next-generation batteries.”

Current technology for laptops

Smartphones, tablets and laptops: Thanks to their many functions, mobile devices are part of everyday life. Each individual component of these complex electronics must perform at a particularly high level. Some parts, such as the CPU or hard disk, need current with a different voltage than that supplied by the battery; if the voltage were to deviate from the required value, these components would sustain damage. BASF’s high-purity carbonyl iron powder makes a decisive contribution toward solving this problem: Incorporated into the cores of high frequency coils, it ensures that the current flowing into delicate electronics always maintains exactly the right voltage.

BASF discovered how to produce carbonyl iron powder in 1925. Back then, it was used in applications like magnetic tape for the first tape recorders.

Powder in coils: Their perfect spherical shape makes BASF’s carbonyl iron particles especially suited for use in electronic components like high-frequency coils.
How can everyone have access to healthy food?

In 2050, more than nine billion people will live on Earth. One person in eight is already going hungry today. Yet nutritious food is essential to a healthy life. The faster the world’s population grows, the more important it becomes to consider how we will feed everyone:

How will everyone be able to eat healthfully? How can we combat malnutrition? What will the agriculture of the future look like?
We at BASF have been working on answers to these questions for 150 years: by recognizing a need early on, conducting inquisitive research, and sharing our expertise with others.

This includes innovative products and solutions for agriculture with which we support farmers in growing high-quality food. Together, we work to keep cultivated land arable for future generations. We use information technology to help farmers engage in efficient, careful, high-yield agriculture. Furthermore, we produce vitamins and fatty acids that contribute to a balanced diet.
In the field

In order to secure harvests around the world, our crop protection products guard against fungal infections, insect pests, and weeds, and raise the quality of agricultural products. One of the most destructive soybean diseases is Asian soybean rust – a fungal infection. To combat it, farmers can turn to BASF’s proven strobilurin fungicides and Xemium®, our product launched in 2011.

Rice is the main food source for a large percentage of the world’s population, and thus one of the most important crops of all. Yet “red rice,” a type of wild grass, can cause considerable harvest losses in rice cultivation. BASF’s Clearfield® production system provides a solution: It combines an herbicide with Clearfield technology’s nontransgenic, herbicide-tolerant seeds, which can secure rice yields and increase them up to threefold.

Our research in plant biotechnology concentrates on plants for more efficient agriculture that are hardly affected by heat or drought, for example. One such product is the Genuity® DroughtGard® variety of corn we developed together with our partner Monsanto. In times of drought, it is more stress-resistant than conventional corn varieties.

As a project partner in the “Better Rice Initiative Asia,” we support the distribution of information in Indonesia and Thailand on the proper use of crop protection products. We are also involved in the development of courses to train farmers and agricultural consultants, as well as in the creation of educational materials and conducting seminars. For the staple rice, especially, farmers receive consultation on the selection of seeds, the right application of crop protection products and the analysis of growth. We support soybean farmers in a similar cooperation in India.

In North America, innovation specialists visit our customers in the field, where they work together on tailor-made solutions for success. One of these farmers is Matt Miles from the U.S. state of Arkansas. Together, we developed a plan – from planting seeds to applying fertilizers and crop protection products, all the way to harvest. Matt produced a record yield in Arkansas in 2013: He harvested more than 7 tons of soybeans per hectare. Farmers usually achieve 3 to 4 tons on average.
“You’ve got to give the plant what it needs before it needs it, to really ensure that you’re going to get that kind of yield.”

Matt Miles, soybean farmer in the U.S. state of Arkansas

See all of Matt’s story on youtube.com under the search term “planting a legacy”
Modern farms rely more and more on high-tech solutions. It is not uncommon today to see farmers using a tablet or smartphone to assist their work in the field. John Deere and BASF agreed on a collaboration in 2013 to develop an integrated IT-based solution for farmers worldwide. The plan combines BASF’s agronomic expertise with John Deere’s experience in agricultural data management. This enables farmers to more easily interpret data in order to make more sound, efficient decisions on crops and processes. Farm machines equipped with sensors provide detailed data that is used to evaluate the optimal treatment of each piece of land.

Aside from the cooperation with John Deere, BASF also has other IT-based solutions on offer. Farmers in Brazil, for example, can take photos of diseased plants and compare them with a database in order to learn about possible treatments and recommendations.

“A successful harvest these days is determined not only by soil and weather, but also by smart IT.”

Dr. Matthias Nachtmann, Global Manager of business development in BASF’s Crop Protection division

Agriculture 2.0
Vitamin A deficiency is a serious problem in over 70 of the world’s countries. Each year, one million children die from the effects of this deficiency. It can cause blindness and make children more susceptible to deadly infections like measles and pneumonia. Vitamin A is necessary for nearly every function in the human body, including vision, the nervous system, skin, bones, and the immune system. Because the body cannot produce the vitamin on its own, we need to eat foods that contain it. This presents a problem for many people in emerging and developing countries: They cannot afford the expensive foods, like meat and vegetables, where the vitamin is naturally found. In our Food Fortification Initiative, we assist governments, developmental aid agencies like UNICEF, and producers in supplementing necessary staples like oil, corn, rice and flour with additional vitamins and minerals. At the Rio+20 United Nations summit in 2012, BASF committed to reaching 60 million more people per year with enriched staple foods in order to protect them from the consequences of vitamin and mineral deficiencies. A balanced diet is also not necessarily a given for people in industrialized countries, where strokes, high blood pressure and other cardiovascular diseases are on the rise as a result of unhealthy food. Long-chain omega-3 fatty acids, such as those found in fish, can offer protection from these illnesses. BASF produces highly concentrated omega-3 fatty acids and makes them available for many consumers to take in various forms, from powder to oil.

Promoting a balanced diet

"UNICEF and BASF have been working for years to combat Vitamin A deficiency, helping reduce child mortality worldwide."

Roland Kupka, Senior Advisor for micronutrients at UNICEF

Fewer deficiencies for greater health: Food fortification means enriching staple foods with supplementary vitamins and minerals. In one kilogram of enriched flour, for example, there are 3 to 5 milligrams of Vitamin A.

For food that can do more:

In the laboratory, we research omega-3 fatty acids that can be added to foods like yogurt.