Climate and Energy

Innovating in response to change

Responding to the challenge of climate change is a moral imperative but also an opportunity for value creation, as customers worldwide look for products which deliver new benefits while reducing their own carbon footprint.

Our strategy for Climate and Energy

Our strategy is to focus on Life Sciences and Materials Sciences in response to a number of long-term societal trends. One of these concerns Climate Change and Energy.

Our goal in respect of Climate Change and Energy is to increase awareness of the topic among our stakeholders, to measure the environmental impact of our activities, to reduce our energy consumption and to leverage new commercial opportunities.

In 2008 we published several articles on this topic in our internal media, established a carbon footprinting methodology and measured the eco-footprint of a number of our products.

Some of our specific objectives are to:

- Improve DSM's environmental performance by reducing our energy use and greenhouse-gas footprint. This will be achieved by means of our Manufacturing Excellence programs, our N_2O reduction program and our sourcing program.
- Map our product eco and carbon footprints. Our Footprint Competence Center will establish a methodology which will enable us to measure up to 80% of our footprint by 2010.
- Create major production and product solutions through our innovation programs (for instance Climate Change Induced Innovation) and the cross-fertilization of Life Sciences and Materials Sciences (such as by means of white biotechnology).
- Use active internal advocacy and organizational learning to engage and align our employees in support of our sustainability agenda.
- Demonstrate our involvement by participating in initiatives such as the Carbon Trust and Thema1.

Our management approach to Climate Change involves engaging people both within and outside DSM.

Informed, engaged and aligned employees will foster improvement and drive innovation. Our wider employee base therefore receives general information on this topic, while our strategic direction is communicated in greater detail to departments like our Innovation Center, our Manufacturing Center, the DSM Marketing office, our Sourcing Department and our business groups. Externally we engage with start-up companies, academic and research establishment, governments, customers and peer companies to collaborate, innovate and offer solutions for today and the future.

This chapter outlines our main activities related to Climate and Energy during 2008, as well as offering some initial examples of DSM product eco-footprints.

"The need to change towards a low-carbon economy will challenge us to significantly increase our own energy and carbon efficiency and that of our customers and suppliers."

Fokko Wientjes
Manager Sustainable Development DSM
With DSM since August 1988

The limited availability and the environmental impact of fossil-based fuels and raw materials creates a need for new and sustainable energy resources and raw materials. To develop these, new business models, processes and products are required. DSM is contributing to the evolution of a low-carbon economy with products such as Dyneema®, Turane™ and Stanyl®, which enable the manufacture of lighter products with higher performance characteristics for a wide range of applications in, for example, the construction and automotive markets, as well as with products like enzymes for food processing. We are also contributing to the development of a new generation of sustainable and commercially viable biofuels and to the creation of a portfolio of coating resins with zero or near-zero VOC (volatile organic compound) emissions.

Eco-effectiveness drives innovation

Responding to the challenge of climate change is a moral imperative but also an opportunity for value creation, as customers worldwide look for products which deliver new benefits while reducing their own carbon footprint. Climate change has been an important focus of DSM's sustainability policy for some years. We are addressing this in numerous ways, including the development of waterborne coating resins, the use of renewable energy sources, and the inclusion of innovative enzymes in animal feed to help reduce the environmental impact of livestock farming. Our technologies, market knowledge and investments in innovation are used in pursuit of tangible improvements for society and the environment.

Our Climate Change Induced Innovation program taps into the opportunities created by global climate change. The objective of this program is to realize added value by responding in an innovative way. Exploiting the opportunities offered by climate change will take place in the context of DSM's strengths in Life Sciences and Materials Sciences and synergies between these domains. For example, DSM Venturing participates in Tianjin Green Bio-Science Co. Ltd. (China) for the development and production of biodegradable polymers and products.

With the world's population expected to increase from 6 billion currently to 9 billion by 2050 according to the United Nations, the demands on the planet's resources, both fossil and non-fossil, are continually growing. An important component of our response to this challenge is our expertise in white or industrial biotechnology. In certain cases, the application of biotechnology may replace chemical processes. This may offer significant benefits, as production under mild conditions results in lower utilization of water, energy and solvents. In other cases, biotechnology may offer the opportunity to use biomass as a raw material for a wide variety of products or to improve the efficiency in the valorization of biomass.

DSM has identified white biotechnology as an Emerging Business Area. We actively invest in the development of white biotechnology. We also liaise with regulators, industry peers and other thought leaders to promote the uptake of this valuable technology worldwide.

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"We are proud to be part of a company that has put sustainability high on its agenda. DSM encourages us, the next generation, to take the lead in future sustainability developments so as to really make a difference."

Early career professionals and members of DSM NEXT: Robbie van Bree, Hanneke Prinsen, Anne Janssens, Esther Kersten, Azra Alic and Felipe Toledo

In January 2008, DSM NEXT – the association for early career professionals within our company – held a joint workshop on Sustainability and Environmental Impact with Young Leaders for Nature (from IUCN). Deputy Chairman of the Managing Board Jan Zuidam joined this team to support the initiatives. This was followed by the roll-out of a DSM-wide DSM NEXT workshop on the topic 'What does sustainability mean for you?' Commenced in 2008, this initiative will be continued in 2009. This program was nominated among the top three entries for a Dutch Young Sustainability Award 2008 given by the Dutch Sustainability Congress.

Consortium for second-generation biofuels

'First-generation' biofuels are derived from biomass which might equally be used for the production of food or feed. 'Second-generation' biofuels are derived from biomass that is not edible, for instance agricultural byproducts or waste matter from the food and feed industry. 'Second-generation' biofuels could also be produced on the basis of non-food crops grown on land that is not suitable for the production of food crops.

DSM is actively engaged in the ongoing dialogue concerning improved biofuels and sustainable biomass production. We were involved in the pre-summit stakeholder dialogue held by the FAO (Food and Agriculture Organization of the United Nations), which helped pave the way for a successful FAO Summit in June 2008. DSM has also decided to step up its efforts to find solutions in this area, in terms of both policy and of business activity.

The use of non-food biomass (such as switchgrass and corn stover) as feedstock will facilitate the operation of large-scale biorefineries to meet growing demand for biofuels, bio-based chemicals and other bio-derived end products. This has the potential to reduce the dependency of the chemical manufacturing industry on fossil raw materials.

Proprietary enzymes for hydrolyzing cellulose and xylose from plant residues have already been identified, but the process involved is not yet practicable on a commercial scale. Our experience in enzymes, together with our competencies in chemical engineering and biotechnology, place us well to further improve the process for producing second-generation biofuels. This will potentially be a major breakthrough for global society as well as for DSM's future business.

In 2008 DSM received a grant from the US Department of Energy for a technical consortium dedicated to creating an innovative biotechnological approach to the production of bioethanol. The grant will fund an extensive enzyme development program aimed at producing bioethanol in a cost-effective manner. The research will be carried out by a technical consortium in which DSM will be the lead partner. The program is being delivered with the assistance of Abengoa Bioenergy New Technologies, Los Alamos National Laboratory and Sandia National Laboratory.

Microprocess technology

Microprocess technology is about continuously operated processes in reactors that are very small compared with the batch reactors traditionally used for pharmaceutical production. It is one of the technologies operated by DSM under the umbrella of Process Intensification (PI). DSM is taking PI very seriously in view of its potential for higher energy efficiency, lower production costs and better quality control. Microprocess technology can achieve a breakthrough in productivity by offering improved control over chemical reactions and transfer of molecules.

Since 2005, DSM has been exploring the potential benefits of micro-reactors for chemical processes on an industrial scale. Micro-reactors, which may be of the size a shoebox, offer many advantages, such as better energy efficiency, safety and reliability. DSM's site in Linz, Austria, operates one of the largest-capacity micro-reactors in the world. With an internal reactive volume of just 3 liters, it has a capacity of 2,000 tons per annum. It is currently used for the production of a fine chemical intermediate. The technology was developed in collaboration between the Karlsruhe, Germany based Institute for Mechanical Process Technology (IMVT), Graz University of Technology in Austria and DSM Fine Chemicals.

Fermentation processes

Process and product innovations continue to drive the growth of our portfolio of bio-based products destined for applications in the feed, food, beverage and pharmaceutical sectors. These are specialty products based on fermentation processes.

Besides offering functionalities which can be deployed against conditions such as diabetes, high blood pressure and excess weight, bio-based products have the benefits of being more efficient to manufacture than compounds produced by chemical synthesis. This means that they require far fewer solvents and far less energy. DSM Anti-Infectives, for instance, uses an 'Energy and Utility Scorecard' to help proactively reduce its consumption of resources. In 2008 the business group set itself the target for 2010 of reducing its energy consumption by 27% compared to its 2005 utilization – the most ambitious target for a DSM business group.

Bio-based intermediate for polymer production

An important step in the development of bio-based performance materials was announced in January 2008. DSM and the French starch and starch-derivatives company Roquette joined forces to implement and commercialize the fermentative production of succinic acid, which can be used as an intermediate to produce bio-based polymers (polymers are used to create plastics and foams which find application in a host of industrial and consumer sectors).

The development forms part of DSM's strategy within the Emerging Business Area (EBA) white biotechnology and shows the innovation opportunities of cross-fertilization between DSM's expertise in Life Sciences and Materials Sciences.

Succinic acid is currently produced as a derivative from crude oil and natural gas. Bio-based succinic acid will be produced by fermentation, drawing on sugar as a feedstock. This novel production process will stimulate further market development of bio-based polymers. Fermentation processes based on renewable resources will in this case lead to an energy saving of 30-40% compared to a typical chemical process, thus reducing CO_2 emissions.

The current target of the cooperation is to have a demonstration plant in Lestrem, France operational at the end of 2009. The capacity of this plant will amount to several hundred tons per year. It is expected that after a successful trial, the technology will be transferred to large-scale production in 2011.

"Broad knowledge of life science processes plus good platform technologies are the prerequisite for responding to the diversity of market demands for new processes and products."

Willy de Greef
Secretary General EuropaBio
Brussels, Belgium

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Employees map their own eco-footprint during Sustainability Week

In May, a Sustainability Week was held at our site in Delft, the Netherlands. The purpose of this initiative was to educate our employees in Delft further to the exciting possibilities of sustainability and to engage them more closely in our sustainability agenda. Each day was dedicated to a different aspect of sustainability, while the company restaurant ran a special 'Food and Sustainability' program for the week. Employees had the opportunity, among other things, to calculate their own eco-footprint, explore the theme of cradle-to-cradle manufacturing, examine green solutions for the automotive sector, and listen to the experiences of a colleague who had just returned from an assignment with the World Food Programme (WFP) in Kenya.

Bio-based processes

DSM continues its efforts to develop a 'green' route to caprolactam, the building block for nylon 6. This long-term development option should result in new manufacturing plants being fed with ligno-cellulosic feedstock and delivering 'green' caprolactam (Bio-Cap) with both improved economy and a reduced eco-footprint.

Progress on this project, for which an external partner network has been set up to supply complementary technology, has so far delivered novel enzyme-based conversion steps, and several patent applications have been filed.

DSM Anti-Infectives invests in enzymatic processes

DSM Anti-Infectives is currently investing to upgrade activities in India, Mexico, Europe and China towards enzymatic processes.

DSM's enzymatic technology provides substantial environmental advantages in comparison with chemical processes – such as a strong reduction in waste and energy consumption – but also enhanced quality, and is more cost-effective throughout the value chain.

DSM reduces greenhouse-gas emissions by more than 20%

In 2008 DSM Agro reduced the emissions of N_2O (dinitrogen oxide) in its four nitric acid plans in Sittard-Geleen and IJmuiden, the Netherlands. New technology was installed, resulting in a reduction of two million tons of CO_2 equivalents, which is more than 20% of our worldwide emission of greenhouse gases.

In recognition of this achievement, VNCI (the Association of the Dutch Chemical Industry) awarded DSM Agro the Responsible Care Award 2008. The success of this project goes far beyond what is required legally under IPPC (European Integrated Pollution Prevention and Control Directive). As a consequence, DSM Agro can sell excess emission allowances under the ETS (European Emission Trading System). In that sense, outstanding environmental performance and good business go hand in hand.

Greenhouse-gas emission trading to be upgraded

The European Emissions Trading System (ETS) was initiated in 2005 to support the reduction of greenhouse-gas emissions in Europe. Until now, emission allowances have been allocated to operators based on their emissions in the past. DSM actively advocated abandoning this so called 'grandfathering' system and replacing it by the allocation of allowances based on best performance (benchmarks).

At the end of 2008 the European authorities decided that from 2013 onwards, benchmarks will be used for the allocation of allowances to industries that are exposed to global competition. The allowances per unit of product (the benchmark) will be derived from the top 10% best-performing production plants in the EU.

"Sustainability is a moral issue. If we don't take responsibility for it, DSM cannot look forward to a long future."

Luca Rosetto
Vice-President Europe/Americas DSM Anti-Infectives
Corporate Vice-President CSHE&M from 1 March 2009
With DSM since November 1996

DSM very much welcomes this approach, which rewards the most efficient producers and stimulates the further reduction of greenhouse gases. At the same time, it prevents unfair competition on the global market for producers in the European Union, which is also good for employment in this region.

In order to make the ETS sustainable, however, some important issues still need to be resolved. First, the allocation of allowances should be based on actual production levels rather than production in past reference years. In the latter case, companies that reduce their emissions in Europe by shifting production from Europe to other continents would benefit from the ETS without really contributing to the global reduction of greenhouse gases.

Second, benchmarks need to include the use of electricity in order to compensate for the impact of ETS on electricity prices in the EU. This should include an adequate arrangement for CHP (combined heat and power) plants, in order to unlock the huge potential of this technology for reducing greenhouse-gas emissions. DSM actively contributes to the ongoing discussion aimed at further improving the ETS and making it suitable for application not only in Europe but also in other regions of the world.

Eco-efficient enzymes portfolio

Enzymes are naturally occurring proteins that act as biological catalysts. DSM manufactures enzymes for innovative applications in both the feed and the food and beverage sectors.

Used in feed for livestock, enzymes have an important role to play in current farming systems. They can increase the digestibility of nutrients, leading to greater efficiency in the production of animal products such as meat and eggs.

At the same time, they can play a role in minimizing the environmental impact of increased animal production. Enzymes produced by DSM also find use in a broad spectrum of food and beverage applications such as dairy, baking, fruit processing and beer brewing. They are deployed to improve product characteristics such as flavor, appearance and stability. The year 2008 saw the launch of Panamore™, an alternative to chemical emulsifiers. This natural ingredient improves the performance of flour in a cost-effective and sustainable way.

Claristar® best practice in carbon footprinting

An important addition to our enzyme portfolio in 2007 was Claristar®, which is used to clarify wine. The use of Claristar® requires less energy and water than is the case with traditional wine clarification techniques, thereby creating less waste and less impact on the environment.

In 2008 Claristar® was used as an example of best practice by the Product Carbon Footprint Pilot Project Germany, as it allows consumers to clearly see the carbon footprint of the product they consume. The Carbon Footprint Pilot Project Germany was initiated by the Institute for Applied Ecology (Öko-Institut) of the Potsdam Institute for Climate Impact Research (PIK), the Berlin-based think/do tank THEMA1, and the World Wildlife Fund (WWF).

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Environmentally friendly UV-curable coatings

Considered a 'green' technology, UV-curable coatings convert instantly from liquid to solid upon exposure to UV light, and offer a variety of processing and environmental benefits. Although some UV-curable coatings nevertheless require a certain amount of solvent in their production and give off a certain amount of solvent when applied, DSM's UV-curable coatings for fiber optics are entirely solvent-free.

They are therefore considered much safer for both workers and the environment. An additional benefit of UV curing is that this procedure does not require traditional curing ovens, which require high temperatures and consume a great deal of energy.

A dedicated UVention™ group within DSM Desotech is tasked with delivering new innovations in UV-curable coatings to a variety of markets including aerospace, medical, automotive, industrial finishing, pipe manufacturing and more.

In March 2008 DSM Desotech, a global leader in the development of materials that can be cured with UV light, strengthened its portfolio by acquiring Texas-based Polymeric Processes Inc. (PPI), which specializes in UV-curable coatings for pipe applications.

In June 2008 DSM Desotech opened a newly-expanded China facility for their production of UV-curable inks for optical fiber, DSM Desotech Specialty Chemicals (Shanghai) Ltd. (DDSC). The ISO-9001 certified operation was relocated from Gonglu to Xinghou, China, and the new facility designed in such a manner as to be able to accommodate anticipated growth in the optical fiber and cable market (for more information on the relocation see page 51).

Product eco-footprinting

To determine a product's effect on the environment, its entire life cycle must be examined. DSM uses PEF (product eco-footprinting) to chart the ecological footprint of products. DSM's Global Manufacturing Competence Center deploys PEF to analyze all phases of a product's existence, from the extraction of raw materials through the manufacturing process and use of the product to the disposal of the product once it has reached the end of its useful life.

This approach makes it possible to develop and manage products on the basis of detailed insights as well as principles of product stewardship. Some of our customers have recently begun to ask for a 'PEF hallmark' that clearly states the effects of their product on the environment. DSM is investigating this possibility. In 2008 we conducted PEFs for Rapidase® apple maceration enzymes, Claristar® wine stabilizer, Brewers Clarex® beer stabilizing enzyme, Synthon B resolution, Stanyl®, cephalexin and vitamin C.

REACH and ICCA-GPS: supporting global product stewardship

Product stewardship aims to improve the SHE performance of products during their entire life cycle. Communication about the potential risks involved in handling and using substances is fundamental to this intention. In 2008 DSM started implementing REACH (Registration, Evaluation and Authorization of Chemicals), the new European Union legislation on product safety information. We pre-registered all the substances that we manufacture in, and import into, the EU, which total approximately 600.

Between now and 2018 we will prepare dossiers describing the hazards presented by these substances and the conditions for their safe handling and use. This will be done in cooperation with the producers and downstream users of these substances. Although the full implementation of REACH will cost DSM some tens of millions of euros, we welcome this legislation as an opportunity to strengthen our product stewardship.

DSM is also actively contributing to the GPS (global product strategy), an initiative of the ICCA (International Council of Chemical Associations). This initiative aims to introduce globally harmonized practices for product stewardship and, in addition, greater transparency concerning the safety of substances. In this context, we contributed to the development of formats for Basic Set of Information and Product Stewardship Reviews. In 2009 DSM will start publishing product stewardship reviews according to this format.

A challenge for DSM

Using chemistry to combat climate change

"The demands placed on the world's ecosystem by the fossil-fuel-based economy are unsustainable. Alternative sources of energy must be found. DSM believes that the energy challenge – and thus the climate change challenge – cannot be solved without the enabling agency of chemical manufacturers.

The chemical industry can help to reduce the world's energy consumption by delivering products which encourage the use of less fuel – for instance, materials for the production of windmill blades and solar panels, lightweight materials for the automotive sector, or foam for insulating buildings. These are just some examples of the many ways in which chemical manufacture can be used to promote the move towards a low-carbon economy.

As a Life Sciences and Materials Sciences company, DSM consumes considerable amounts of energy. Our aim is to generate more units of energy savings in the value chain than the units of energy we consume. We have investigated several of our production processes with this in mind and found that they all demonstrate a positive return. Our challenge is to ensure that this positive ratio of energy consumption to energy saving is applied across our entire product portfolio and to continuously increase the ratio of energy saved to energy used."

Jan Zuidam
Deputy Chairman of the DSM Managing Board
With DSM since May 1973