

working together in many cases. In procurement we cooperate with select raw material suppliers, working on emission reduction solutions in concrete projects. We are researching and identifying cost-effective processes in the technology field of raw material change, exploring the use of alternative raw materials such as natural gas, coal, renewable resources or also carbon dioxide. In some applications we are replacing fossil fuels with renewable resources where this is reasonable based on technical, economic and ecological aspects. Next to economic criteria, environmental protection, occupational safety and social standards are already part of evaluating new and existing supply relationships and are anchored in our purchasing terms and conditions. With the help of the initiative "Together for sustainability" (TfS), we advance sustainability in the supply chain. The initiative aims to develop and implement a global program for the responsible supply of goods and services and improve suppliers' environmental and social standards (e.g. energy consumption and emissions).

## Logistics

Logistics makes a contribution to sustainability through the energy-efficient combination of various means of transport. For example, we are increasingly utilizing ship and rail transportation as more environmentally friendly alternatives. Transporting goods by train instead of truck reduces CO<sub>2</sub> emissions by up to 65 %. We use combined road-rail transport at the large production sites in Ludwigshafen, Schwarzheide and Antwerp. The expansion of the combined road-rail transport terminal in Ludwigshafen was completed in 2012. This allows us to continue shifting the transportation of our goods to railways, avoiding up to 100,000 tons of CO<sub>2</sub> emissions for transportation annually. For transports to and from the Ludwigshafen site, the proportion of the distance covered by truck is significantly below the European average (EU 27).

## Employees

Our employees know that each and every one can contribute to the reduction of greenhouse gases, improving energy efficiency and resource conservation. Various promotions have already been implemented in order to inform our employees about energy efficiency and motivate them to actively participate. These include for example the BASF SE employee campaign at Ludwigshafen "Energy efficiency: Get involved!" resulting in a brochure with everyday energy saving tips.

Our employees can find all important information about the energy management system on the BASF intranet. Employees with pronounced influence on energy performance are being specifically trained in energy management. A manual with best practice examples from various production operations and buildings was compiled to support the transfer of knowledge between employees in technical areas of activity.

Our Human Resources department offers a broad range of continuing education measures and specifically promotes the internal suggestion plan to improve energy efficiency and reduce greenhouse gases.

## Energy management in the company context

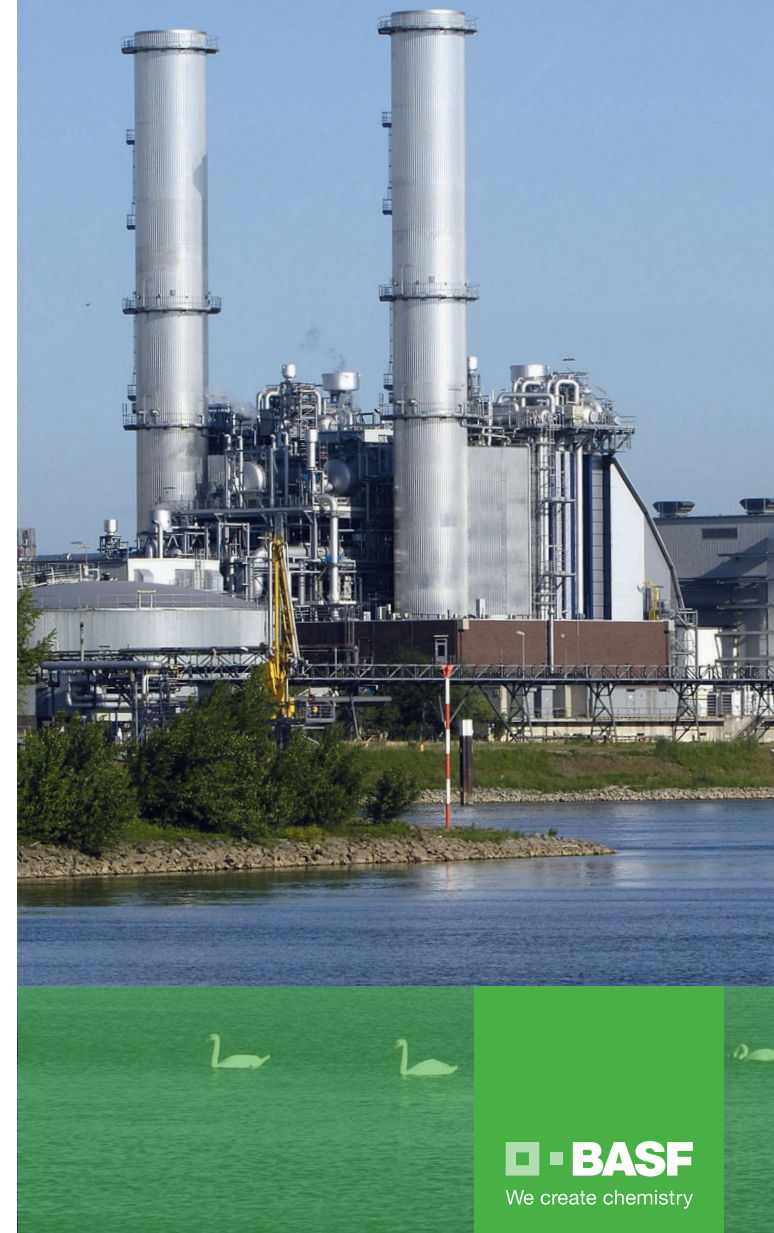
Our energy management system is based on a continuous improvement process. We regularly examine our energy policy, energy targets and energy performance in the course of internal reviews. This also includes an evaluation of measures that were implemented as well as our action plans. We have already achieved a lot on the way to improved energy efficiency and therefore better climate protection. Our absolute emissions in the chemicals business have been reduced by 50 % compared to the year 1990. The reduction per ton of saleable product during this period was even better at 74 %. In the view of the renowned "Carbon Disclosure Project", we are among the leading companies worldwide in terms of transparency and completeness in climate protection reporting. We intend to continue our climate protection efforts unabated. Our experts are always working on the further improvement of processes. We also look beyond the requirements of ISO 50001 in this regard. In addition to research and development for our growth clusters, we offer innovative solutions for the further improvement of energy efficiency by our customers – for example through the optimization of existing processes. Our climate protection products help make renewable energy sources more competitive, for example through a new epoxy resin that enhances an efficient production of high-performance rotor blades.

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# Energy Management, Energy Efficiency and ISO 50001 at BASF



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## **BASF is the world's leading company in the chemicals industry.**

With more than 110,000 employees, six Verbund sites and 338 additional production sites around the world, we serve our customers and partners in almost all of the world's countries.

We combine economic success, social responsibility and environmental protection. With research and innovation, we help our customers in virtually all industries meet the requirements of society, today and in the future. Our products and system solutions help conserve resources, provide healthy nutrition and foods, and improve the quality of life.

Our company mission statement sums up the contribution made by BASF:

## **We create chemistry for a sustainable future**

We are committed to energy efficiency and global climate protection. With our efforts to continuously reduce emissions along the value chain and with our climate protection products, we are making an important contribution. In doing so, the conservation of resources is also among our fundamental principles. We use efficient technologies for the generation of electricity and steam, as well as energy-efficient production processes, and have implemented a comprehensive energy management system.

## **Global objectives**

We want to reduce our greenhouse gas emissions per ton of saleable product by 40 % by the year 2020 compared to the base year 2002. We already achieved a reduction of 34.6 % in the year 2015. Moreover, we improve energy efficiency of our production processes. By 2020, we want to have introduced certified energy management systems (DIN EN ISO 50001) at all relevant sites. Taken together, this represents 90 % of BASF's global primary energy demand.

## **Energy policy**

Our energy policy is associated with the obligation to comply with all relevant legal requirements and the objective of further improving the reliable and economical supply and use of energy at our sites while conserving resources. We passed our own directive in 2012 for this purpose.

To implement our energy policy, we have put in place a comprehensive energy management system that helps us review and continue to improve our energy performance.

Within the scope of our global energy goal, the internal BASF energy management system is being certified according to ISO 50001. Certification will take place step-by-step, by the end of 2020 at the latest, depending on the site. At the end of 2015, we had completed the certification at 27 sites, which represents 39.5 % of our primary energy demand.

## **Energy efficiency at BASF**

As a company with a high demand for energy, we have been paying attention to the efficient use of energy for decades already. A comparison with our competitors – e.g. under the benchmark system for European emissions trading – shows that our plants operate at above-average efficiency. We only achieve this efficiency by analyzing the entire value chain, from the energy supply and distribution to the individual energy consumers and also including the logistics chain. Here the employees make an important contribution to the continuous improvement of energy efficiency at BASF.

## **Energy supply**

We use gas and steam turbines in cogeneration plants for the generation of energy. Their very high fuel utilization efficiency of up to 90 % allows us to minimize the use of primary energy and currently constitutes the best available technology for industrial energy generation.

Plants with this technology cover about 70 % of our worldwide demand for electricity. These plants allowed us to save more than 13.5 million MWh of fossil fuels in 2015 compared to the separate generation of electricity and steam, avoiding 2.7 million tons of CO<sub>2</sub> emissions as a result.

Closely linking our plants in a so-called "Verbund" is an important element of our energy concept. Heat generated in production by one operation is used as energy by other operations. We have thereby saved around 17.6 million MWh in 2015 – which corresponds to an environmental impact of 3.5 million tons of CO<sub>2</sub>.

## **Energy audits**

Since energy efficiency is very important for BASF, we have always been analyzing energy consumption and costs, identifying potential for savings and deriving measures at our sites worldwide. For example, the comprehensive implementation of heat integration analyses has resulted in more than 40 % of global steam demand at BASF being covered by waste process heat – in other words, heat that is quasi a by-product of our production processes and can be utilized.

Thanks to the energy efficiency analyses performed in the last few years, numerous additional potential has been identified and is now being shaped into action plans according to ISO 50001.

The system prescribed by ISO 50001 is being used for energy planning as well. Production operations define suitable energy performance indicators to measure and monitor energy performance. These help the plant operators control the plant for energy optimization.

## **Plant layout and procurement**

Our competence centers establish the framework and directives for the conservative use of energy. Economic efficiency and environment are closely linked, even during the development of products and processes as well as the layout of production plants. Our process engineers and purchasers work together closely in this regard. In our economic efficiency analysis, we examine the lifecycle costs known as the total cost of ownership. Here the long-term operating costs such as energy costs are taken into account. Our experts in procurement and the technical centers work together to optimize and standardize technical material management subject to value-based management aspects. The standardization of energy-efficient machines and plant equipment, low-energy motors, lighting and the installation of frequency converters ensures the consistent implementation of these technologies.

Close cooperation with our partners along the entire value chain is a prerequisite for lowering greenhouse gas emissions, since emission reduction potential can only be realized by