

BMW Group Research and Technology.

Creative Power - customer oriented and efficient.





Dr. Klaus Draeger, Member of Management Board of BMW AG, Development

The BMW Group feels a particular sense of responsibility toward the topic of innovation. As a successful premium manufacturer in the automobile industry, we pursue the goal of achieving a leading role in the area of innovation. Our automobiles are more comfortable, functional, powerful, clean and above all more fuel-efficient than ever before. Innovation significantly enhances the substance of our vehicles. Therefore, it is critical that customers are actually able to make use of our innovations. It is only through this kind of innovation that the customer value of the vehicles is increased and thereby the long-term success of the BMW Group.

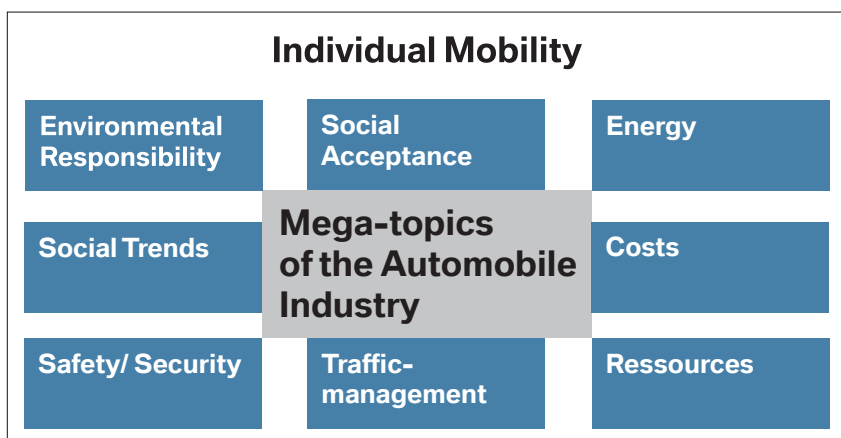
In this respect, the employees of the BMW Group Research and Technology provide important impulses in actively shaping the future of our automobiles. Our primary goal is to be continually one step ahead of the competition. In order to achieve this, we have to plan two steps ahead and think three steps ahead. Innovation is the main criticism in setting oneself apart from an ever-stronger competition in the automobile industry.

Innovative technologies allow the reduction or elimination of conflicting goals in vehicle development, such as reduced fuel consumption with a simultaneous increase in vehicle dynamics. For this reason, the BMW Group promotes progress through an intensive investment of resources. In order to secure individual mobility, even in the

distant future, significant challenges must be addressed. The organizational structure of the BMW Group Research and Technology directly reflects these major topics in its projects.

In this respect, this research subsidiary of the BMW Group is not solely responsible for the immense innovative power of the company. The independent BMW Research and Technology GmbH belongs to a global innovation and production network of the BMW Group. On the one hand, we are present in the triad markets of Japan and the USA with research, technology and design offices. The local offices regularly exchange their analyses with colleagues in the Research and Innovation Center (FIZ). On the other hand, we use our networks of external partners, such as suppliers, universities, research institutions and high-tech businesses in order to systematically expand our know-how. These cooperations open the door to a virtually inexhaustible pool of ideas.

The paths of innovation and production networks merge together in the FIZ. In Munich, one of the largest research and development locations in Europe, the collected expertise of the BMW Group flows together in the development of successful and fascinating products. In the FIZ, research meshes with vehicle development in a unique process of partnership. The development divisions are included in research projects from the very beginning. For this reason, those innovations which offer a clearly recognizable customer value and are able to strengthen the character of our vehicles and brand, as well as which satisfy the highest demands of quality and dependability and make sense economically, are determined at an early stage. Only innovations of this kind will succeed along the way from research through pre- and series development – and ultimately to the road.



Mega-topics

The automobile is the basis of individual mobility. This, in turn, ensures social prosperity. Vanishing resources, a continual increase in traffic, transformations in society and lifestyles, as well as customers' diverse needs all pose a wide variety of challenges to future automobiles. The BMW Group Research and Technology focuses its projects on these challenges: specifically, which foundations must be laid, what must be observed and implemented in order to maintain individual mobility in the future.

**Research
Start (Idea)**

Subsidiary Company.

In 2003, the BMW Group founded the subsidiary BMW Forschung und Technik GmbH, laying the foundation for its technological leadership: through freedom for creative ideas and a short path to implementation, the wholly-owned subsidiary is working on the future.

The specialists at the BMW Group Research and Technology have a clear mission: tapping new, groundbreaking technologies for utilization in automobiles. In order to explore new creative frontiers – unhindered by the day-to-day operations of automobile series development – sufficient creative freedom must be made available to experts. This has been realized in the BMW Group Research and Technology. Due to its corporate independence, it offers a working environment with flat hierarchies and quick decision-making processes. A conscious separation from the strictly controlled product development process in the BMW Group makes it possible for ideas and inventions to mature in the shortest possible time. The feasibility and usability of “new products” are thus quickly determined and are conveyed in the initial prototype application. Thus, subsequent decisions pertaining to series production have a sound basis.

Proximity.

The concept of “so-called” cooperative research has proven particularly successful in the early determination of series-production readiness: from the outset, departments which will later be involved in the series development process are included in the procedures and contents of the research projects. In addition, after the conclusion of the research phase, the responsible experts accompany their project from pre-development through to series development.

Advantage.

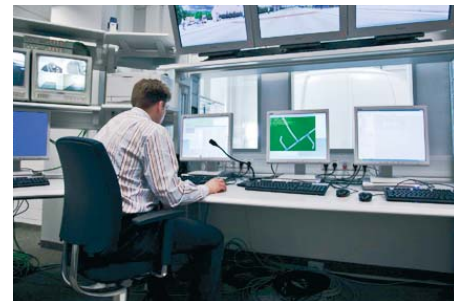
Know-how remains located in one source. According to Professor Dr. Freymann, head of the BMW Group Research and Technology, “In this way, we are able to implement vehicle research with greater concentration and efficiency, and tap chances for realization early on. The innovation talent within the company can act with increased focus and speed.”

Distance.

However, freedom and creativity are also necessary. Researchers must be allowed to think beyond the vehicle itself, so that ideas with a technological vision result. Bionics and aerospace technology, the utilization of dissipated energy or future vehicle concepts are but a few examples from the extensive list of topics.

Employees.

The center of creativity is found in the employees, who transport important knowledge and experience. This is why the BMW Group Research and Technology provides them with the optimal working conditions: direct and quick decision processes, room to take on individual responsibility, as well as attractive career development possibilities. The concept of cooperative research and the resulting personal involvement in projects, ensure a continual renewal of research teams and the necessary networking within the company. More than 200 experts, working there continuously, cover the given core competencies in the areas of powertrain and automotive technology, information and communications, mechatronics, vehicle and traffic safety, and human/machine systems.



Pre-Development

Proof of Feasibility

BMW Group Research and Technology. Projects.

The challenges for future mobility are bundled into five main areas of research. At the same time these topics determine organization and contents:

“VehicleTechnology”, “CleanEnergy” (hydrogen technology), “EfficientDynamics” (alternative engine and energy management concepts), “ConnectedDrive” (active safety and driver-assisted systems), and “ITDrive” (information and communication technologies related to the automobile and its environment). The specialised departments and project groups focus directly on these topics. Flat hierarchies and individual business directions are also particular characteristics. An integrated technical department with experienced specialists is responsible for the rapid, practical implementation of developed technology in automobiles. This lean and self-enclosed structure guarantees efficiency and success.

VehicleTechnology.

“VehicleTechnology” researches vehicle and technology concepts and tests in detail the integration of new powertrain, mechatronics and light-weight construction concepts. To this end, the engineers gladly turn to nature. The bionic seat conforms to the driver’s spine in the same way as the spinal skeleton of a fish, ensuring more relaxed driving.



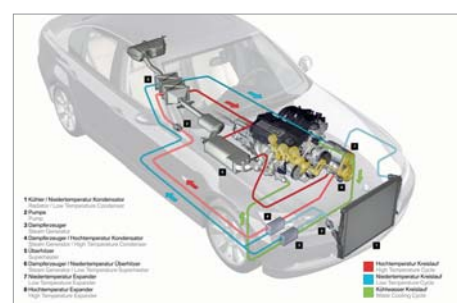
CleanEnergy.

As a source of energy, hydrogen conceals many challenges. Therefore, the specialists in the “CleanEnergy” department work on the optimization of hydrogen combustion engines, the conventional and alternative storage of hydrogen, a tank shape conforming to the shape of the vehicle, and fuel cell development. For example, in the HylCE project, assisted by the EU, a team has cooperated for over three years with American research institutions and eleven European companies in order to present the enormous potential of hydrogen combustion engines to the public in early 2007.



EfficientDynamics.

Intelligent energy management and alternative engines stand at the center of the “EfficientDynamics” department. Specialists have experimented with hybrid technology since the 1990s. Alternative engine systems and intelligent energy management make up researchers’ daily work. In 2005, they introduced to the public the “so-called” turbo steamer – a thermal hybrid that transforms the heat given off from the motor into additional drive energy.



Series Development
Start of Production

ConnectedDrive.

The primary areas of interest of this department are active safety and driver assistance. The intelligent integration of the driver with the environment and automobile, driver assistance systems which relieve burdens thanks to sophisticated sensor technology, as well as control concepts all pursue a single goal: turning a “driver’s workplace” into a “driver’s place of well-being.” Remote parking assistance, cross-traffic and intersection assistance or intelligent language dialogue systems currently stand at the forefront. In addition topics beyond the norm are explored by researchers: in 2006 they introduced TrackTrainer, which is used as a part of the BMW driver training course. This type of assistance system, with the aid of sensor signals, teaches drivers the optimal line on race courses.

ITDrive.

Intelligent information, new communication technologies for increased safety and an improved traffic flow (e.g. Car2X-Communication), as well as entertainment in automobiles are a portion of the range of topics in this project group. Already in 2005, this project group introduced “Personal Radio” to the public. This personalized radio in the car turns the driver into a program director. He or she is able to put together a personalized listening program – anytime and anywhere. Specialists are also involved with the future implementation and further development of automatic emergency call (eCall). Together with a rescue station of the Bavarian Red Cross, they are conducting field testing of an automated forwarding of coordinates of vehicles involved in accidents in the route planning of rescue vehicles. The critical question is how many valuable minutes can be saved? Furthermore, a new onboard network architecture plays an important role. The internet protocol (IP) will guarantee that the increasing requirements of safety and entertainment in automobiles are met in the future.



Research Network.

In looking for ideas across borders, the BMW Group Research and Technology maintains “so-called” Technology Offices or Liaison Offices in the triad markets of the USA (Palo Alto in the Silicon Valley and in Clemson, South Carolina) and in Japan (Tokyo). These field offices maintain close contacts with local elite universities, research institutions and high-tech companies in order to track down the latest trends and technologies even beyond the automobile industry. From a base of operations at the German Research Center for Artificial Intelligence, a research subsidiary advances the automation of intelligent behavior, and thereby the “car of the future.” These networks are an important source of the wealth of innovation for the BMW Group and open the door to a virtually inexhaustible pool of ideas.

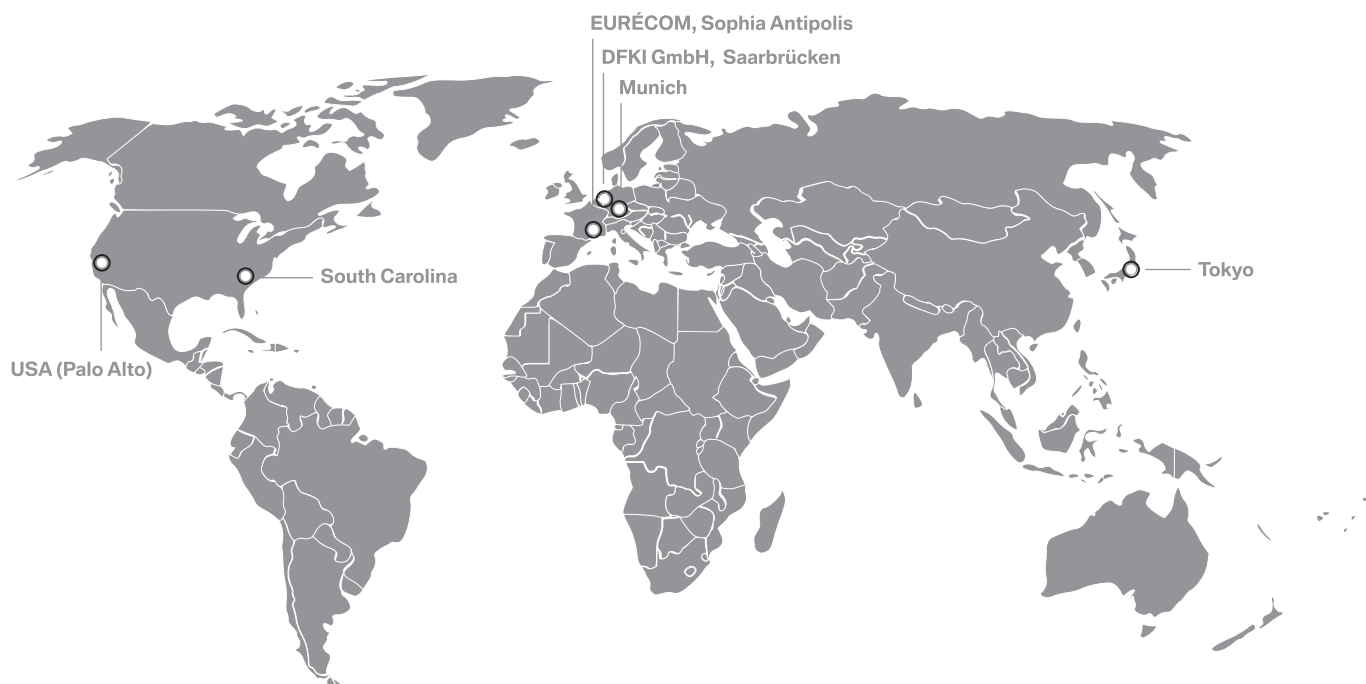
Through cooperation with technical colleges and universities – global, national, regional and local – the BMW Group Research and Technology has secured a long-lasting contact to first-class potential employees and to important findings from fundamental research. Through CAR@TUM (Munich Center of Automotive Research), founded in 2007, the traditional cooperation with the Technical University of Munich took on a set organizational structure. Numerous high-tech projects are carried out on

an interdisciplinary basis within this excellence network. Through participation in the inter-European university network Eurécom – situated at the high-tech center Sophia Antipolis in southern France – the research subsidiary has access to information and telecommunication technology.

Alongside research projects in series development, in creative independence or together with universities, there are certain topics that can only be addressed in cooperation with other manufacturers and partners. These topics involve technical challenges, high costs and an enormous potential for change.

The BMW Group Research and Technology works on such comprehensive projects together with the EU Commission, the Federal Ministry of Education and Research, or The Association of Bavarian Research Cooperations. Cooperation with other automobile manufacturers or suppliers creates industry-wide standards, which ultimately benefit the customer. These ensure simple and identical conditions as well as technological compatibility across the borders of various manufacturers.

BMW Group Research and Technology. Research Network.



BMW Forschung und Technik GmbH is a 100 % subsidiary of BMW AG and is in charge of the following research topics at the BMW Group since 2003: VehicleTechnology, CleanEnergy (hydrogen technology), EfficientDynamics (intelligent energy management/alternative drivetrains), ConnectedDrive (driver assistance/ active safety systems) and ITDrive (IT-architecture and communication technology). Being a limited company, legal autonomy from the BMW Group allows a maximum of creativity and flexibility. An internationally established network, with Technical Offices in the USA (Palo Alto, CA und Clemson, SC) and Japan (Tokyo) as well as Liaison Offices in France (with Eurécom in Sophia Antipolis) and in Germany (with German Research Center for Artificial Intelligence, DFKI GmbH, in Saarbrücken) ensures global access to trends and technologies.

Contact:

BMW Group Research and Technology
Research Communication
80788 Munich, Germany

Mailing Address:

Hanauer Str. 46
80992 Munich, Germany

Additional Informations on the Internet

<http://www.bmwgroup.com>
(Category Research and Technology)

Press Enquiries:

presse@bmwgroup.de

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