

# FOCUS

# SUSTAINABILITY

SUSTAINABILITY IN THE LENZING GROUP

## ENVIRONMENT

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Voluntary commitment  
to stringent environ-  
mental standards

## WORKFORCE

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Corporate culture as  
the basis for working  
together successfully

## CUSTOMERS

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Close cooperation  
along the entire value  
creation chain

Taking  
Responsibility  
for Our Business

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# Sustainability

## in the Lenzing Group

Lenzing achieves sustainable success by thinking in the long term in a spirit of partnership giving equal attention to ecological, economic and social criteria:

- Lenzing makes products from the renewable raw material wood while at the same time meeting its environmental responsibilities. In light of the complex chemical and technological processes at its facilities, Lenzing considers environmental protection and a safe mode of production to be vital.
- Lenzing is following a path of generating long-term value through growth, innovation, quality and market-orientation. All stakeholders, e.g. customers, employees and shareholders, benefit in a fair balance.
- Lenzing promotes the personal development of its employees regardless of factors such as for example their origin, religion or gender. Lenzing remains in an open dialog with all stakeholders and is committed to the well-being of those around it.



## Dear Readers,

Industrially manufactured cellulose fibers, usually referred to as man-made cellulose fibers (MMC), make up the core business of the Lenzing Group. Wood, a renewable raw material, is the starting material for these products. Given this raw materials base, Lenzing is “genetically” predisposed to the principles of sustainable management and industrially implements and applies these principles throughout the Group, a fact of which many stakeholders are still unaware.

We are proud that Lenzing fibers contribute in important ways to making life better and more comfortable. About two thirds of our fibers go into textile applications. In garments, Lenzing fibers cover another basic human need besides the aspect of fashion; they enhance people’s sense of well-being. About one third of our fibers are used for nonwovens, where they make an important contribution to personal hygiene and are employed in health care and child care.

Lenzing fibers have become a small but often indispensable part of our modern industrial society. Fiber products are basically used all day and night in a variety of applications by men and especially women. We make every effort to produce these consumer goods with minimum environmental impact and view this as a continuous

## Preface by the Chief Executive Officer

improvement process that can never come to an end.

In earlier decades viscose plants were considered polluters. Lenzing shows that they do not have to be. Besides sustainable process improvements, Lenzing has made its chemical cycles largely closed and uses the most modern processes for cleaning waste water and waste air. Through these efforts, it has set new benchmarks for the entire cellulose fiber industry. The environmental standards we set for ourselves are considered at all production locations and in all regions of the world to be the yardsticks that will also guide our future actions.

Technologies used by Lenzing do not become truly globally effective until these innovations are also used by the competition or imposed on all local manufacturers as requirements by local authorities.

Lenzing is active around the globe but as an Austrian company with a 75-year tradition in business, we represent values deeply rooted in European culture. Regardless of the region of the world in which Lenzing conducts business, the principles of tolerance, openness and respect toward all human beings apply equally. As a European pioneer in globalization, Lenzing has been a model in applying these principles, for example, to its facilities in Asia for several decades. Social commitment has always been an integral part of our economic activities.

Along with a passion for our business, the “Lenzing Spirit” stands for the will to change, power of innovation and the readiness to accept responsibility,

for our employees, for our customers and suppliers, for compliance with our social, legal and ecological obligations as well as self-imposed standards. These values give rise to the reliability upon which our customers have always been able to count.

With all the economic, ecological and social requirements a global company like Lenzing has to meet, its goals can sometimes come into conflict with each other. Recent years have shown, however, that these conflicts can be handled effectively from an economic standpoint too if we adhere to our principles and values. Lenzing has been able to improve its key economic figures steadily over an extended period of time.

There are many facets to personal accountability and sustainable action at Lenzing. Our intention with this report is to provide our readers, customers, suppliers and all partners of the Lenzing Group with an intermediate report on how we put these principles into practice in our daily operations. We have already achieved a great deal through these efforts. However, we are aware of the many things we can improve in the future too and we are working on doing just that. In this spirit, I hope you enjoy reading this brochure.

Yours,

**Peter Untersperger**

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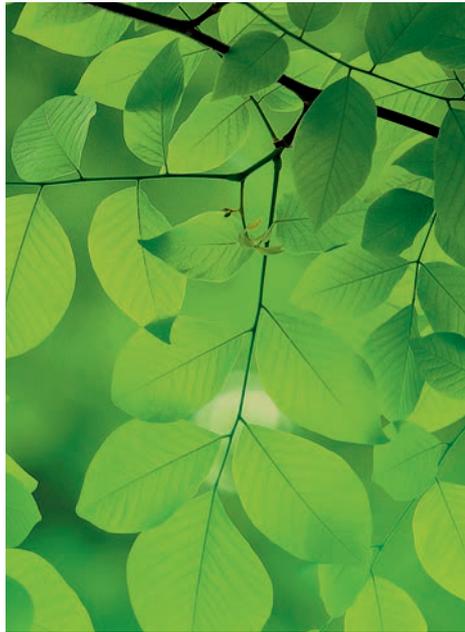
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# Sustainability

## Achieved through Long-term

# Thinking

# 1

## **Our corporate culture is shaped by stability**

Man-made cellulose fiber has been our core business for 75 years. Lenzing has been a standard-setter in the industry for decades.

Our corporate culture has evolved historically. It is geared to long-term partnerships and applies high standards at all business locations.

We have been proving for decades that ecologically and socially responsible production and business success are by no means mutually exclusive.

In terms of ownership structure, the largest shareholder is a foundation (B & C Group). This foundation considers its role to be that of a stable shareholder with a long-term orientation.

## **Renewable raw materials are the industrial future of the fiber industry**

Our fiber products are part of the natural cellulose cycle. One outstanding trait of our products is that they are highly compostable.

The wood or pulp for our cellulose fiber products stems largely from sustainably managed sources. We therefore know the origins of our key forests and plantations and their methods of production.

The importance of cellulose fibers on the world market is growing because consumers increasingly value products manufactured in an environmentally friendly way.

# 2

## 3

**We produce high-quality products to high ecological standards**

Our production methods are gentle on the environment and efficient. Wherever possible, our production systems are closed loops and the chemicals used are reclaimed.

We constantly improve our use of the potential of raw materials by applying innovation.

The Lenzing Group uses a much greater proportion of biogenic energy sources than the industry as a whole. Lenzing fibers have an optimized CO<sub>2</sub> footprint (Life Cycle Analysis).

The highly environmentally friendly TENCEL® process is the third generation of man-made cellulose fiber technology and is considered the cleanest technology of the future for cellulose fiber production.

**Innovation is the factor that guarantees our market leadership**

Lenzing is a global technological pioneer for ecologically responsible industrial cellulose fiber production and for decades has been setting the highest standards in this regard. We strive to achieve long-term market success for our cellulose fibers with the help of constant product improvements, product innovations and enhanced quality.

Our declared goal is to maintain our leadership in innovation and technology. We spend far more than the industry average on research and development as part of a long-term promise to all stakeholders.

Ecological sustainability is a specified target in innovation. We further develop our production technologies on an ongoing basis to achieve optimum returns on all the resources we employ.

We constantly work on optimizing the energy our industrial plants require and on utilizing ecologically sound sources of energy.

Close cooperation with our customers, suppliers and external research institutions is an indispensable part of our innovation work.

## 4

## 5

**Long-term relationships with our stakeholders engender trust**

Our collaboration with all our stakeholders is based on long-term trusting, mutually beneficial relationships.

Our success is based on our employees' commitment, creativity and qualifications.

The Lenzing Code of Conduct is the guideline for all our employees' conduct and economic decisions in day-to-day business. It also goes without saying that we comply with national and international legal provisions and internal guidelines.

As an industrial enterprise with a long-term orientation, we are firmly embedded in the societal and social structures in which we produce and cultivate a lively interaction with those around us. These community ties give us a sense of responsibility to act creatively in helping to improve local economic, ecological and social conditions (good corporate citizenship).

We work together with our customers and suppliers to make the value chain more sustainable ecologically and socially.

We cultivate a transparent and continual dialog with those who furnish our equity and borrowed capital.

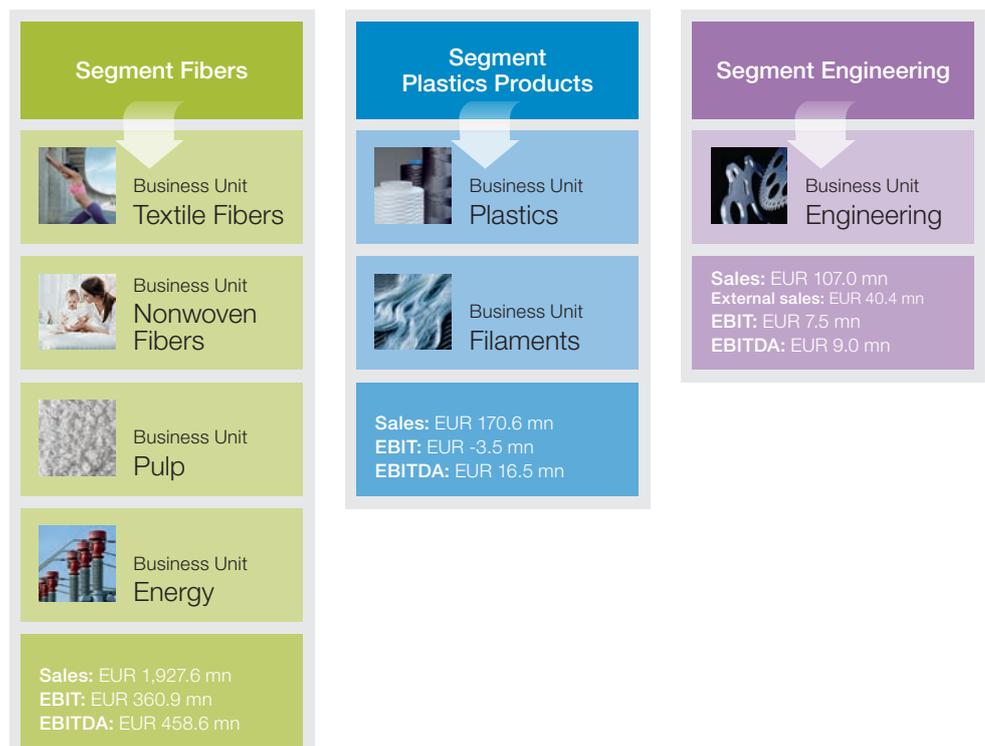
# The Lenzing Group

The Lenzing Group is a world market leader in the production of man-made cellulose fibers. It has its headquarters in Austria and production sites in all key markets plus a network of sales and marketing offices that span the globe. The Group has three segments: Fibers, Plastics Products and Engineering.

**F**ibers is the core segment of the Lenzing Group. The two business units Textile Fibers and Nonwoven Fibers supply the global textile and non-wovens industry with high quality man-made cellulose fibers. The Lenzing Group is the only manufacturer worldwide to produce all three generations of man-made cellulose fibers – from classic viscose to modal and TENCEL® fiber – on a major industrial scale.

Pulp is the business unit that ensures the long-term supply of high quality pulp for the Lenzing Group. The supply is covered by the company's own pulp mills and by supply agreements entered into for the long term. The Lenzing Group operates two pulp mills of its own, one in Lenzing, Austria, and one in Paskov, Czech Republic.

## The Lenzing Group



## Lenzing AG – a company with a 75-year tradition



One of the most modern pulp mills in Europe was already being operated at the Lenzing site back in the 1930s. The fiber production facility was built in 1938 under the National Socialist regime. After the end of World War II, the title to this facility was transferred to three major Austrian banks. In 1969 the facility was merged with the Lenzing pulp mill. In 1983 Lenzing started its first fiber production operations abroad in Indonesia. The initial public offering (IPO) of Lenzing stock on the Vienna Stock Exchange occurred in 1985. Twelve years later, in 1997, Lenzing commenced large-scale industrial production of lyocell fibers. In 2004 Lenzing acquired its British competitor Tencel with facilities in the United States and Great Britain. One year later, Lenzing started construction on its first viscose fiber factory in China. In 2010 Lenzing acquired the Biocel Paskov pulp mill in the Czech Republic. Two years after that, Lenzing started construction on a TENCEL® production plant at company headquarters in Austria. In 2013 Lenzing AG celebrates its 75<sup>th</sup> year in business.

Energy is the business unit that handles the optimum provision of power, process water, steam and cooling at all Lenzing Group production locations. The large fiber production facilities in particular have highly efficient power production plants that all utilize combined heat and power technology. This ensures a high energetic utilization of the fuels employed.

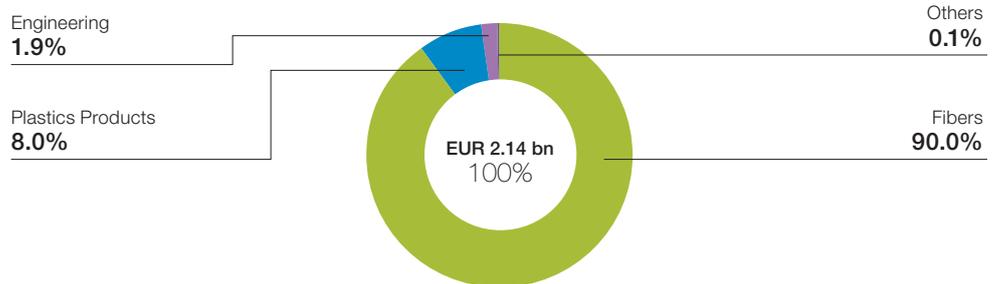
The Plastics Products segment is divided into the two business units Plastics and Filaments. The former consists of the

business areas Thermoplastics and PTFE (Polytetrafluoroethylene) and its products are used in a variety of areas. The latter mainly manufactures acrylic fibers.

Engineering is the Lenzing Group's technical competence center. Its expertise in plants and equipment contributes to Lenzing's technological leadership in fiber production. As a segment, Engineering provides complete tailor-made solutions to meet a variety of requirements for the Lenzing Group and for external customers.

### Sales by segment

Lenzing Group, 2011



Fibers accounted for 90% of the sales of the Lenzing Group in 2011. Owing to the central importance of this segment, this report will focus solely on Fibers and not deal with either of the two segments Plastics Products and Engineering. The figures presented refer primarily to 2011.

“ Owing to the central importance of the fiber business for Lenzing, this report will focus solely on the Segment Fibers. ”

## INTRODUCTION

# Products of the Lenzing Group

## TENCEL®



TENCEL® is produced using the lyocell process, which won the European Award for the Environment from the European Union as an environmentally friendly technology. Unique physical properties such as tenacity (especially when wet), moisture management and pleasantness to the skin make TENCEL® an appealing material for a wide range of uses.

### Uses of TENCEL® in textiles

- Quilts, bedwear, mattresses, sleeping bags
- Shirts, blouses, pants, denim, sportswear, outerwear, workwear
- Various technical applications

### Uses of TENCEL® in nonwovens

- Wipes for baby care, cosmetics and household use and for industrial applications
- Uses in female hygiene (panty liners, sanitary pads)
- Medical wound pads, surgical swabs and components for surgical outer garments in the medical field
- Various technical applications



## Lenzing Viscose®



With its 75 years of experience in producing viscose fibers, Lenzing sets the international quality standards in the industry for this product. Lenzing Viscose® is considered a premium product on the world market and is typically used in ladies' outer garments, such as elegantly flowing printed dresses. Because of its purity, pleasantness to the skin and natural absorbency, Lenzing Viscose® is an outstanding choice for sensitive hygiene applications.

### Uses of Lenzing Viscose® in textiles

- Woven and knit garments (blouses, dresses, tops)

### Uses of Lenzing Viscose® in nonwovens

- Wipes for baby care, cosmetics and household use and for industrial applications
- Wound dressings, surgical swabs and components for outer garments for medical surgery
- Tampons in the hygiene segment



## Lenzing Modal®



Lenzing Modal® is manufactured from the natural raw material beech wood at the Lenzing facility for specialty products utilizing unique integrated process management. Besides being especially soft and pleasant to the skin, the fibers are known for their luster and brilliant colors. The lasting softness plus their high degree of absorbency lend them excellent traits and render them the ideal material for blending with cotton.

### Uses of Lenzing Modal® in textiles

- Homeware
- Fashion knitwear
- Underwear and socks
- Terry products



## Lenzing FR®



Made from the natural raw material wood, this fiber offers protection from heat in a variety of work areas. With its extraordinary characteristics with respect to heat insulation and moisture management, Lenzing FR® reduces the risk of heat stress or heatstroke and increases protection from first- to third-degree burns.

### Uses of Lenzing FR® in textiles

- Protective wear for industry, fire departments and the military
- Flame resistant fabrics for public transport (aircraft, trains)
- Flame resistant fabrics for furniture
- Thermal insulation systems for protective jackets



# The Production Sites of the Lenzing Group

## Viscose production sites<sup>1</sup>

Viscose capacity: 732,000 tons/year

**Lenzing/AT**  
252,000 tons/year



**Purwakarta/ID**  
320,000 tons/year



**Nanjing/CN**  
160,000 tons/year



**Patalganga/IN**  
in preparation



## TENCEL<sup>®</sup> production sites<sup>1</sup>

TENCEL<sup>®</sup> capacity: 155,000 tons/year

**Mobile/USA**  
50,000 tons/year



**Grimsby/UK**  
40,000 tons/year



**Heiligenkreuz/AT**  
65,000 tons/year



**Lenzing/AT**  
under construction



<sup>1)</sup> All capacities as at 31/12/2012

## Pulp production sites<sup>2</sup>

Pulp capacity: 407,000 tons/year (dissolving pulp), 280,000 tons/year (paper pulp)

**Lenzing/AT**  
290,000 tons/year  
dissolving pulp



**Paskov/CZ**  
117,000 tons/year dissolving pulp  
280,000 tons/year paper pulp



<sup>2)</sup> All capacities as at 31/12/2012; air-dry

# Sustainability Management

Efforts were stepped up to systematize the internal sustainability work in the year under review. The goal of this Lenzing sustainability initiative is to expand the list of key figures for ecological, economic and social sustainability criteria, so sustainability activities in the Lenzing Group can become more transparent. The Steering Committee for Sustainability spearheaded the initiative. This body is made up of a Management Board member, the two heads of the business units Textile Fibers and Nonwoven Fibers as well as the heads of two Corporate Center units, namely Safety, Health and Environment and Corporate Communications.

The development and cultivation of relationships with stakeholders is a major factor in the long-term success of the company. Lenzing conducts an open dialog with all its stakeholders and takes their interests into account when making business decisions.

## Stakeholders of the Lenzing Group





## ECONOMY

# Responsibility for the Economy

Lenzing produces input stock for end products that improve people's daily life and make it more pleasant.

**A** number of input factors are required to manufacture these products: raw materials and energy, human labor, extensive expertise, but also a great deal of capital. Lenzing strives to give back to all these suppliers the value added from fiber production in a proportion that is fair and balanced in the long term, from suppliers of raw materials to its own employees and the providers of its capital.

The Group can only achieve this goal if it regularly generates profits. In its 75 years in business, Lenzing has always geared its corporate strategy to long-term performance, never to short-term profit maximization. Long-term thinking is indispensable in a capital-intensive sector such as the man-made cellulose fiber industry. The large investments Lenzing makes in production facilities and in research and development only make sense if they are used for decades or even longer.

Long-term economic success is therefore an integral part of the sustainability mindset at Lenzing.

“ In its 75 years in business, Lenzing has always geared its corporate strategy to long-term performance, never to short-term profit maximization. ”

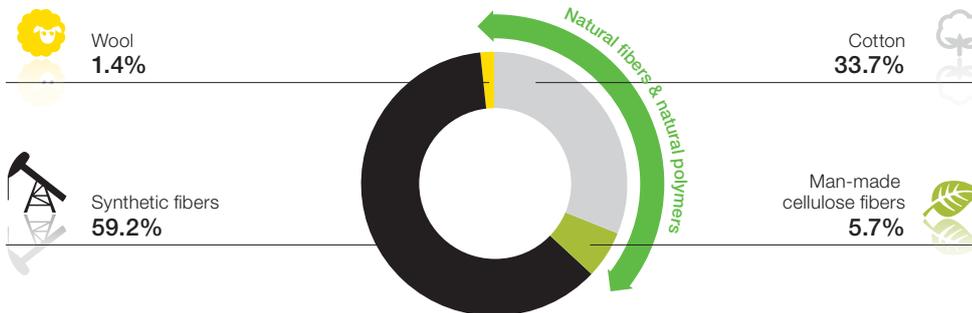
ECONOMY

# The Global Fiber Market

There were 81.0 million tons of fibers produced worldwide in 2011. Synthetic fibers (such as polyester) accounted for the largest portion (59.2%) followed by cotton (33.7%), man-made cellulose fibers (5.7%) and wool (1.4%). Demand for fibers is expanding by about 3% a year owing to the global megatrends of population growth and increasing prosperity. By 2020, the global demand for fibers is expected to exceed 100 million tons.<sup>1</sup>

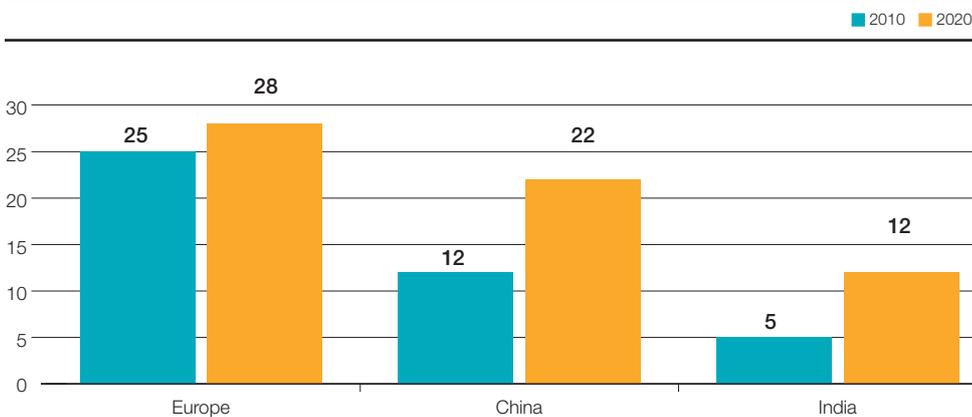
## Global fiber market

Global fiber production 2011



Source: Gherzi, The Cellulose Gap, February 2011; Lenzing estimates

## Per capita fiber consumption



Source: Gherzi, The Cellulose Gap, February 2011

## Three megatrends are shaping overall developments in the global fiber market:

**1** Ongoing population growth is a driving force in global fiber consumption. UNESCO expects the global population to rise from its current total of some 7 billion to 7.7 billion in 2020.

**2** Increasing prosperity generates additional demand, particularly in emerging economies as they seek to catch up with the western industrialized countries. Per capita fiber consumption in 2010, for example, totaled about five kilograms in India, twelve kilograms in China and 25 kilograms in Western Europe.<sup>2</sup>

**3** Sustainability and climate change are gaining in significance. Consumers increasingly prefer products manufactured with the minimum possible environmental impact and use of resources and question the influence products have on global climate change (CO<sub>2</sub> footprint).

<sup>1</sup> Cf Gherzi, The Cellulose Gap, February 2011; own calculations    <sup>2</sup> Cf Gherzi, The Cellulose Gap, February 2011

# Fiber Types

Fibers are basically divided into two groups: natural fibers and chemical fibers (man-made fibers).

**N**atural fibers are all fibers with a natural origin. Cotton accounts for the largest percentage of this category. Chemical fibers is a general term for fibers produced industrially using chemical processes. The fiber types of greatest significance in this category are those made of petroleum-based (synthetic) polymers such as polyester or polyamide.

The Lenzing Group fills a niche in the global fiber market with its man-made cellulose fibers Lenzing Viscose®, Lenzing Modal® and TENCEL®. They are somewhere between natural and chemical fibers. Like natural fibers, Lenzing fibers are made from wood, a renewable raw material. Wood contains about 40% cellulose, which is industrially produced as pulp under high temperatures and with the use of chemicals. The natural origin of man-made cellulose fibers is what gives them their excellent characteristics such as absorbency and superb moisture management. The industrial mode of production is responsible for their purity as well as their uniformity and clearly defined quality.



Fibers made out of TENCEL® (top picture) have an extremely smooth surface compared to cotton (bottom picture). This characteristic of TENCEL® fibers prevents skin irritation and makes the fibers feel pleasant on the skin.

## Fibers on the world market

| Fibers                                     |  |   |                                      |   |                                      |
|--|--|---|--------------------------------------|---|--------------------------------------|
| Natural fibers                             |  | Man-made fibers   |                                      |   |                                      |
|  |  | From natural polymers                                   |                                      | From synthetic polymers   | From anorganic substances            |
| Protein-based                              | Cellulose-based                        | Cellulose-based   | Protein-based                        |   |                                      |
| Wool<br>Silk<br>Angora<br>Cashmere<br>Etc. | Cotton<br>Flax<br>Hemp<br>Jute<br>Etc. | Viscose<br>Modal<br>Lyocell<br>Cupro<br>Acetate<br>Etc. | Casein<br>Collagen<br>Ardein<br>Zein | Polyester<br>Polyamide<br>Polypropylene<br>Polyurethane (Elastan)<br>Acrylic<br>Polytetrafluoroethylene | Carbon<br>Ceramics<br>Glass<br>Metal |

The products from Lenzing are fibers industrially made from the natural raw material wood (man-made cellulose fibers), putting them halfway between natural fibers and man-made fibers. They combine the natural wearing characteristics of natural fibers with the advantages of synthetic fibers, such as purity or consistent quality.

# Research and Development

The commitment to be and to remain the innovation leader in the industry is a central part of the strategy of the Lenzing Group. The company has been a global technological pioneer in the ecologically responsible and profitable production of cellulose fiber for decades.

Lenzing sets the standards in this area. The company's research achievements lay the groundwork for the strategy of marketing about one third of

The surface tension of TENCEL®Biosoft nonwovens is tested on a contact angle measuring device.



its fibers as specialty products and insuring the high quality level of Lenzing's products even in standard grades.

## Innovation – a key to long-term success

An internationally recognized team of about 160 experts is conducting research on the latest advances in the field of fibers at the facility in Lenzing. Research is organized within the operational business units to ensure maximum closeness and responsiveness to the markets. The resulting interfaces with marketing ensure intensive collaboration.

Spending for research and development amounted to EUR 27.2 million\* in fiscal year 2011, a peak value compared with the rest of the industry – by both percentage of sales and in absolute terms. Lenzing has set itself the goal of investing about 1.5% of sales in research and development in order to retain its innovation leadership in the man-made cellulose fiber industry in the long term.

“ The company has been a global technological pioneer in the ecologically responsible and profitable production of cellulose fiber for decades. ”

\* Calculated according to the Frascati method – expenditures on research including investments in research facilities minus depreciation and grants



## Milestones in research

### 1963

Lenzing started the successful development of a high wet modulus (HWM) fiber, later the Lenzing Modal® fiber.

### 1988

Lenzing produced fibers for the first time in its testing facility for spinning using the revolutionary solvent method based on the organic solvent NMMO. These successes led to the construction of the first lyocell pilot plant at Lenzing in 1990.

### 1989

Lenzing started with MicroModal®, the finest man-made cellulose fiber for high-quality applications.

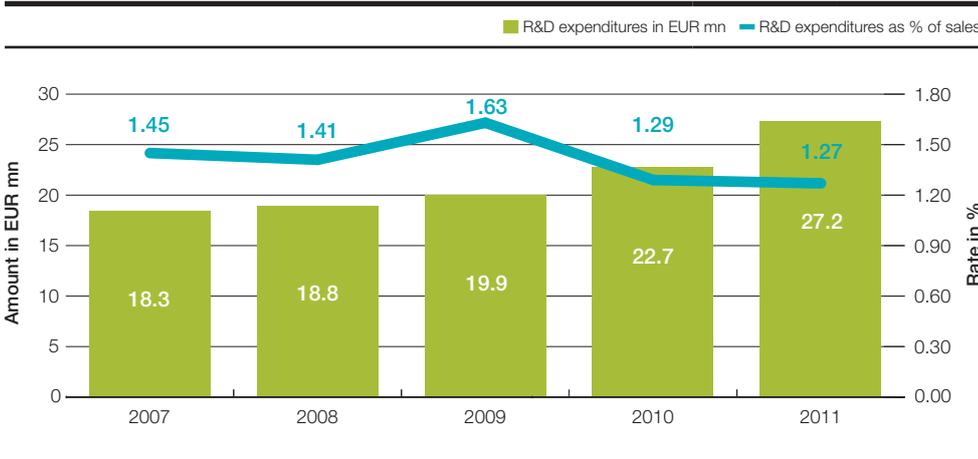
### 1993

Lenzing eliminated chlorine completely from its pulp bleaching at the facility in Lenzing and converted fully to an environmentally friendly, chlorine-free bleaching method that utilizes ozone.

### 1997

Lenzing successfully put into operation its first large-scale lyocell plant at its facility in Heiligenkreuz with an annual capacity of 12,000 tons.

## Expenditures for research and development\*



\*1) Calculated according to the Frascati method, excluding the research premium

The Lenzing Group currently has about 1,400 patents belonging to 226 patent families in 57 countries. The majority pertain to the lyocell fiber TENCEL®.

The Lenzing Group has received many awards for its research achievements. It was, inter alia, among the winners in 2012 of the state prize from Upper Austria for innovation and the federal prize for creating jobs through innovation. Both prizes were

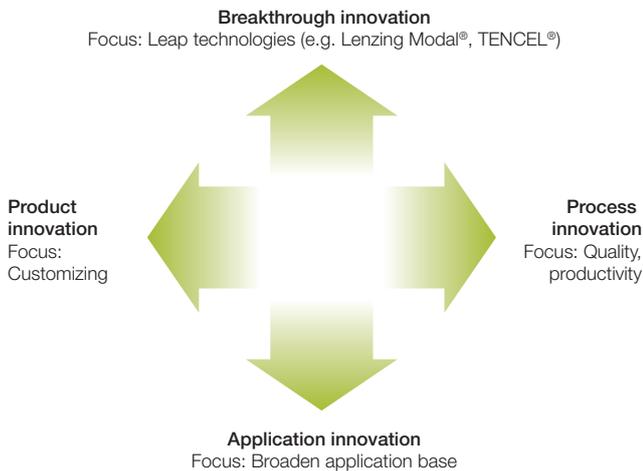
awarded in connection with successful research on TENCEL® fibers.

## Lenzing's model for innovation

Lenzing's research and development activities are based on an innovation model which encompasses all research activities of the Lenzing Group.

## R&D organization

### Unique innovation model



## Breakthrough innovation

Breakthrough innovations are usually highly innovative and complex. They set the course for the future and allow the Group to tap into new customer and market segments, generating lasting competitive advantages and thus laying the groundwork for long-term success for the company. The two new fiber generations Lenzing Modal® and TENCEL® in particular are excellent innovations at Lenzing in this respect.

## Process innovation

Process innovations optimize the process of fiber manufacturing. The primary goal is to design production processes to be more effective while boosting quality and productivity and optimizing the consumption of raw materials and energy. Process innovations can subsequently serve to increase operating safety or the degree to which the material employed can be recovered and recycled. At Lenzing, the entire process sequence, from pulp production to fiber production, is an inherent part of continuous further development and the innovation process. As a result of these efforts, Lenzing has become highly expert in pulp cooking and bleaching. The technical facilities in the company are capable of simulating processes in fiber production. Lenzing also operates several pilot plants for fiber production with a view to constantly optimizing the manufacturing processes.

## Product innovation

Further development work on fibers focuses on customers' requirements and their processing technologies. Many Lenzing customers are small- to medium-sized companies with limited developmental resources. With its size, financial strength and global market position, Lenzing makes a valuable contribution to protecting its customers' competitiveness. The object is to adapt fibers to meet the specific needs of customers and to offer ways customers can differentiate themselves from the competition.

Product innovations are also indispensable for the constant further development of the company and the future long-term protection of the Lenzing Group's position in the market. They are crucial for differentiating Lenzing from its competitors. As regards new fiber types, efforts extend from the further development of the special fibers Lenzing Modal® and TENCEL® as well as new brands such as ProModal®, MicroModal®, TENCEL®C, TENCEL®Skin, TENCEL®Biosoft to developments and applications involving innovative TENCEL® powder, which is used to improve moisture regulation in mattresses.

## Application innovation

Innovations in applications help to open up new market segments with existing products or to transfer existing technologies to new markets. Existing developments are used for this purpose to identify and develop further areas of application.

The use of fibers from Lenzing has expanded over the years to encompass broad areas of application. Along with classic uses in the textile industry, Lenzing fibers are also convincing choices for the production of wipes, hygiene articles and medical products thanks to their natural origin. In addition, Lenzing fibers are employed increasingly in ever more areas in technical textiles. A few examples are mattress foam, filtration in the food and beverages industry, industrial air and liquid filtration and use in plastering/rendering for the construction materials industry.

## Cooperation in the value creation chain

Incorporating research and development in the individual business units allows Lenzing to develop products geared as closely as possible to the market and to customer needs. Responsiveness to customer needs is characteristic of the Lenzing business model, which takes into account the requirements of everyone from primary customers to end consumers. Relationships with customers are geared to the long term and often extend over many decades. It is extremely important to us that we maintain and cultivate these relationships in both good times and bad.

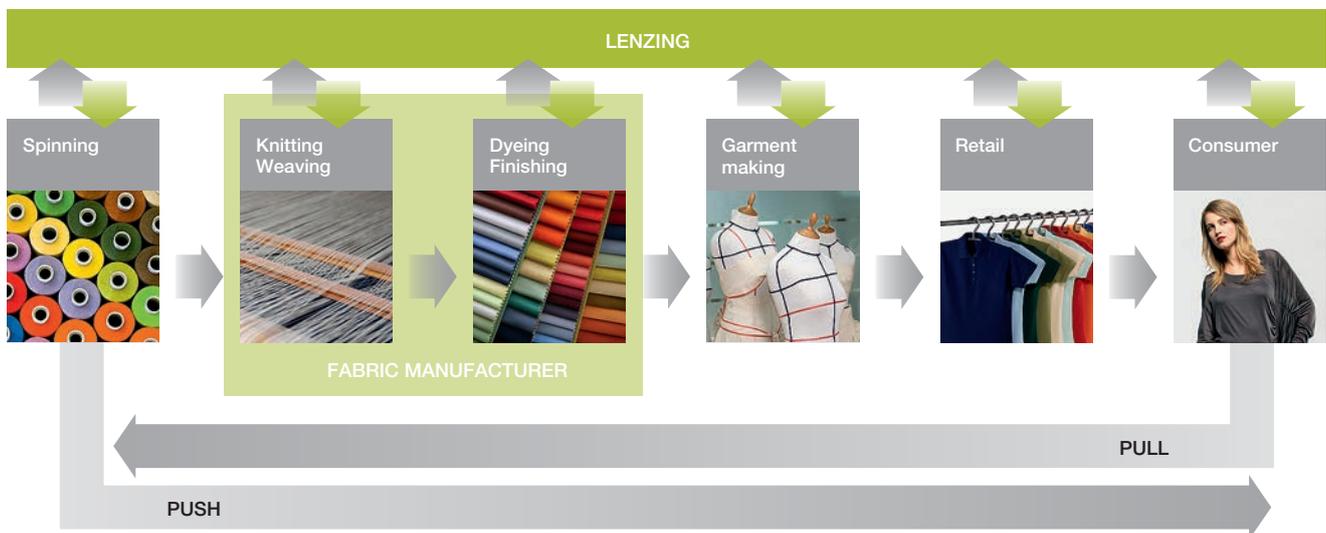
Many innovations are already traditionally developed jointly with customers but also with partners. The latter range from external research centers or university organizations such as the Christian Doppler Laboratory, for example, or the Wood K plus competence center to networks from the framework programs of the European Union and a host of others.

As a fiber producer, Lenzing is at the beginning of a long value creation chain in the textile industry (see diagram). Although this chain is substantially shorter in the nonwovens segment there are still multiple stages between fiber production and the end consumer. For this reason, innovations can only be implemented if all links in the value chain communicate with each other. The Lenzing business model involves push-and-pull marketing, where different links in the value chain become involved up to the retail level. It is based on Lenzing customers and their customers being able to differentiate themselves from the competition with the help of the fiber products.



Further information about the Business Unit Textile Fibers is available at:  
[www.lenzing.com/en/fibers/home.html](http://www.lenzing.com/en/fibers/home.html)

## Communication in the textile chain



## Man-made Fibers Congress in Dornbirn



Friedrich Weninger, COO of the Lenzing Group, has been president of the Austrian Man-Made Fibers Institute since 2009.

For decades Lenzing AG has been closely involved in developing the Man-made Fibers Congress in Dornbirn, Austria. This symposium is the leading European/American forum for presenting fiber innovations of relevance to the industry. The congress

- promotes dialog in the textile and nonwovens value chain,
- encourages collaboration in research and development between industry, universities / universities of applied science and associations,
- furthers the exchange of expertise on new technical advances for processing man-made fibers and
- provides a platform for presenting innovative processes or product improvements to an expert audience.

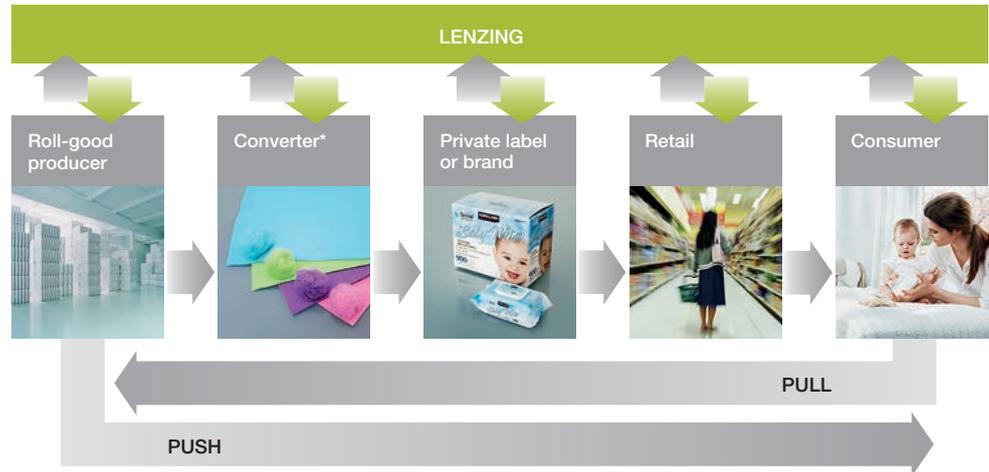
Research on sustainable approaches for the fiber industry has repeatedly been a central topic of this annual congress.



For further information and the date of the next conference see:

[www.dornbirn-mfc.com/en](http://www.dornbirn-mfc.com/en)

## Communication in the nonwovens chain



<sup>\*)</sup> Manufacturer of wet wipes

Customers of the Lenzing Group greatly profit from the expertise within the Group. Technical Services provides fiber customers with a full range of services. The specialists from Lenzing in spinning technology, weaving and knitting, dyeing and finishing provide support from the spinning process to dyed textile fabrics (finished wovens or knitwear). To give customers optimum service locally, Lenzing operates test systems ranging from state-of-the-art industrial spinning installations and weaving machines to a pilot plant for dyeing and finishing. Any problems arising at the customers' premises can be quickly analyzed and solved. Tests on serviceability are conducted internally at Lenzing under laboratory conditions to determine, among other things, the flammability of a fabric or the appearance of a material after it has undergone multiple washings and been subjected to physical stress. The microscopic laboratory examines both test results and complaints with meticulous care.

Lenzing also offers its customers competent support on all technology issues pertaining to nonwovens. With its global

team of specialists from all areas of application for Lenzing Fibers, the customer can be provided with optimum service through local contact partners. Since a majority of Lenzing nonwoven fibers are made into hygiene products, this segment is a special priority area. Customers benefit both from Lenzing Fiber's extensive expertise and from its many certifications. Other priority topics besides fiber characteristics and purity are special issues such as environmental impact, compostability and contact with foods.

In 2011 more than 1,300 technical questions from the textile chain were processed. About 1,000 fiber and fabric tests were also conducted as well as approximately 2,500 fabric certification procedures.



Further information about the Business Unit Nonwoven Fibers is available at:

[www.lenzing.com/en/nonwovens/home.html](http://www.lenzing.com/en/nonwovens/home.html)

## Lenzinger Berichte – a recognized flagship of Lenzing innovation



Since first appearing in 1953, Lenzinger Berichte has been a fixed and regular part of research activities at Lenzing. 90 issues of this scientific publication have already been released. Lenzinger Berichte is the only corporate publication worldwide listed in the Chemical Abstracts (the world's most important evaluation service for original sources in chemical literature). This inclusion attests to the quality content in Lenzinger Berichte as well as to its position in scientific discourse. A number of renowned researchers in the field of man-made cellulose and polymer fibers already use this medium to share their knowledge with industry and the academic community.

The topics range from research on pulp and fibers to production and process technologies or market and marketing aspects. Sustainability is also a regular topic of scientific discussion. For example, specialists from the University of Utrecht produced a study in 2008 entitled "Life Cycle Assessment of Man-Made Cellulose Fibers" about the environmental impact of various fibers

and published the full version in Lenzinger Berichte in 2010. This study is the first and so far only one to compare the environmental impacts of all major textile fibers with each other using comparable methodology and is therefore recognized as an important reference throughout the industry.

“ Lenzinger Berichte is the only corporate publication worldwide listed in the Chemical Abstracts (the world's most important evaluation service for original sources in chemical literature). ”



Further information about these topics is available at:  
[www.lenzing.com/en/lenzinger-berichte](http://www.lenzing.com/en/lenzinger-berichte)

### Lenzinger Berichte 90/2012



#### The content of this issue:

- Sustainable Cellulosics
- Protection and Comfort
- Applications besides Textiles
- Cellulose and Cellulose Derivatives



# Sustainability through Innovation

Consumers naturally demand quality products but are also increasingly interested in products that are gentle on the environment and the climate. This trend has raised the industry's awareness of sustainability and led to more questioning of suppliers on environmentally and socially relevant issues. Lenzing has achieved a number of innovations with ecological objectives in recent years.



## Lenzing Modal® with Edelweiss technology

The cellulose fiber Lenzing Modal® has been manufactured from the renewable raw material beech wood at the Lenzing specialty site utilizing integrated process management for many years. The fiber is extremely soft and highly absorbent, giving it excellent wearing properties. The latest innovation involving Lenzing Modal® is called Edelweiss. The advantages of this technology come in the form of reduced environmental impacts, optimum use of raw materials as well as improved cost advantages.

The facility in Lenzing uses a very high proportion of renewable energy and biogenic fuels to produce these fibers which are manufactured using a modified viscose process. As a result, the fiber is CO<sub>2</sub> neutral when it leaves the plant and thus represents another step toward a "low carbon economy", an objective set by the EU in various strategy papers. In addition, the company dispenses with the use of chlorine compounds throughout the process chain, using oxygen-based chemicals for bleaching instead.

Lenzing Modal® fibers made with Edelweiss technology therefore offer substantial ecological advantages over other major textile fibers. Lenzing Modal® fares well in a comparison with cotton, using much less water and no environmentally poisonous agricultural chemicals at all for cultivation. It also has a smaller CO<sub>2</sub> footprint than cotton. The major advantage Lenzing Modal® fibers have over polyester is that they are based on renewable raw materials. This fact provides the customer with an ecological differentiation.



## Lenzing Modal® COLOR – spun- dyed fibers as an ecological alternative



Lenzing Modal® is a specialty fiber that is also produced in a variety of colors. Color pigment is incorporated directly in the fiber matrix, so it is no longer necessary to dye the fibers in an additional processing step. The advantages of these spun-dyed fibers lie in their environmental friendliness because water and energy are conserved in the production of fabric.

Life cycle analysis was the method used to quantify the extent to which spin-dyeing reduces the environmental impact. Environmental influences of conventionally dyed and spun-dyed fibers were investigated and then compared and contrasted with each other. The results from the study clearly show that spun-dyed fibers bring major improvements in the level of greenhouse gas emissions, the avoidance of non-renewable energy sources and the consumption of process water. Materials made from Lenzing Modal® COLOR were compared with materials made out of standard fibers and then dyed conventionally. It turned out that the fabrics from Lenz-

ing Modal® COLOR helped to reduce energy use by as much as 80% and water use by as much as 75%.<sup>1</sup>

## TENCEL®Biosoft – new advance from the nonwovens segment

TENCEL®Biosoft is the first hydrophobic and home-compostable fiber to offer unique advantages for wipes and hygiene products.

Following the disastrous Deepwater Horizon oil spill in the Gulf of Mexico in April 2010, Lenzing's researchers began looking for new materials for handling oil. Lenzing conducted initial testing for producing a new TENCEL® fiber. The objective was that the fiber should absorb oil but no water while at the same time remaining biodegradable.

In the course of the research, it became evident that the advantages of the developed fiber far exceeded the original

objective. In addition to developing the first hydrophobic and sustainable TENCEL® product, the researchers ended up creating a fiber that was especially soft, supple and functional. With these traits, the fiber is an ideal base material for sensitive nonwoven applications.

TENCEL®Biosoft can be used in various blends for wipes, with absorbency and cleaning performance adjusted to fit the widest variety of functions. The spectrum of uses extends from moist wipes capable of completely absorbing oil to products complying with requirements for special lotions. When these fibers are used for making sanitary pad top sheets<sup>2</sup>, their excellent penetration time for liquids and reduced release of moisture make the sheet feel pleasant and dry to the skin. TENCEL®Biosoft is based on natural resources so it is biodegradable and also satisfies the extended standards for Vinçotte home compostability. The Belgian certification company Vinçotte tests and certifies products suitable for industrial compostability and for proper disposal in a garden composter.

“ Fabrics from Lenzing Modal® COLOR helped to reduce energy use by as much as 80% and water use by as much as 75%. ”



<sup>1</sup> For jet dyeing; results varied with the dyeing process involved <sup>2</sup> The top layer of a sanitary pad that is in direct contact with the skin

## Guest Commentary: Economic Value Creation by the Lenzing Group



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Friedrich Schneider has been professor at the Institute of Economics at Johannes Kepler University Linz since 1986. He was also Vice President for Foreign Affairs of Johannes Kepler University from October 1996 to September 2007. Originally from Germany, Friedrich Schneider has taught at universities in Europe, America and Australia. In his research, he delves into the economic theory of politics, public finance as well as economic, environmental and agricultural policy, with a special focus on analyzing government activities and the effects they can have on economic events.

Every company has an impact on its immediate environment that extends beyond its direct area and the perimeter of its plants. It influences activities and relationships at many direct and indirect interfaces. The Lenzing Group with its business locations is also an economic, ecological and social part of the environment in which it is embedded. Besides exerting social and ecological influences, the company also has economic effects on those around it.

To make an objective assessment of the additional economic influence of the Lenzing Group, I calculated the value created by the individual production sites belonging to the Lenzing Group and by the Lenzing Group as a whole. In the process, a model calculation featuring the economic activities of the Lenzing Group (ongoing operation and investments) was juxtaposed with a simulation in which these activities did not take place. With this method, it was possible to determine which economic effects the ongoing operations and the investment activities of the Lenzing Group have in terms of additional gross domestic product (GDP), additional jobs and additional mass income. The analysis was carried out with the help of a simulation model based on economic estimates in which all significant economic parameters and all relevant business areas were taken into account.

“ The Lenzing Group is a prime example of a company with a successful internationalization strategy and extremely high potential for value creation. ”

The results from the study attest to the fact that the ongoing operations and investment activities of the Lenzing Group generate substantial effects with regard to value creation. For instance, the activities of the Lenzing Group at the seven production sites in 2011 caused GDP there to rise cumulatively by a total of more than EUR 930 million, mass income at these locations to increase by a total of EUR 400 million and over 8,000 additional jobs to be protected or created there in addition to the jobs within the Group itself.\* The Lenzing Group helps regionally to ensure jobs, create stable income and generate value in the countries where it produces.

To what extent is the Lenzing Group significant for the given region as a leading company? Austria is a high-wage country. Successful industrial compa-

nies in this country can compete internationally only if they can use the advantages found in other countries (of course, not just the wage cost advantages but also the other advantages of the given business locations). The Lenzing Group has taken

this approach with great success. The internationalization strategy that the Lenzing Group has been pursuing for many years has therefore led to major increases in jobs created not only in Indonesia and China but also in the Austrian provinces of Upper Austria in particular and Burgenland. The successful diversification of the Lenzing Group has meant that the facilities in the various countries and regions have quickly become a leading business because they utilize a high level

of expertise to manufacture products that are in heavy demand worldwide. Owing to the diversification strategy and structure of the leading companies, the expertise has remained within the Group, allowing Lenzing to act globally and deliver promptly while remaining stable with respect to price and exchange rate fluctuations.

In conclusion, one can say that the growth potential of the entire Group and of all seven production sites is considerable. This fact has enabled all production sites to establish themselves as leading companies and helped the Group to generate additional income, to secure further jobs and to increase value creation in these countries. The Lenzing Group is thus a prime example of a company with a successful internationalization strategy and extremely high potential for value creation. The very fact that Lenzing has established leading companies in the regions in which it operates shows that Austrian entrepreneurs in particular accept global responsibility. After all, they create added value and long-lasting secure jobs on a global scale.



The study is available at (only in German):  
[www.lenzing.com/studien](http://www.lenzing.com/studien)

\*1) This helps to give an average of 25,000 family members a higher standard of living and a more secure existence.

# Key Economic Figures

The Lenzing Group has enjoyed great business success in recent years. Figures show that as well as generating strong annual results, the company has also focused on those aspects that ensure long-term success and stability.

Value creation within the Lenzing Group is calculated as the company's business performance less cost of materials, other expenses as well as depreciation and amortization. The distribution of value creation shows the extent to which it is distributed among stakeholders such as employees, the public sector or lenders. In 2011 the Lenzing Group created value totaling EUR 666.8 million.

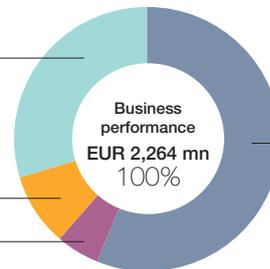
## Analysis of value creation

Lenzing Group

Value creation  
29.6%

Other expenses less taxes  
8.9%

Depreciation and amortization  
5.2%

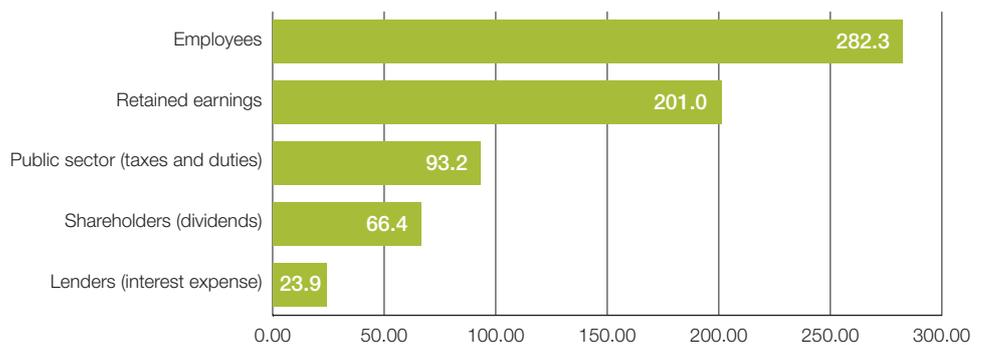


Cost of materials  
56.3%

## Distribution of value creation

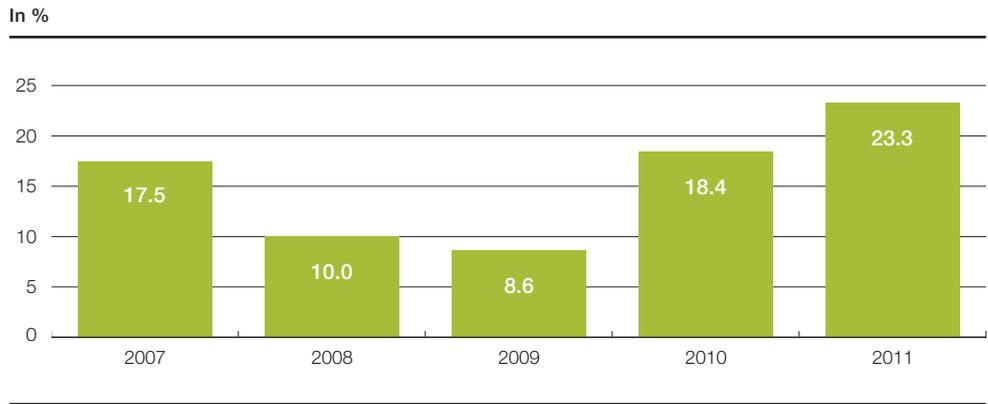
Lenzing Group in EUR mn

The employees of the Lenzing Group ranked first in 2011 in benefiting from the industrial value created by the company. Second was the Lenzing Group itself, which took a considerable portion of the value created and plowed it back into the company. This practice strengthens Lenzing's power of self-financing and lays the groundwork for new growth. Third was the public sector, which benefited from the sizable tax payments Lenzing made. Fourth and fifth are the shareholders and the lenders, respectively.



Return on capital employed (ROCE) is a key ratio for the return received on the total capital employed in the Lenzing Group for business operations. This return was more than four times as high as a regular savings account in Austria even in economically difficult periods such as the crisis year 2009.

### ROCE



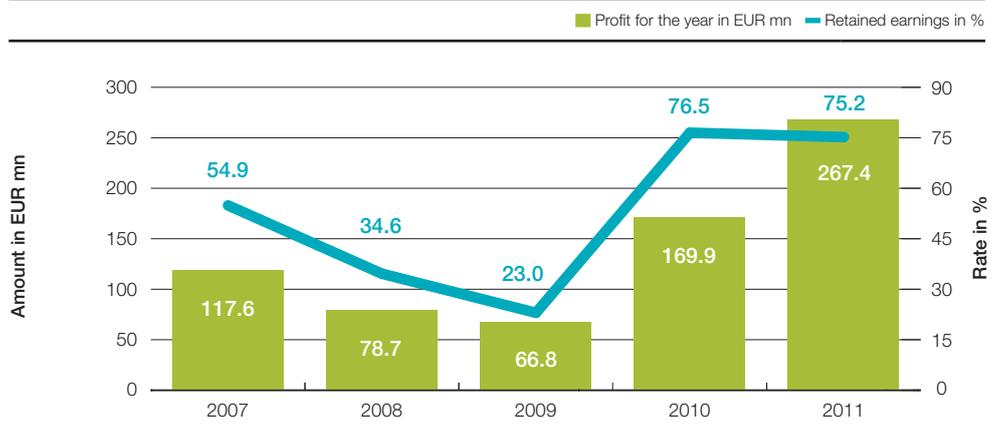
Lenzing and its core shareholder, the B & C Group, constitute a tax group. Lenzing meets its tax obligations in Austria, the country where its headquarters are located, as well as at the production sites. It does so because it is aware that public taxes are compensation paid for taking advantage of public services.

### Income tax expense compared to corporate tax rate



The Lenzing Group has pursued a policy since 2010 of distributing about one quarter of the net profit in the form of dividends to shareholders. About three quarters remain in the company. This balanced distribution policy strengthens the intrinsic value of the company in the long term and lays the groundwork for financing further growth.

### Profit for the year compared to retained earnings

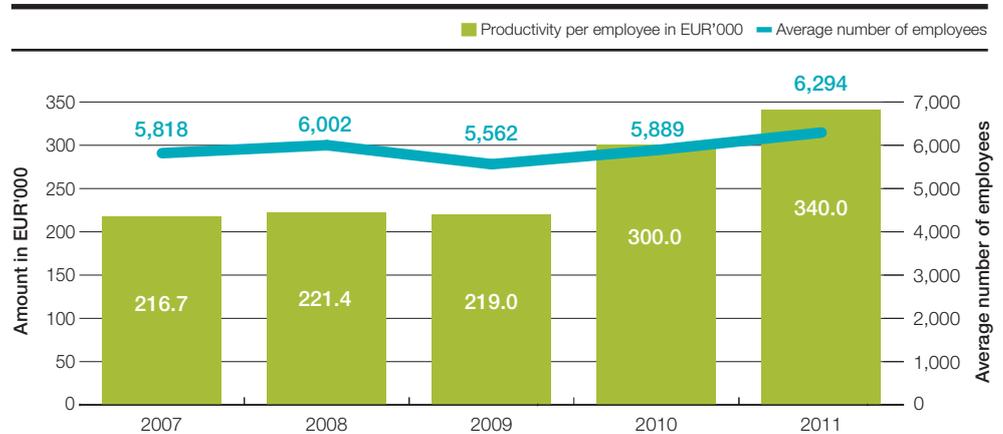


## ECONOMY

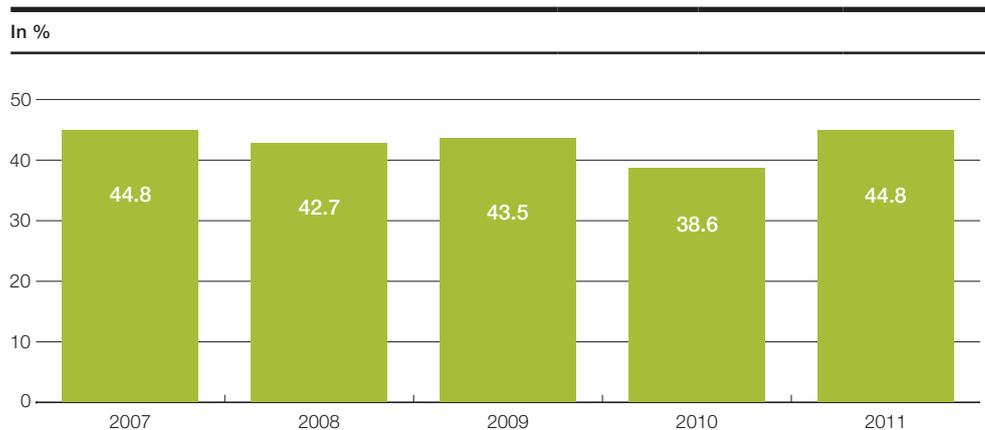
Lenzing is the technology leader in the man-made cellulose fiber industry. Lenzing continually manages to increase productivity per employee by constantly optimizing processes and improving the mix of products in the direction of high-grade special fibers. The dynamic growth is reflected in the employee figures.

Lenzing intentionally pursues a conservative balance sheet policy. Its equity ratio is a key benchmark for the company's financial power. This ratio has stayed at around 40% at Lenzing for many years, a level about double the average for Austrian industry. This stability provides a high degree of security, also in economically tough times.

## Productivity compared to number of employees



## Adjusted equity ratio\*



\*) Including government grants less proportional deferred taxes

“ Recent years have shown that the conflicting goals between economic, ecological and social requirements can be handled effectively from an economic standpoint, too, if we adhere to our principles and values. Lenzing has been able to improve its key economic figures steadily over an extended period of time. ”

# Purchasing

**T**he Lenzing Group has a strategic goal to optimize as many links in the value creation chain as possible in accordance with the principles of sustainable management. That means all stages, from wood to the finished product. The purchasing of primary and raw materials for fiber and pulp production plays a crucial role in this context. With a purchase volume of goods and services totaling nearly EUR 1.3 billion in 2011 (more than half of consolidated sales), Purchasing is responsible for a considerable amount. Lenzing is only able to ensure smooth production and sufficient deliveries for customers if it has an uninterrupted supply of primary materials, on the one hand. Yet on the other hand, mistakes made in the purchase of raw materials can not be undone in subsequent processing stages within the scope of a transparent and self-contained value creation chain.

Lenzing cuts costs and risks by gearing its purchasing process to the principles of sustainability. In doing so, it makes an

important contribution to the total economic success of the Group.

Lenzing has already implemented detailed supplier evaluation processes for its site in Lenzing, Austria, and for its site in Nanjing, China. Major suppliers are evaluated based on five criteria: price, quality, delivery, service and sustainability. If results are unsatisfactory, personal meetings are held with the suppliers to set scheduled procedures for implementing improvements. If the desired improvements are not forthcoming, the relationship with the supplier is terminated.

It is important to Lenzing to purchase raw and other materials from the region in which its production facilities operate if at all possible. This practice pertains in particular to purchased chemicals. The distances over which they are shipped should be kept as short as possible for safety reasons. The various Lenzing sites buy a large part of the purchased chemicals from their own nearby regions.

**In selecting suppliers, Lenzing is guided by the following principles:**

- Production should be as gentle on resources as possible.
- Logistics processes should be safe and environmentally friendly.
- Lenzing should be supplied from the surrounding region whenever technically possible and economically sensible.
- Material should be purchased from certified sources wherever possible and available.
- Lenzing has defined certain ethical, social and legal standards for itself and must comply with them also with regard to suppliers.
- Customer-supplier relationships should be built up and maintained for the long term on a partnership basis.
- Fair price for the given quality.
- The Lenzing purchasing chain should be transparent and traceable.



Wood and pulp are proportionally the two most important resources in the Lenzing Group.



## ENVIRONMENT

# Responsibility for the Environment

Cellulose is the most common organic compound occurring in nature. It is the main substance in plant cell walls and thus the most important building material in nature. Cellulose is also the basic material out of which Lenzing fibers are made.

Lenzing fibers are made of pulp produced from wood. This natural renewable raw material in itself forms the cornerstone of sustainability at Lenzing. Only companies that produce in harmony with nature can also rely on nature producing sufficient raw materials in the future. That is why preserving and protecting the environment is integral to Lenzing's business model.

That is why Lenzing uses environmentally gentle processes to manufacture fibers, which can be used with a clear conscience, not least because of the long-term availability of pulp as a raw material.

“Producing man-made cellulose fibers is a technologically demanding task. That is why the ecological dimension of sustainability and careful handling of the necessary raw materials and technologies has been a core area of expertise in the Lenzing Group for decades.”

# Operational Excellence



Friedrich Weninger, member of the Management Board (COO) of the Lenzing Group, on the approach Lenzing takes to efficiency in production

- Benchmarking of input factors
- Efficiency in personnel organization
- Constant employee training at all locations
- Productivity and production increase accompanied by constant quality improvement
- Process innovation – development of new processes

The Lenzing Group operates a total of seven fiber and pulp production sites worldwide. This setup allows us to set the benchmarks in operational excellence based on intensive data collation throughout the Group. This challenging job is done by a team of highly qualified specialists, process engineers at all production locations and highly dedicated employees at the machines. They form the world's largest and leading network of cellulose fiber experts.

Operational excellence at Lenzing pertains to environmental factors in particular, such as the efficient use of raw materials, process chemicals and energy. Thanks to regular Group-wide benchmarking processes, Lenzing fiber production sites are among the best in the world not only ecologically but economically, too. These processes also pave the way to productivity and production increases as well as constant quality improvement. In addition, we work tirelessly on improving environmentally relevant processes and on developing new technologies. Two of the latest examples are the reclaiming of zinc from waste water and the chlorine-free bleaching of modal fibers.

“Operational excellence at Lenzing pertains to environmental factors in particular, such as the efficient use of raw materials, process chemicals and energy.”

The Environmental Standards of the Lenzing Group represent a voluntary commitment to maintaining strict environmental criteria. They are based on stringent recommended values for various international standards such as the EU Ecolabel. The Environmental Standards of the Lenzing Group apply to all sites and in all regions of the world as a benchmark to guide the company in future actions relevant to the environment.



# Environmental Standards in the Lenzing Group

The environmental standards in the Lenzing Group support our Policy for Safety, Health and Environment:

## Policy – Responsibility for the environment

- We apply environmentally sensitive processes to ensure that the environment is a place worth living for future generations. Reducing our impact on the environment is a top priority and a never ending process of continuous improvement.
- We respect the environment in everything we do. We are considerate in our use of resources.
- We create opportunities by facing environmental challenges.
- We respond to stakeholder concerns regarding Safety, Health and Environment and address them proactively in our operations.

## Lenzing Environmental Standards

Our environmental standards have been developed considering the European Ecolabel (EU Flower), best available technologies (published by the European IPPC bureau) and the dialog with our stakeholders, especially with customers. Our environmental standards are the basis for environmental targets and programs. The standards will be reviewed annually and amended if appropriate.

- Legal compliance: we comply with local law and regulations wherever we do business.
- All our production sites are ISO 14001 certified.
- Wood/pulp:
  - To the utmost extent possible, we source wood and wood pulp from certified forests and pulp suppliers.
  - We do not use wood which has been harvested illegally.
- Bleaching technologies:
  - Our preferred pulp bleaching is totally chlorine free (TCF).
  - Our standard fiber bleaching makes use of a mild hypochlorite solution.
  - TCF fibers are produced as a specialty.
  - We generally obey the OX limits of the EU Ecolabel for fibers.
- Sulfur emissions: our viscose plants aim to meet the requirements of the EU Ecolabel.
- Waste water: waste water treatment plants aim to meet the requirements of the EU Ecolabel (e. g. for COD, Zn, pH and temperature).
- Fiber finish: we only use fiber finishes that meet the requirements of the EU Ecolabel.
- Energy use: we monitor the consumption of power, steam etc. at all sites and set targets for improvement as appropriate.
- Water use: we monitor the use of water at all sites and set targets for improvement as appropriate.
- We monitor selected parameters to benchmark production sites.

Lenzing, November 2012

Peter Untersperger

Friedrich Weninger

Thomas G. Winkler

**LENZING**  
LEADING FIBER INNOVATION

# Wood and Pulp

Wood and pulp are the main raw materials for the man-made cellulose fibers produced by the Lenzing Group. That is why this chapter will thoroughly examine the mechanisms of the wood and pulp industry and show their significance for the Lenzing Group.

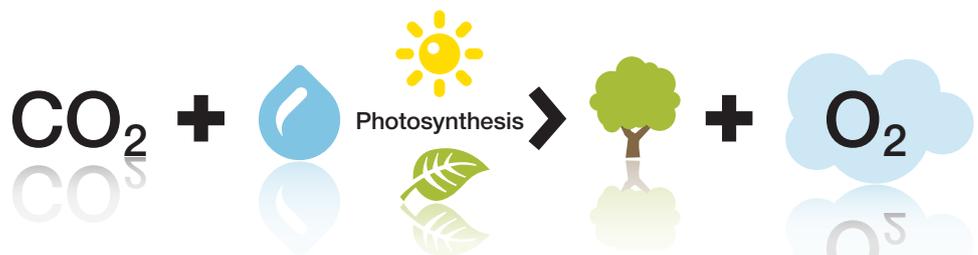
for plants and animals. The cellulose used as the base material for pulp and fiber production accounts for 40% - 50% of the wood substance.

Cellulose has a fundamental significance in nature. It is the most common organic compound on Earth, the main component of cell walls in plants and thus the most important construction material in nature. It can be found in soft leaves as well as in hard cactus spines. About 181 million tons of pulp is produced every year\*, a negligible part of all cellulose occurring on our planet. Much of this industrial pulp is used in the paper industry; only a small portion of 2% to 3% goes into the fiber industry.

Cellulose occurs in the course of photosynthesis in plants. In this biochemical process, a plant converts carbon dioxide (CO<sub>2</sub>) from air and water into organic material with the help of energy from the sun and releases oxygen (O<sub>2</sub>) into the air. Forests are therefore a supplier of energy and a neutral raw material in terms of the climate. When wood is used, no more carbon dioxide can be released than was previously contained in the plant.

**T**he term sustainability originated in the forestry industry. Forests are managed in such a way that no more wood is taken out of them than can be replaced by new growth. Forests perform functions vital to humankind and this sustainable approach ensures that they can continue doing so for generations to come. These functions go beyond their role as a supplier of raw materials and oxygen to include the entire ecological community of the forest, its acting as a shield against natural dangers and a place for recreation, as a supplier of drinking water and habitat

## The principle of photosynthesis

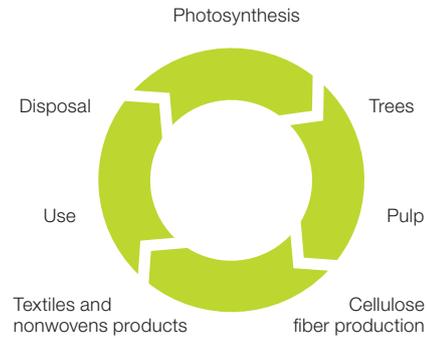


\*1 Source: Pöyry

“ Cellulose is the most common organic compound on Earth, the main component of cell walls in plants and thus the most important construction material in nature. ”

Lenzing fibers are part of a self-contained raw material cycle. Biodegradability is inherent to Lenzing fibers because of their botanic origin, an origin confirmed by certifications (DIN CERTCO, Biobased and Vinçotte).

The cellulose cycle



## Guest Commentary: On the Sustainability of the Forestry and Wood Industry in Austria and Europe



Peter Schwarzbauer is a professor at the University of Natural Resources and Life Sciences in Vienna at the Institute for Marketing and Innovation. He has worked since 2001 as a key researcher for Wood K plus (Competence Centre for Wood Composites and Wood Chemistry) in the research area “Market Analysis and Innovation Research”.

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The term “sustainability” first appeared in German-speaking lands in a publication dating from 1713; even at that early date it referred to the use of forests. After centuries of excess use of forests in Central Europe to obtain wood for mining, ship construction and – in particular, also in Austria – for salt production, the principle of forest management was developed to safeguard the wood supply. In accordance with this principle, no more trees should be felled than

## Guest Commentary: On the Sustainability of the Forestry and Wood Industry in Austria and Europe

can be replaced by new growth. In other words, “sustainability” originally referred solely to the amounts of wood used or being grown back. The modern understanding of the term is that three aspects must work together in any given system, such as the forestry and wood industry, for the system to be able to be called sustainable. The three aspects are economic, social and ecological.

About 38% of the land area of the EU-27 are covered by forests (in Austria: 47%), the majority of which are suitable for wood use. Unlike other regions of the world, Austria and Europe are experiencing continuous growth both in wooded areas and in timber reserves (refer to the diagram). The increase in reserves in Austria is attributable largely to the ownership structure. Privately owned small forestry operations have not been fully utilizing their sustainable potential for decades. Much less wood is harvested than is regrown.

In the EU-27, about 2.5 million jobs are based on the raw material wood (not counting jobs pertaining to energy use). In Austria, wood accounts for about 3% of total employment. One factor of special significance is that the forestry and wood sector offers and creates jobs mostly in structurally weak regions. Across the EU, the forestry and wood sector contributes about 1% to total economic output and in Austria nearly 3% (excluding use as energy). For

the EU-27 and Austria, one can say that the wood industry and the paper and pulp industry have maintained their share of total output within overall industrial production and in many cases even increased it compared to other industrial segments.

In the figure, Austria is presented as an example of a country that uses and further processes wood from forests in ways that are internationally competitive (e.g. Austria ranked sixth worldwide in the export of sawn coniferous timber and fifth in textile pulp production [dissolving pulp]). And it does so without endangering its own forest resources.

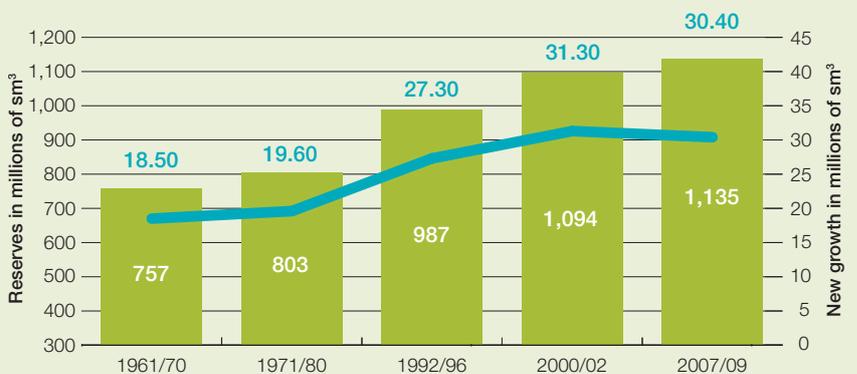
The forestry and wood sector is also highly significant with respect to sustainable climate protection because of the capacity of wood to store carbon.

The wood use chain has the following effects on the carbon balance:

- Storage of carbon in the forest itself (wood and forest floor).
- Storage of carbon in wood products.
- Substitution of fossil-based materials and energy through the use of wood.
- Less energy is usually needed for producing wood-based materials than for producing fossil-based materials.
- Comparatively less (landfill) waste is generated thanks to the possibility of recycling and reusing wood.

### Development of reserves and new growth in Austrian forests

Average solid cubic meters (sm<sup>3</sup>) in reserves ■ Reserves in millions of sm<sup>3</sup> — New growth in millions of sm<sup>3</sup>



Source: BfW (2004, 2011), FBVA (1973, 1983, 1997)

- Wood can be used as a source of energy at the end of the recycling process (cascading use).

Various conflicts surrounding forests and wood have crystallized recently in connection with conservation and climate protection. One issue is whether keeping a maximum amount of wood in forests and using less wood than previously is in fact in the interest of conservation and/or of increased carbon enhancement. A Swiss study conducted by several

from wood and thus a reduction in binding carbon long-term and in substituting fossil-based materials.

A second issue is the conflict or competition among different uses of wood, i.e. as a source of energy or as a material. Several studies from Austria and elsewhere show that the promotion of types of renewable energy from woody biomass have created major supply problems for two segments of the forestry and wood sector, namely in particular the

**“ Unlike other regions of the world, Austria and Europe are experiencing continuous growth both in wooded areas and in timber reserves. ”**

institutions (2007: GEO Partner AG, Werner Umwelt & Entwicklung, Swiss Federal Institute for Forest, Snow and Landscape Research, Swiss Federal Office for the Environment) arrived at the following conclusion on this subject: The forestry and wood industry can contribute most positively to the carbon issue by managing forests in a way that results in maximum additional long-term growth that is constantly used. Wherever possible, the wood should be used to make durable wooden products, in which the carbon remains stored. A limitation of wood use would cause more carbon to be stored in forests but growth and the ongoing capture of carbon would decline because of aging trees. In addition, decreased use of wood would mean fewer products made

board and pulp producing industries. It is recommended in these studies that only wood unable to be used in higher-quality goods (as material) should be used as energy. This suggestion applies both to forest wood and to by-products of wood processing and would help the sector to make a sustainable optimum contribution to climate protection.

#### **In closing, a few final remarks on the sustainable future of the forestry and wood sector:**

- The potential for sustainable use in European and Austrian forests is greater than the quantity of wood currently being put on the market. Forests as a resource are growing continuously.
- Use of wood as energy is the driving force for the future use of woody biomass. The growth rates for wood used as a material are far below those for wood used as energy, both in Austria and in Europe as a whole.
- A key to future competitiveness for the Austrian and European wood and paper industry lies in the sustainable availability of sufficient amounts of wood as an affordable raw material.
- Since raw wood imports are limited in volume, it is especially important to mobilize domestic resources without materially endangering them.
- Wood from forests is used for material and for energy without casting doubt on the sustainability of forest management and it can continue to be so used in the future.

# Wood and Pulp Supplies in the Lenzing Group

Besides fiber production, another core area of expertise of the Lenzing Group is pulp technology. For its own pulp production Lenzing mainly uses wood that is not suitable for use in higher-quality goods such as in the furniture industry. Lenzing has the strategic medium term goal of covering two thirds of its pulp consumption with its own production capacities.

In addition, the company has been pursuing the successful approach of integrated fiber production at its facility in Lenzing for decades. The integration of pulp production with fiber production offers many advantages. A decisive factor is to match pulp quality with the specific requirements of fiber production while taking into account economic and ecological parameters. By thinking in this integrated and networked way, the company can make optimum use of all valuable ingredients in wood as the raw material. These efforts led to the creation of a “bio-refinery for wood” at Lenzing, an approach not found anywhere else in the world. Lenzing spent many years developing the requisite expertise itself. The focus is on obtaining as deep an understanding as possible of the complex chemical and physical processes in pulp production.

## Pulp supply

Lenzing Group



Today, Lenzing can apply this expertise to obtain cellulose, energy and a number of valuable chemicals from wood, a renewable raw material – nothing is lost. Lenzing is also implementing this expertise at its pulp facility in Paskov (Czech Republic).

Supplying fiber production facilities with suitable dissolving pulp is the main task of the Pulp Business Unit. Fundamental decisions there are based not only on economic criteria but also on ecological ones. Dissolving wood pulp is the type of pulp Lenzing needs for fiber production. This grade of pulp is characterized by a higher alpha-cellulose content and by a high degree of purity. Dissolving pulp can be produced from almost any type of wood, but entails greater production cost and effort than paper pulp.

Today, the Lenzing Group covers much of the pulp it needs with its own pulp production. Lenzing currently produces pulp at two business sites: at company headquarters in Lenzing, Austria (since the founding of the company), and at its pulp mill in Paskov, Czech Republic. The Group purchased this mill in 2010 as a second Lenzing production facility and will have retrofitted it for dissolving pulp production by mid-2013. Both pulp mills produce pulp using the acidic magnesium bisulfite process.



# In-house Pulp Production

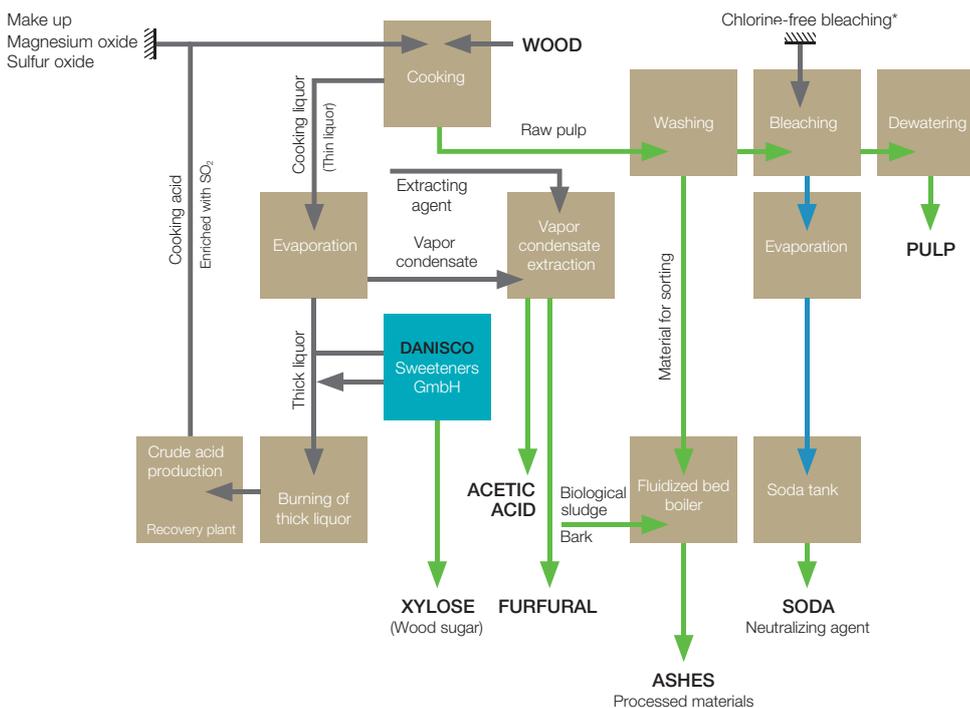
## Pulp production in Lenzing

The facility in Lenzing, Austria, is the largest integrated pulp and fiber production site in the world. Integrated pulp production not only offers exceptional economic benefits, it is also a method of production with many ecological advantages. Lenzing boasts double the savings of non-integrated mills. For instance, it saves on transportation because of

the short distances involved and it eliminates altogether the need for the energy-intensive drying and packaging of pulp. In addition, waste heat from processing and heat from the incineration of bark and residual materials from the integrated production process are carefully used as resources and reintroduced into the production cycle. The production of co-products such as acetic acid, furfural and xylose likewise helps to increase the total yield from the wood as well as value creation.

## Pulp production process – chemical cycles, co-products, utilization

### Lenzing site – simplified depiction



\*) Oxygen, hydrogen peroxide, ozone

## Co-products for diverse applications



Acetic acid for use in the food industry, for example



Furfural used, inter alia, as a solvent in refining lubrication oil



Magnesium lignin sulfonate used, inter alia, to produce refractory bricks

The Lenzing site produces the pulp needed for fiber production itself. This pulp production is exemplary (“bio-refinery”). Traditionally, the base materials for the pulp made at the Lenzing site comprise a mix of mainly red beech but also ash and maple. The logs are barked, chipped and dissolved in a cooking liquor of magnesium bisulfite at a temperature of about 150 °C. The cellulose – nearly 40% of the wood – is separated off as raw pulp in the process. The raw pulp is then bleached in a completely chlorine-free process using oxygen, ozone and hydrogen peroxide and processed into pulp sheets or flakes. The other wood components remain in what is called the thin liquor together with the other cooking chemicals. Marketable spin-off products (co-products) such as acetic acid, furfural and xylose are obtained in further processing steps. In recent years, the use of wood substance has increased to such an extent that more than half of the wood is now transformed into products. The cooking chemicals are recovered from the remainder. The components in what is called the thick liquor that are unfit to be used as material (such as lignin) are used for producing energy. It is the most important source of energy at this facility.

Pulp production at the Lenzing site is not only self-sufficient in terms of meeting its energy needs; it actually produces a

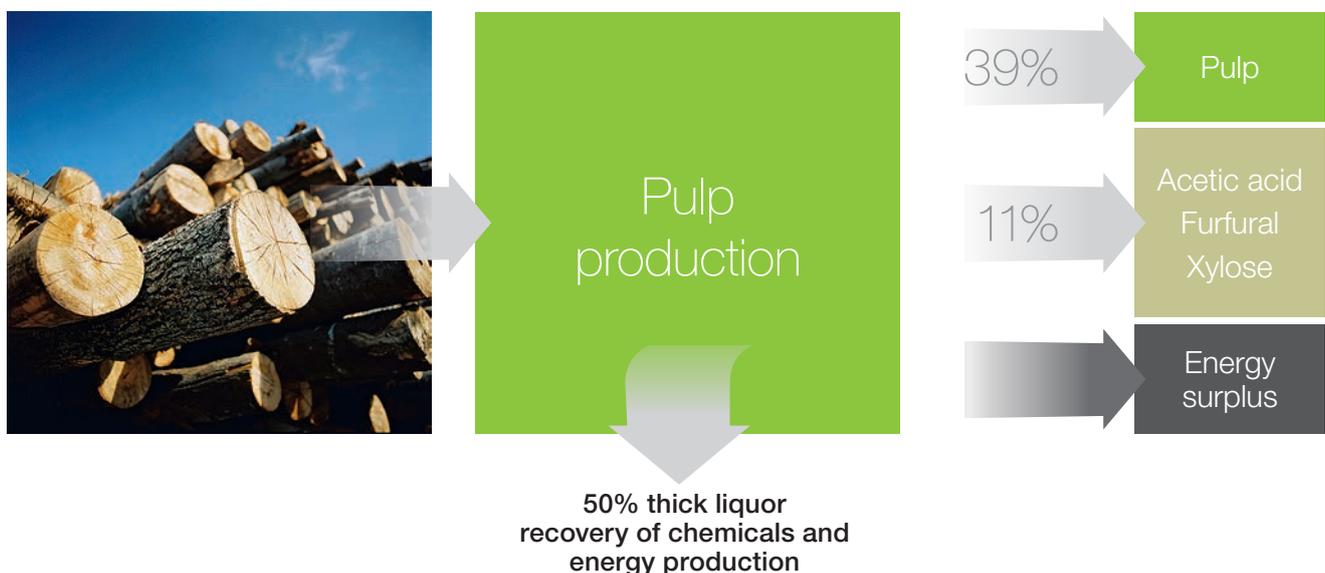
surplus of energy. In fact, each ton of (absolutely dry) wood yields a net surplus of heat (in the form of steam) averaging 3.65 Gigajoule (GJ) a year. This corresponds to the output of 91 kilograms of heating oil. The steam also produces electricity with the aid of steam turbines. On deducting electricity consumed for pulp production and the associated power installations, Lenzing ends up with 182 kWh of surplus electricity per ton of beech wood.

The Lenzing site utilizes the surplus heat (steam) and the surplus electricity for fiber production. The production of fibers from pulp using the viscose process is a chemical-technological process that proceeds in multiple steps. Closed-loop production processes are provided with recovery facilities. A substantial portion of the chemicals can be recycled as a result.

The new TENCEL® factory at the Lenzing site is scheduled to go into operation in 2014. The plan is for it to initially use spruce pulp from the Lenzing pulp mill in Paskov, Czech Republic.

The Lenzing facility is fully integrated. That means all steps in fiber production are concentrated at one and the same site, from the raw material wood to pulp production and fiber production. Lenzing uses over 50% of the wood substance in its own pulp factory. The remaining components are used as the most important biogenic source of energy in the facility.

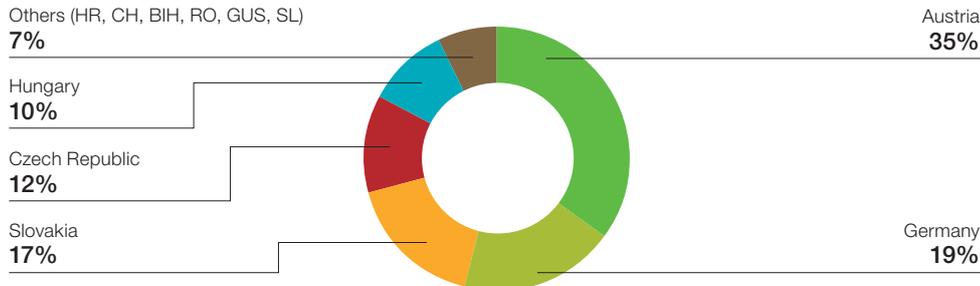
### Highly efficient utilization of the raw material wood



## ENVIRONMENT

## Wood purchase mix beech/spruce

## Lenzing site, by country in %

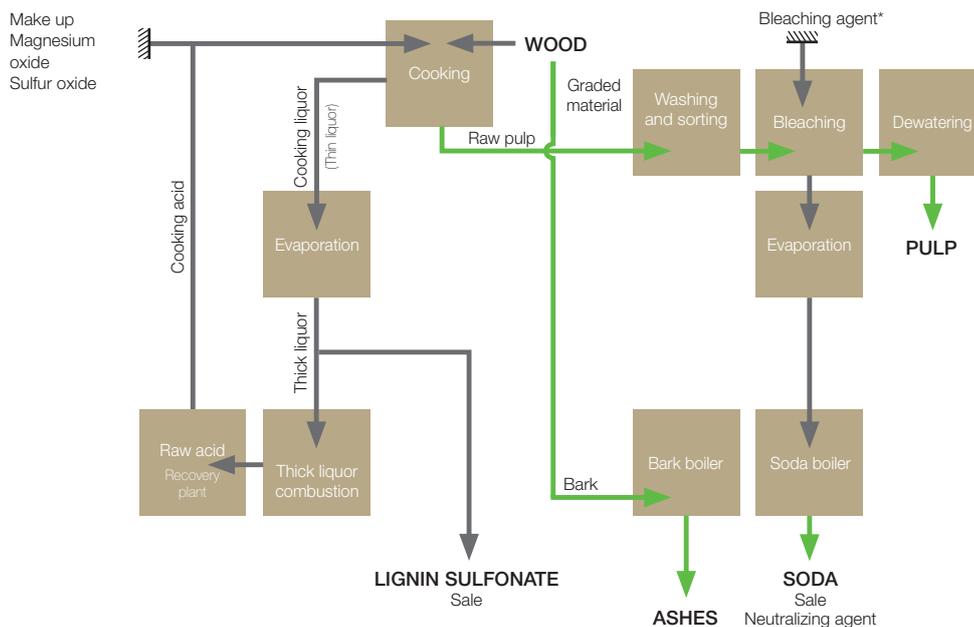


## Pulp production in Paskov

In 2010, Lenzing AG acquired a 75% stake in the Czech pulp producer Biocel Paskov a.s. In October 2012, it took over the remaining 25%. Since the acquisition Lenzing has invested about EUR 100 million in converting the facility from a paper pulp mill into what is known as a swing-capacity pulp mill, i.e. a mill capable of producing paper pulp as well as dissolving pulp.

## Pulp production process – chemical cycles, co-products, utilization

## Paskov site – simplified depiction



\*) Chlorine dioxide, oxygen, hydrogen peroxide, ozone

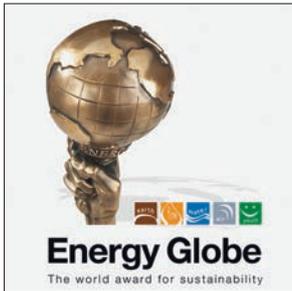
Another priority was to increase energy efficiency and improve the recovery facilities. The conversion is slated to be completed by mid-2013. In 2011 the Paskov site already produced 55,000 tons of dissolving pulp. When the conversion is finished, it will have an annual capacity for the production of 240,000 tons of dissolving pulp. In 2014, that capacity will rise to 260,000 tons of dissolving pulp following a project to eliminate bottlenecks.

In the course of conversion work, fuel use will be shifted from fossil fuels toward fuels from renewable resources. All new installations satisfy the Best Available Technologies Standards (BAT Standards). Lignin sulfonate will continue to be sold as a co-product in small quantities on the European market in the future. Certified and inspected spruce wood is the type of raw material that will be processed.

The Paskov site has been cooperating since 2004 with the neighboring sawmill of Mayr-Melnhof, an Austrian group of companies conducting business in the wood industry. It covers about a fourth of the wood needs at Paskov in the form of chips. The facility in Paskov currently has about 400 employees.

## Energy Globe Award

### Silver in the category “Earth”



Lenzing garnered 2<sup>nd</sup> place honors at the 2012 Energy Globe Award Upper Austria in the category “Earth”. This category acknowledges careful, sustainable treatment of our planet and its resources and all actions contributing to that type of treatment.

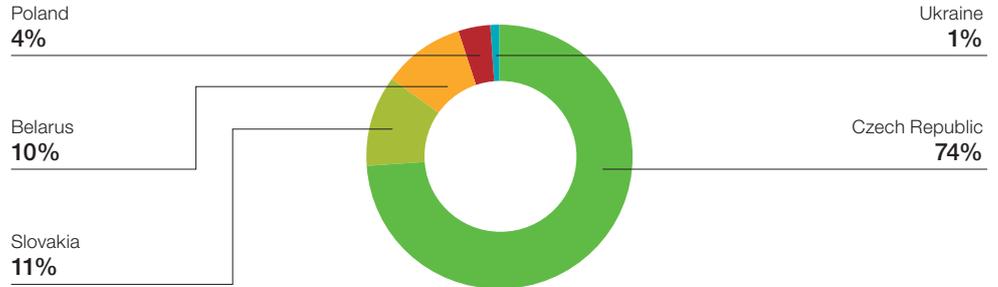
The Lenzing Group convinced the panel of judges with its Lenzing Modal® Edelweiss project. These fibers are produced from the renewable raw material beech wood at the Lenzing mill utilizing integrated process management. Extremely efficient use is made of the resources employed. Lenzing Modal® Edelweiss therefore meets the toughest environmental standards and offers substantial ecological advantages over other textile fibers such as cotton and polyester (refer also to page 24).



You will find more information on the Energy Globe Award at: [www.energyglobe.info](http://www.energyglobe.info)

## Wood purchase mix – spruce wood and spruce wood chips

Paskov site, by country in %



Lenzing was one of the pioneers in the industry to advocate environmentally friendly pulp bleaching. Pulp produced at the Lenzing site has been bleached with totally chlorine-free chemicals for decades. The site at Paskov, Czech Republic, is also eliminating chlorine-containing chemicals from bleaching by shifting its pulp bleaching from elemental chlorine-free (ECF)\* to totally chlorine-free (TCF). Other pulp companies work mainly with elemental chlorine-free bleaching (ECF).

## Pulp sources according to bleaching

Lenzing Group, own production and purchased pulp



“ Lenzing was one of the pioneers in the industry to advocate environmentally friendly pulp bleaching. Pulp produced at the Lenzing site has been bleached with totally chlorine-free chemicals for decades. ”

\*1 ECF: with chlorine-containing bleaches, no chlorine gas

ENVIRONMENT

# Responsible Purchasing of Wood and Pulp

In order to provide the entire Group with pulp, its major raw material, Lenzing has to purchase supplies on the world market in addition to the quantities it produces itself.

Lenzing considers it extremely important to have good and transparent business relationships with its pulp suppliers in order to promote and improve a sustainable supply chain. A responsible approach to wood as a raw material and sustainability criteria are taken into account in the basic choice of pulp suppliers whenever possible. The individual points are described in the Pulp sourcing policy (see right).

Wood processed in Lenzing and Paskov is sourced from verifiably legal and sustain-

ably managed sources. For years, Lenzing has voluntarily complied with the Code of Conduct against Illegal Logging sponsored by the Confederation of European Paper Industries (CEPI).

Lenzing uses two certification systems (PEFC and FSC) as additional verification that the wood is from sustainable sources. Wood certifications are gaining in significance. They have established themselves as a label for sustainable value creation and as a sign of a responsible approach to

## Pulp sourcing policy



We avoid using wood which has been harvested:

- illegally
- in violation of traditional and civil rights
- from forests of high conservation value
- from forests converted to plantations or to non-forest use
- from forests or plantations growing genetically modified trees
- in violation of any of the ILO Core Conventions as defined in the ILO Declaration
- on Fundamental Principles and Rights at Work



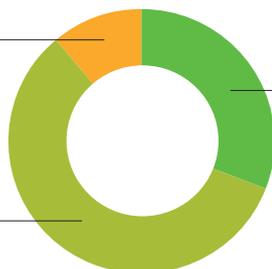
The Pulp sourcing policy is available at: [www.lenzing.com/en/pulp-sourcing-policy](http://www.lenzing.com/en/pulp-sourcing-policy)

### Wood and pulp certifications

Lenzing Group

FSC Controlled Wood  
10%

FSC Mixed Sources  
58%



PEFC  
32%



At the Lenzing site, pulp is supplied directly via a conveyor belt from the company's own pulp mill to fiber production.

“ It is a strategic objective of the Lenzing Group to produce at least two-thirds of the pulp required for fiber production from its own capacities. ”

wood as a raw material. These quality labels enable further-processors to obtain additional certifications themselves in accordance with the criteria in the product chain. For customers, certifications are a crucial means of orientation that makes it easier to identify products manufactured in an economically, socially and ecologically sustainable manner. Besides the PEFC Chain of Custody (CoC) certification, Lenzing has also managed in recent years to earn the FSC Chain of Custody (CoC) certification. It has thus achieved total certification of 75% of its wood and pulp.

The Lenzing Group will continue in the future to do everything in its power to maintain and further improve the high level of quality. Lenzing received the first-ever PEFC Award in 2011 in recognition of its above-average support of PEFC goals and of its special achievements in promoting ecologically, economically and socially sustainable forest management.

On March 1, 2013, a law went into effect in the European Union obligating operators who place timber on the market for the first time to furnish proof of the legal origin of their products to buyers. In connection with the strict forestry laws in the EU and adjoining countries, this proof is additional confirmation that the wood used gives no cause for concern. A further argument for the use of these types of wood is the comparatively small distance that has to be covered to deliver them. That is why Lenzing opts for regional supply sources wherever possible even if they are not certified. The forestry industry in Central Europe has thousands of owners of small woods who run their forestry operations as a sideline. They do not participate in the certification process, because it is too costly for them. From experience, Lenzing knows that the ratio of use to felling is especially favorable at these operations.

# Lenzing Fibers

The main features of the process to produce fibers out of pulp have been known for over a century.

In the early years, viscose fibers were thought to be a cheap substitute for cotton. In keeping with attitudes at the time, the risk of environmental pollution from fiber production was simply accepted. With the advent of cheaper, petroleum-based synthetic fibers like polyester and nylon in the 1970s, people began recalling the advantages of cellulose fibers such as absorbency and wearing comfort. Unlike other fiber producers, Lenzing always focused mainly on cellulose fibers. Lenzing had the central goal of improving fiber quality while minimizing environmental pollution in production. It did so through intensive research and development efforts. The priority in fiber production was to make chemical processes closed-loop and optimize the use of energy while minimizing contaminants in air and waste water and replacing chlorine bleaching in pulp production with oxygen bleaching.

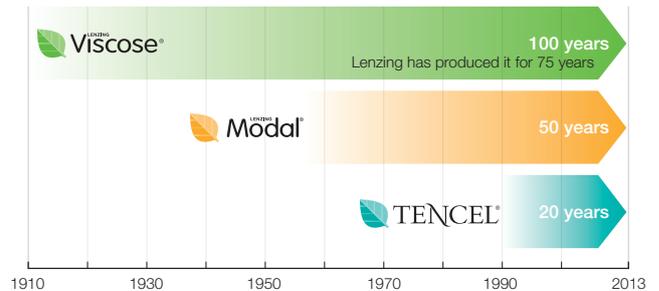
At the same time, Lenzing invested in the further development and broadening of cellulose fiber portfolios. Its aim was twofold: first, to adapt classic viscose fibers qualitatively to match customer needs better; second, to put new fibers and fiber applications on the market for special uses. A reasonable balance had to be found in the course of these efforts between ecological and economic parameters.

Man-made cellulose fibers are known today as premium products filling a special niche in the spectrum of fibers. This reputation is attributable not least to the efforts of Lenzing, the world market leader.

Thanks to its ongoing technological advances, the Lenzing Group is the only producer in the world today globally offering all three generations of man-made cellulose fibers, viscose, modal and the lyocell fiber TENCEL®. TENCEL® is the newest generation of man-made cellulose fibers. Lenz-

## Fiber generations

### Lenzing Group



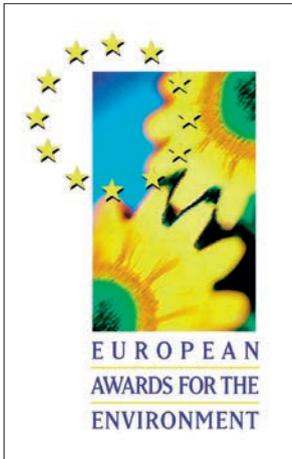
ing is the only fiber producer to manufacture TENCEL® on a commercial scale.

## The TENCEL® production process

As with viscose, the TENCEL® process involves wood as the raw material. The cellulose contained in it is extracted and the pulp obtained in this way is finely dispersed in a concentrated aqueous solution of N-Methylmorpholine N-oxide (NMMO)\* and dissolved. The excess water is evaporated to form a solution of cellulose. The highly-viscous solution is filtered and then pressed through spinnerets into an aqueous spinning bath. There, the cellulose precipitates in the form of fibers. Further auxiliary materials, dulling agents and stabilizers are needed for this process. Finishing agents are applied to the fibers to improve their running and gliding properties for further processing. The finishing agents used are fully biodegradable.

The production process features a nearly complete closed-loop process involving the aqueous, organic solvent NMMO. The spin bath is cleaned, reconcentrated and then reused for solvent production. NMMO is recovered at a rate of more than 99%, the small losses being offset with make-up NMMO.

\* NMMO – N-Methylmorpholine N-oxide is an aqueous, non-toxic, biodegradable, organic solvent



The TENCEL® production process is especially gentle on the environment and has received numerous awards, among them the European Award for the Environment and the European Flower.

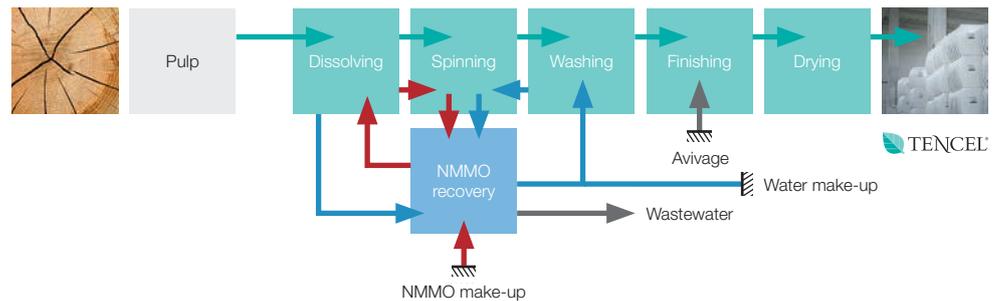
## TENCEL® production process

Simplified depiction

— Pulp/Fiber — NMMO\*/Water — Water

Procured pulp

TENCEL® production process



\* NMMO – N-Methylmorpholine N-oxide is an aqueous, non-toxic, biodegradable, organic solvent

## TENCEL®, fiber of the future

Lenzing has over 20 years of expertise in the large-scale industrial production of TENCEL® fibers. This is certainly one reason Lenzing is the innovation leader in the industry. New applications are developed all the time. TENCEL® fibers have optimum moisture management properties that make them appealing for use in high-grade home textiles such as bedspreads, sheets and pillow cases, but also in sportswear and outer garments for women. The environmental friendliness and biodegradability of TENCEL® fibers are essential market criteria for sensitive segments such as cosmetics, hygiene and medicine.

Until now Lenzing has produced TENCEL® fibers at three facilities worldwide: Heiligenkreuz, Austria; Grimsby, United Kingdom;

and Mobile, Alabama, USA. A TENCEL® production plant is now being built at the Lenzing site. The company has invested about EUR 130 million in the new facility, making it one of the largest single industrial investments in Austria at present. Substantial infrastructure investments are also being made. Once in operation, the TENCEL® production plant will ensure 110 additional highly qualified, long-term jobs in Lenzing and a number of further jobs in the region. Planning and construction naturally also generate value.

## Viscose and modal fiber production

The production of fibers using the viscose process is a chemical-technological process that proceeds in multiple steps. The individual stages, which are electronically controlled

“ Man-made cellulose fibers are known today as premium products filling a special niche in the spectrum of fibers. This reputation is attributable not least to the efforts of Lenzing, the world market leader. ”

## ENVIRONMENT

## Fiber Finishing

This production step involves the application of finishing agents, i.e. soap-like materials, in the final wash cycle. The adhesive properties of the fibers are adjusted in such a way that the common types of processing for textile or nonwovens production can run ideally. The effect is similar to using a fabric softener when washing household laundry. A mixture of gliding agents, adhesive agents and antistatics is used. All these agents are completely biodegradable. Finishing agents are used in the production of both TENCEL® and viscose as well as modal fibers.



Sodium sulfate is produced as a co-product during viscose fiber production. The white crystalline powder undergoes further processing, inter alia, in the detergent, cleaning-agent and glass industry.

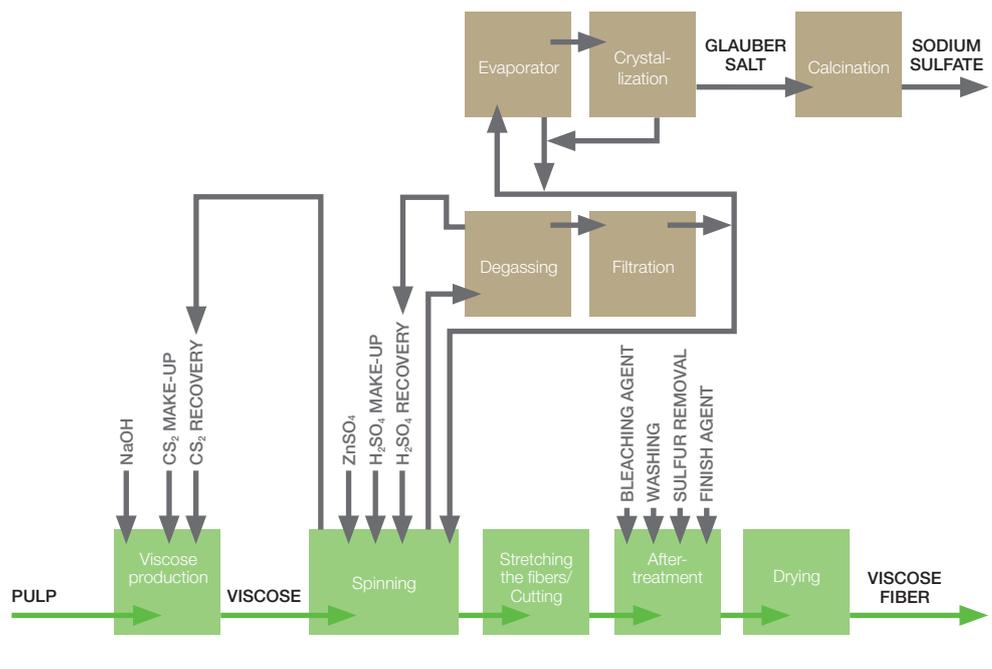
and constantly monitored, determine the processability of the viscose and quality of fibers.

Pulp is steeped in a sodium hydroxide solution and converted to alkali cellulose. The addition of carbon disulfide causes cellulose xanthate to form. The xanthate is dissolved in diluted sodium hydroxide solution, filtered, deaerated, ripened and

metered through spinnerets into a sulfate regenerating bath. After that, the fibers are stretched, cut, desulfurized and bleached with a sodium hypochlorite solution or a hydrogen peroxide solution. The fibers are repeatedly washed between the individual subsequent treatment steps. After the last wash, finishing agents are applied to ensure the running and gliding properties for further processing. As a final step, the fibers

## Viscose production process

Simplified depiction



NaOH (caustic soda), CS<sub>2</sub> (carbon disulfide), ZnSO<sub>4</sub> (zinc sulfate), H<sub>2</sub>SO<sub>4</sub> (acid sulfur)

are dried and pressed into bales. Zinc sulfate is removed or recovered from the wastewater\*. Sulfur-containing gases generated during spinning are collected and recovered once again in the purest form as the chemicals carbon disulfide and sulfuric acid. The co-product sodium sulfate is produced from the input chemicals sulfuric acid and sodium hydroxide solution.

\*<sup>1</sup> At site in Lenzing only



Viscose is converted into a cellulose thread. The molecules are then aligned through stretching. Thus the continuous filaments threads can be cut.

Modal is a viscose fiber refined through modified viscose production conditions and spinning conditions. The special characteristics of Lenzing Modal® are improved washability due to greater tenacity, especially when wet, which in turn gives textiles greater dimensional stability. It stands apart for its ultra-softness and is the preferred fiber for high-quality linens and similar products. The latest advance is Modal Edelweiss; refer to page 24.

## Management systems

The development of management systems has been a continual process in the Lenzing Group for years. In the meantime, it has certified all fiber and pulp production sites, without exception, in accordance with the system certifications ISO 9001, ISO 14001 and OHSAS 18001.

### Certification in the Lenzing Group

|                         | ISO 9001 | ISO 14001 | OHSAS 18001 |
|-------------------------|----------|-----------|-------------|
| Lenzing (Austria)       | ✓        | ✓         | ✓           |
| Heiligenkreuz (Austria) | ✓        | ✓         | ✓           |
| Grimsby (UK)            | ✓        | ✓         | ✓           |
| Mobile (USA)            | ✓        | ✓         | ✓           |
| Purwakarta (Indonesia)  | ✓        | ✓         | ✓           |
| Nanjing (China)         | ✓        | ✓         | ✓           |
| Paskov (Czech Republic) | ✓        | ✓         | ✓           |



The International Organization for Standardization (ISO) is the umbrella organization for standard-setting organizations worldwide and one of the world's major developers of voluntary international standards.  
[www.iso.org](http://www.iso.org)

# EU Ecolabel

In 2002, Lenzing became the first fiber producer in the world to be awarded the EU Ecolabel. The EU Ecolabel has been an important benchmark for the Lenzing Group ever since due to the strict criteria for awarding it and the high level of public recognition it enjoys.

The EU Ecolabel was established by the European Commission in 1992. It is an environmental quality label awarded to products and services that have less impact on the environment and on health throughout their entire life than comparable substitute goods. Products

bearing the EU Ecolabel are therefore among the most environmentally friendly in the industry.

Independent experts, scientists and NGOs devised the guidelines and criteria for awarding the EU Ecolabel in col-

## EU Ecolabel for Textiles

| EU Ecolabel criteria  | Limit    | Lenzing Viscose® |               |               | TENCEL®               |            |            |
|---|----------|------------------|---------------|---------------|-----------------------|------------|------------|
|   |          | Lenzing Austria  | Nanjing China | SPV Indonesia | Heiligenkreuz Austria | Grimsby UK | Mobile USA |
| <b>Man-made cellulose fibers criteria</b>                     |          |                  |               |               |                       |            |            |
| AOX   | 250 ppm  | ✓                | ✓             | ✓             | ✓                     | ✓          | ✓          |
| Sulfur content of sulfur compounds to air, annual average     | 30 g/kg  | ✓                | ✓             | ✗             | ✓                     | ✓          | ✓          |
| Zinc to water   | 0.3 g/kg | ✓                | ✓             | ✓             | ✓                     | ✓          | ✓          |
| <b>Criteria for wastewater discharges from wet processing</b> |          |                  |               |               |                       |            |            |
| COD   | 20 g/kg  | ✓                | ✓             | ✓             | ✓                     | ✗          | ✓          |
| pH  | 6-9      | ✓                | ✓             | ✓             | ✓                     | ✓          | ✓          |
| Temperature   | 40 °C    | ✓                | ✓             | ✓             | ✓                     | ✓          | ✓          |
| <b>Processes and chemicals criteria</b>                       |          |                  |               |               |                       |            |            |
| Restricted chemicals  |          | ✓*               | ✓             | ✓             | ✓                     | ✓          | ✓          |
| Disclosure energy demand                                      |          | ✓                | ✓             | ✓             | ✓                     | ✓          | ✓          |
| Disclosure water demand                                       |          | ✓                | ✓             | ✓             | ✓                     | ✓          | ✓          |

\*1 FR fibers excluded

**AOX:** Adsorbable halogenated organic compounds: measure for the use of chlorine compounds in the production of pulp as well as fibers.

**Sulfur content of sulfur compounds to air:** Measure for air pollution control actions in viscose fiber production; not relevant to the TENCEL® process.

**Zinc to water:** Relevant for viscose fiber production; no zinc salts used in the TENCEL® process.

**COD:** Chemical oxygen demand: measure to determine organic pollutants in surface water. The degree to which the wastewater can undergo chemical oxidation is measured.

**pH:** Measure of the acidic or base content.

“ Products bearing the EU Ecolabel are among the most environmentally friendly in the industry. ”

laboration with the EU Member States. The criteria are determined on a scientific basis and take into account the entire product life cycle. Regular revisions ensure that the criteria are adapted to new developments and that assessments remain current.

What this means concretely for a company in the chemical industry such as Lenzing is that strict criteria have to be met in pulp and fiber production, both with regard to emissions released to air or water and with regard to our handling of the chemicals we use. Aspects of the life cycle analysis are also included in the assessment.

Four of the six fiber production facilities of the Lenzing Group presently have EU Ecolabel certification: Lenzing and Heiligenkreuz in Austria, Mobile in Alabama, USA, and Nanjing in China. Lenzing is striving to have all production sites meet the criteria in the medium term. Purwakarta, Indonesia, and Grimsby, United Kingdom, are the two production locations not currently certified. There is only one criterion not yet met at Purwakarta: sulfur emissions released to

the air. Work is already underway to upgrade the technical facilities to reduce these emissions. Further actions will be needed to achieve the challenging limit. The Grimsby facility, too, has just one criterion left to satisfy, namely the chemical oxygen demand in the wastewater. However, the wastewater situation complies with local legal regulations and also the EU Water Framework Directive.

## VÖNIX Sustainability Index



The most sustainable companies on the Austrian stock market are grouped together in VÖNIX, the Austrian sustainability index. Lenzing was included in this index from the outset. In the current ranking based on data from 2011, Lenzing succeeded in being ranked among the top five of Austria's most sustainable companies. About 60 of the largest Austrian companies on the Vienna Stock Exchange were analyzed for this purpose and assessed in accordance with 100 individual environmental and social criteria. 21 of them are in the current VÖNIX Index.



For further information on VÖNIX, please visit: [www.voenix.at](http://www.voenix.at)

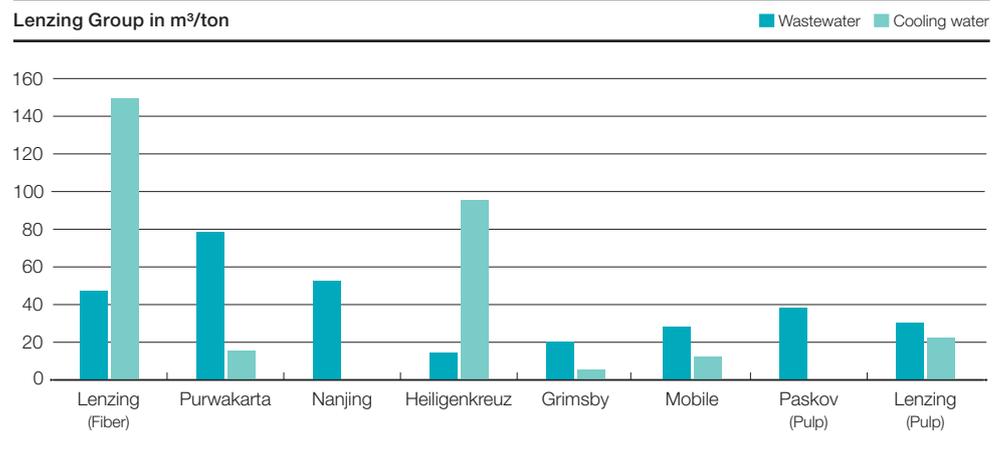


The EU Ecolabel helps consumers to identify products and services that have minimal impact on the environment. [www.ecolabel.eu](http://www.ecolabel.eu)

# Water

Water is used at the production facilities of the Lenzing Group primarily as process water for pulp and fiber production and for cooling the equipment. Unlike wastewater from production, cooling water is subject to no emissions but only to thermal energy (i.e. it is heated up).

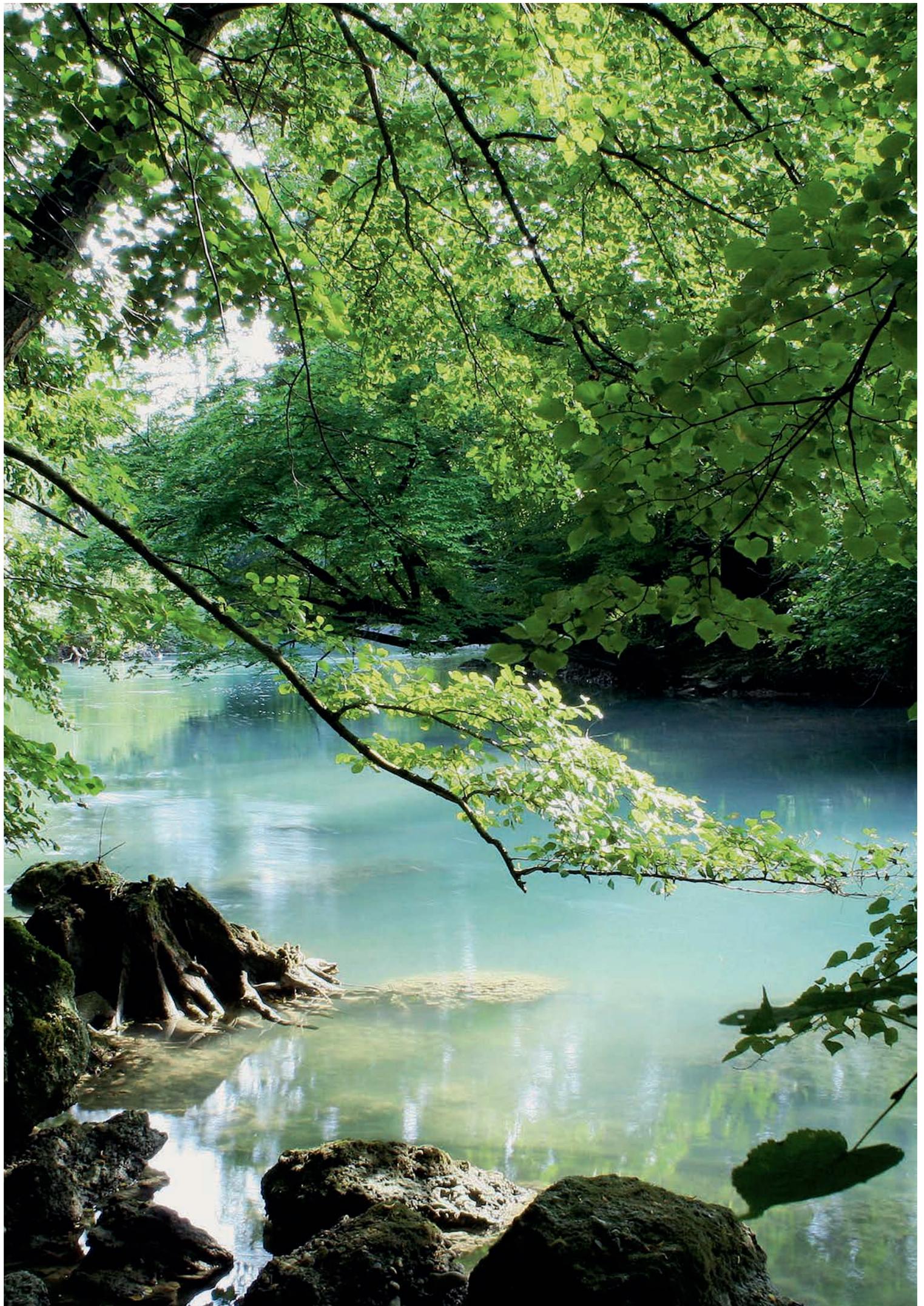
## Water demand



The above diagram presents the volume of wastewater and process cooling water at the individual sites per m<sup>3</sup>/ton of fiber or pulp manufactured. The water consumed by ancillary equipment, such as an on-site power plant, is included in the calculation.

The water supply and wastewater treatment at the Lenzing facility pertain not just to pulp and fiber production but also to enterprises not covered by this Sustainability Report. Only the water consumed for pulp and fiber production and for associated power production is taken into account in this report.

Photo: The Ager river at the Lenzing site. All wastewater is purified in a multi-stage biological wastewater treatment plant. In this process, the organic pollutants are decomposed and reduced to as little as a few thousand population equivalents (PE) which can be discharged into the river without overtaxing its self-purification potential.



# Energy

Pulp and fiber production is energy intensive. Energy conservation has a long tradition in the Lenzing Group, for economic and ecological reasons. Many of the ongoing optimization efforts are aimed at cutting energy use.

All production sites of the Lenzing Group have a secure high-tech energy supply based either on their own highly efficient power stations or on close cooperation with local power producers.

The energy sources range from the thermal utilization of the remaining wood components that are not used for material purposes to gas and other fossil fuels. Pulp production at the Paskov site is nearly self-sufficient in terms of energy because of the use of wood as a raw material. The Lenzing facility generates a surplus of energy in pulp production and uses that surplus in fiber production in the form of heat (steam) and electricity.

## Energy production at the Lenzing site



Today energy production at the Lenzing site is characterized by almost fully combined power and heat generation, high energy efficiency, optimized fuel input and the promotion of biogenic and waste fuels.

For reasons of history and process design, energy production at the Lenzing site is divided into two units – Energy I and Energy II.

Both energy units are operated in interconnection:

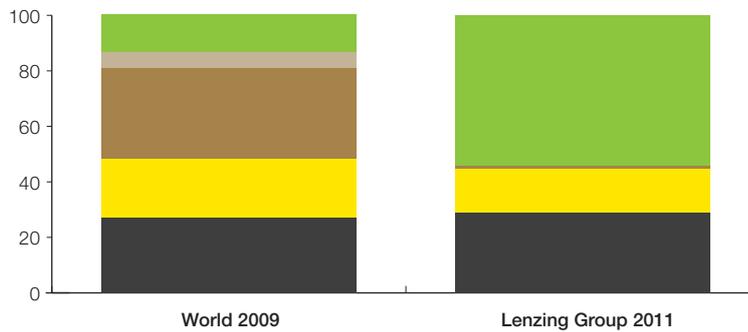
- common electrical grid, joined to the EVU grid (EAG-110kV)
- common low-pressure steam network
- common high-pressure steam rail

“Energy conservation has a long tradition in the Lenzing Group, for economic and ecological reasons.”

This figure compares the Lenzing Group and the world in terms of the percentage of biogenic renewable energy sources used. Lenzing is far above average. It covers far more than half of its energy needs with renewable fuels.

### Comparison of energy sources

#### Global and Lenzing Group



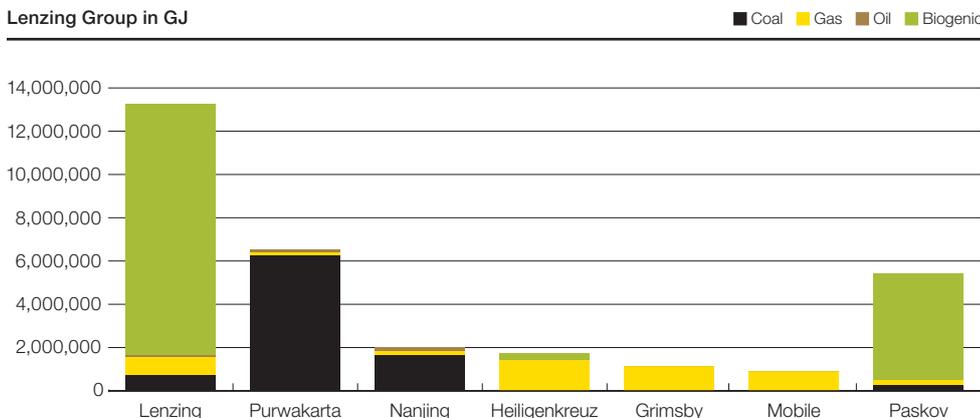
| Energy Source | World 2009 (%) | Lenzing Group 2011 (%) |
|---------------|----------------|------------------------|
| Biogenic      | 13.3%          | 54.3%                  |
| Nuclear       | 5.8%           | 0.0%                   |
| Oil           | 32.9%          | 1.1%                   |
| Gas           | 20.9%          | 15.7%                  |
| Coal          | 27.1%          | 28.9%                  |

Sources: World Energy Outlook 2011, Lenzing AG

The energy supply of the individual production locations is heavily dependent on the local on-site conditions. The pulp production sites in Lenzing, Austria, and Paskov, Czech Republic, both have an exceptionally high percentage of biogenic fuels (about 90%). The production sites for the specialty fiber TENCEL® – Heiligenkreuz in Austria, Grimsby in the United Kingdom and Mobile in Alabama, USA – use natural gas to cover most and in some cases all of their energy requirements. By contrast, the two sites at Purwakarta, Indonesia, and at Nanjing, China, are largely dependent on coal as an energy source. Oil plays almost no role at all in the Lenzing Group unlike in worldwide energy consumption, where it certainly does.

### Primary energy demand

#### Lenzing Group in GJ



## ENVIRONMENT

Below is a detailed list of power generation at all production sites of the Lenzing Group.

### Lenzing

| Austria                                 |   |
|---|---|
| Steam and hot water                     | 100% self-generated                           |
| Electricity                             | 88% self-generated                            |
|   | 12% purchased                                 |
| Facilities                              | 5 liquor boilers                              |
|   | 2 gas boilers                                 |
|   | 2 fluidized bed boilers (including RVL plant) |
|   | 3 sulfuric acid boilers                       |
|   | 5 steam turbines                              |
| Fuels                                   | thick liquor                                  |
|   | thickened bleaching liquor                    |
|   | bark  |
|   | sludge  |
|   | in-house residual matter                      |
|   | external residual matter (RVL plant)          |
|   | oil   |
|   | natural gas                                   |
|   | coal  |
| sulfur                                  |   |
| Installed capacity (thermal/electrical) | 750 MW / 100 MW                               |
| Electricity consumption                 | 77 MW (average)                               |

### Nanjing

| China                        |                     |
|------------------------------|---------------------|
| Steam                        | 31% self-generated  |
|                              | 69% purchased       |
| Electricity                  | 14% self-generated  |
|                              | 86% purchased       |
| Facilities                   | 1 waste heat boiler |
| Fuels                        | natural gas         |
|                              | sulfur              |
|                              | light fuel oil      |
| Installed capacity (thermal) | 18 MW               |
| Electricity consumption      | 10.3 MW (average)   |

### Purwakarta

| Indonesia                               |  |
|---|--|
| Steam                                   | 100% self-generated                          |
| Electricity                             | 88% self-generated                           |
|   | 12% purchased                                |
| Facilities                              | 4 fluidized bed AFBC or bubbling bed boilers |
|   | 1 multifuel CFBC boiler                      |
|   | 4 gas/oil boilers                            |
|   | 3 waste heat boilers                         |
| Fuels                                   | coal   |
|   | natural gas                                  |
|   | oil  |
|   | sludge                                       |
| Installed capacity (thermal/electrical) | 315 MW / 62 MW                               |
| Electricity consumption                 | 30.5 MW (average)                            |

## Heiligenkreuz

### Austria

|  |  |
|--|--|
| <b>Steam and hot water</b>                     | 76% self-generated<br>24% steam from a biomass power plant |
| <b>Electricity</b>                             | 99% self-generated<br>1% purchased<br>cogeneration         |
| <b>Facilities</b>                              | 3 steam boilers<br>2 gas turbines with waste heat boilers  |
| <b>Fuels</b>                                   | natural gas  |
| <b>Installed capacity (thermal/electrical)</b> | 94 MW / 13 MW  |
| <b>Electricity consumption</b>                 | 10.2 MW (average)  |

## Grimsby

### Great Britain

|                                |  |
|--------------------------------|--|
| <b>Steam</b>                   | 100% purchased from neighboring cogeneration plant |
| <b>Electricity</b>             | 100% purchased                                     |
| <b>Fuels</b>                   | mainly natural gas<br>occasionally oil             |
| <b>Electricity consumption</b> | 6.7 MW (average)                                   |

## Mobile

### USA

|                                     |                     |
|-------------------------------------|---------------------|
| <b>Steam</b>                        | 100% self-generated |
| <b>Electricity</b>                  | 100% purchased      |
| <b>Facilities</b>                   | 2 steam boilers     |
| <b>Fuels</b>                        | natural gas         |
| <b>Installed capacity (thermal)</b> | 56 MW               |
| <b>Electricity consumption</b>      | 7.33 MW (average)   |

## Paskov

### Czech Republic

|  |  |
|--|--|
| <b>Steam</b>                                   | 100% self-generated  |
| <b>Electricity</b>                             | 58% self-generated<br>42% purchased  |
| <b>Facilities</b>                              | 1 liquor boiler<br>1 bark boiler<br>1 coal boiler<br>1 gas boiler<br>1 sulfur oven           |
| <b>Fuels</b>                                   | thick liquor<br>residual wood matter (bark, sawdust, knots)<br>coal<br>natural gas<br>sulfur |
| <b>Installed capacity (thermal/electrical)</b> | 265 MW / 20 MW   |
| <b>Electricity consumption</b>                 | 34.5 MW (average)  |

## ENVIRONMENT



Further information about the Textile Exchange is available at:  
[www.textileexchange.org](http://www.textileexchange.org)



Sustainable Fashion Business Consortium



Further information about the Sustainable Fashion Business Consortium is available at:  
[www.sfbc.org.hk](http://www.sfbc.org.hk)



Further information about the Sustainable Apparel Coalition is available at:  
[www.apparelcoalition.org](http://www.apparelcoalition.org)



Further information about the RITE Group is available at:  
[www.ritegroup.org](http://www.ritegroup.org)

# Global Sustainability Cooperations in the Textile Industry

The international textile industry is facing big challenges with respect to the sustainability of its products and production processes.

To do justice to these tasks, various groups from sustainably managed companies in the textile and chemical industry have joined forces with non-profit organizations and R&D experts. Lenzing is a member of the Textile Exchange, the Hong Kong-based Sustainable Fashion Business Consortium (SFBC) and the RITE Group, a non-profit organization operating out of London. These non-profits have set a goal of reducing the environmental impact of textiles with regard to production, use and disposal. As a member of these initiatives, Lenzing takes an active part in implementing the latest processes and standards and is involved in the interdisciplinary dialog along the entire supply chain.

## Lenzing as first fiber manufacturer to join the Sustainable Apparel Coalition

In 2010 the Lenzing Group became the first fiber manufacturer to be a member of the Sustainable Apparel Coalition on the latter's invitation. Ever since then it has brought its professional expertise and decades of experience to bear in the work processes of this illustrious international group. The vision of the Sustainable Apparel Coalition is to

have a garment and shoe industry which causes no unnecessary environmental impacts and whose activities have a positive influence on the people and communities associated with it. About 70 of the leading retail chains, brands and textile companies representing about one third of the sales in the worldwide apparel industry are working together right now to make this vision a reality. The vision is born of the conviction that ecological and social challenges in the global value creation chain of the apparel industry can only be resolved together and not by individual companies. The members believe there is a need for credible, practicable and uniform standards and measuring instruments for ecological and social performance and that these standards and instruments are in the interest of all relevant stakeholders.

# Biobased Label

## for Lenzing Products

TENCEL® and Lenzing FR® fibers from Lenzing were granted the Biobased Label of the U.S. Department of Agriculture (USDA) in the year under review.

**T**ENCEL® fibers were certified as being 100% biobased, Lenzing FR® fibers as being 96% biobased. The Biobased Label is part of a government program called “BioPreferred” aimed at promoting government procurement of bio-based products. It is already implemented in 95% of the contracts newly awarded by the government and in contract adaptations. The program is highly regarded on the US market and beyond. The Biobased Label was established to extend the advantages of this program to consumer goods and their respective supply chains. Consumers should be able to distinguish whether or not products are of biological origin or not.



For further information on awards, certificates and eco-labels, please visit:  
[www.lenzing.com/en/certificates-and-eco-labels/awards](http://www.lenzing.com/en/certificates-and-eco-labels/awards)

Biobased products must be made of renewable raw materials such as biological farm and forestry products or products from the sea. Products must comply with the following criteria to be awarded the USDA Biobased Label:

- The product must be of biological origin or be made of materials of biological origin.
- At least 25% of the carbon in the product has to be from non-fossil sources. The products are tested for the ratio of carbon 14 to carbon 12 to determine whether the carbon comes from more recent renewable resources or from older, fossil raw materials.
- The product must be from a country approved for participation (Austria and the United Kingdom are approved for the program, China and India are not).
- The product was not on the market in 1972.



For further information, please visit the website of the “BioPreferred” program:  
[www.BioPreferred.gov](http://www.BioPreferred.gov)



## PEOPLE

# Responsibility for People

The employees provide the most important potential for the Lenzing Group. They are the source of all ideas, suggestions and initiatives for the success of the Group.

**W**ith the competition for creative and capable employees becoming ever fiercer, it is vital for a company to be an attractive employer. That is why Lenzing promotes the development of its employees. Lenzing wants a work environment that is motivating and challenging, one that contributes to further development and personal well-being.

In recent years, the Lenzing Group has gone from being an Austrian company with subsidiaries in various countries to being an internationally active corporate group with production and distribution locations in the key economic regions of the world. One secret to Lenzing's success has been this connection between the traditional values of an Austrian company in business for over seven decades and those of a modern and dynamic international industrial group geared to growth.

“ The Lenzing Group is following a course of dynamic growth that poses challenges to its corporate culture. The object is to keep the ‘Lenzing Spirit’ alive while at the same time remaining open to new things so the corporate culture can be further developed in a flexible manner. ”

# Corporate Culture

Shared values make up a big part of Lenzing's identity.

That is why certain principles and guidelines were summarized several years ago in the "Lenzing Principles" and declared binding on all employees and managers:

- Economic value generation
- Entrepreneurial spirit
- Accountability
- Openness and integrity

**"Economic value generation"** and **"entrepreneurial spirit"** are basic prerequisites for the economic prowess of the Lenzing Group, but success cannot be sustainable without accountability and openness in our interaction with each other.

**"Accountability"** is the way in which cooperation and mutual respect is practiced at Lenzing. People can only be accountable and act responsibly if they are made accountable and given responsibility. That is why Lenzing places responsibility for decisions at the level best suited to making those decisions. Personal development is the responsibility of all employees and encouraged by our managers (supportive leadership).

**"Openness and integrity"** are key factors for successful collaboration in a multicultural environment. Tolerance and respect must be shown for other people and their respective cultural backgrounds.

Diversity is what makes Lenzing successful. The company strives to continue in its development, building on an atmosphere of trust and positive cooperation and on a lively exchange of opinions and experiences.

Good working conditions are the basic prerequisite for doing so. It is crucial to success to take careful account of social conditions in the various cultures and to draw a fair comparison despite the different basic conditions at the individual Lenzing sites. Global standards and guidelines help to keep this objective in sight.

In addition, a binding Code of Conduct was drawn up for all governing bodies and employees of the Lenzing Group.

Legal and ethical conduct protects the company, its governing bodies and its employees from prosecution under civil or criminal law but above all protects and strengthens the company's reputation and the trust people have in it.



“ One secret to Lenzing’s success has been the connection between the traditional values of an Austrian company in business for over seven decades and those of a modern and dynamic international industrial group geared to growth. ”

The Lenzing Code of Conduct has binding rules for all of the most important subjects and calls for moral and ethical conduct. Where necessary, the code is rendered more concrete with the addition of Group guidelines or other internal directives (work and procedural instructions, etc.) that go into greater depth. The code is a clarion call to all employees of the Lenzing Group to adopt certain modes of conduct and to refrain from certain other ones.

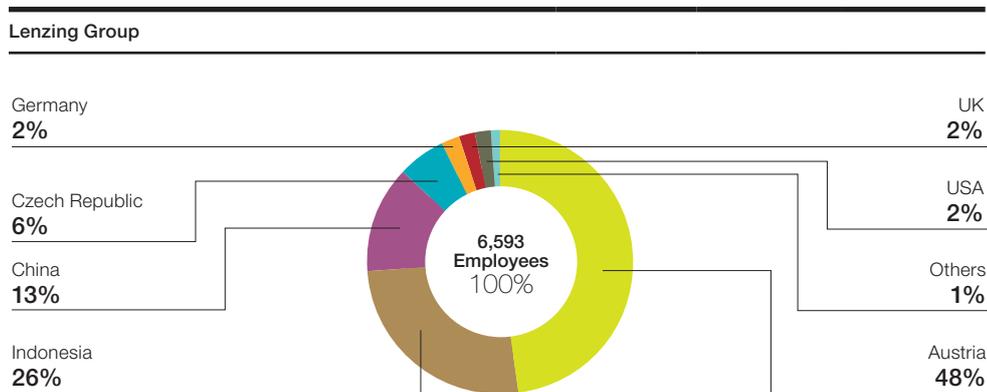
Not only does it assist Lenzing employees in their daily conduct, but it is also brought to the attention of business partners (suppliers, customers, etc.).

The workforce is growing steadily and Lenzing’s activities are becoming increasingly globalized. As a company that conducts business around the globe, Lenzing carefully analyzes sociopolitical developments and their various manifestations in the different

regions of the world. Europe is dominated by declining potential in the labor market and an ever older population whereas Asia faces the challenge of extremely dynamic growth in the economy and the population. The interactions and networks between people from different cultures also grow in this complex environment. Lenzing encourages this intensive communication.

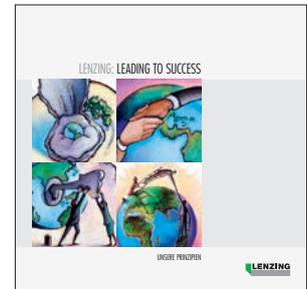
At the end of 2011 the Lenzing Group had 6,593 employees. Women accounted for 16.7% of the total.

### Staff members by country\*



\* Incl. trainees, excl. leased labor, head count

### Our principles



The “Lenzing Principles” are guideposts showing employees how best to master the daily challenges they face.



Available at:  
[www.lenzing.com/en/our-principles](http://www.lenzing.com/en/our-principles)

### Our Code of Conduct



This Code of Conduct contains binding rules and promotes moral and ethical actions.



Available at:  
[www.lenzing.com/en/our-code-of-conduct.html](http://www.lenzing.com/en/our-code-of-conduct.html)

# Health and Safety

Lenzing is a company in the chemical industry. The health and safety of our employees is a top priority.

**W**age earners and salaried employees are represented on our health and safety committees at the different sites of the Lenzing Group, as is the management. Lenzing makes consistent and continuous efforts to minimize as much as possible any potential hazard for its employees. In the year under report, the trend in the accident rate remained at a low level comparable to that of previous years.

The Corporate Center Safety, Health and Environment (SHE) cooperates closely with the local SHE departments to make constant advances and improvements. Communication in this work typically entails annual SHE conferences, monthly reports, video meetings and audits as well as reciprocal visits. Cross learning is an essential part of these efforts. One of the most important projects of recent times involved the preparation of a CS<sub>2</sub> Process Safety Manual. This project was

done in collaboration with representatives from all three viscose fiber sites.

A central topic at all production sites of the Lenzing Group was to improve fire prevention and fire fighting. As these activities unfolded, an information campaign was conducted and the fire protection organization was restructured. All sites made improvements thanks to this initiative.

#### Examples:

- Fire prevention: The Lenzing site named one fire protection manager

and two fire prevention officers. 42 people were trained to be fire wardens as a sideline.

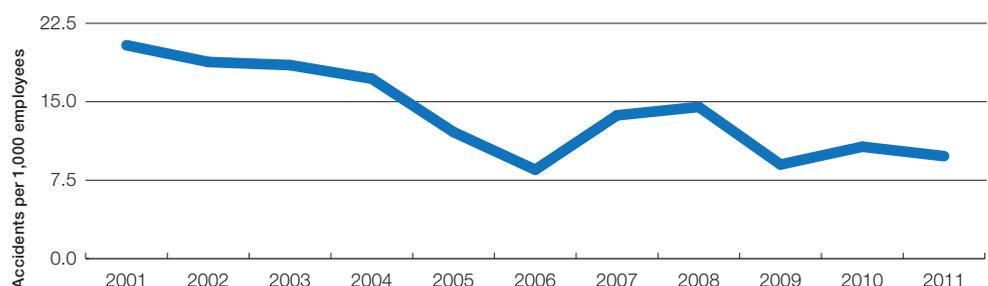
- Fire fighting: The Nanjing site installed its own on-site emergency response team (ERT) and equipped it with the necessary material (fire fighting vehicle, fire station, technical equipment, etc.).
- Crisis management at the Lenzing site was analyzed with the help of outside professionals. The pertinent guidelines

were revised while crisis managers and crisis teams were redefined. Procedures for dealing with various types of emergency scenarios were covered in training and then practiced. An emergency number was instituted for local members of the public and a brochure was issued on how to behave in an emergency.

Our Policy for Safety, Health and Environment underscores the sustainability aspirations of the Lenzing Group.

## Development of accident rates

Lenzing Group 2001 – 2011





# Policy for Safety, Health and Environment

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## Responsibility for people

- It is our policy to provide a workplace free from accidents, injuries and with minimized exposure to hazardous chemicals.
- Each individual has a responsibility to act safely.
- We train and motivate employees to conduct their activities in a safe and environmentally responsible manner.
- Line management is responsible for maintaining an awareness of safe working practices.
- We promote a safe and healthy lifestyle.
- We acknowledge our responsibility to protect our employees, customers, business partners and visitors from dangers arising in connection with natural disasters, accidents and intentional attacks.

## Responsibility for the environment

- We apply environmentally sensitive processes to ensure that the environment is a place worth living for future generations. Reducing our impact on the environment is a top priority and a never ending process of continuous improvement.
- We respect the environment in everything we do. We are considerate in our use of resources.
- We create opportunities by facing environmental challenges.
- We respond to stakeholder concerns regarding SHE and address them proactively in our operations.

## Responsible operation

- All our activities comply with the applicable laws and regulations in each country we do business.
- We work according to international standards and benchmarks.
- We continually review our objectives and set targets to improve our SHE performance.
- We supply and use safe and reliable products and services.
- We integrate SHE evaluation into product design and process improvement.
- We are committed to a comprehensive safety and security policy in order to prevent damage occurring to our tangible and intangible assets.

## Responsibility for prosperity

- We are leaders in fiber innovation.
- We are technology leaders in our core business.
- We add value in all our activities and for all stakeholders.
- We focus on long-term sustainable growth.
- Through our strengths in innovation and technology leadership we provide our customers with high-quality products and services with which they can successfully differentiate themselves in their markets.

Lenzing, November 2011



Peter Untersperger



Friedrich Weninger



Thomas G. Winkler



**LENZING**

LEADING FIBER INNOVATION

# Equal Opportunity

Lenzing wants to make sure that all its employees have the opportunity to take their career in different directions.

That is why Lenzing prepared an internal standard for recruitment that seeks to open up as broad a spectrum of career opportunities to employees as possible. Transparency, trust and personnel selection applying at least the two-man rule give Lenzing employees the assurance that personnel decisions are based on objective facts and that the company takes their professional development efforts seriously. When filling a position, Lenzing always looks internally first. The search for a suitable person only turns outward when no suitable candidate

Lenzing considers positive collaboration and the intensive exchange of views and experience to be extremely important.



for a vacant position is found internally. If an internal applicant is turned down for lack of suitability, the employee's will and motivation for change is nevertheless used to discuss further development opportunities with him or her.

Fair compensation of employees is a cornerstone of successful relations between labor and management. The Lenzing pay policy says that fair compensation, attractive benefits geared to the location and performance-based bonus systems are to be used to recruit, retain and motivate employees for the company.

The Lenzing Group takes various approaches to achieve this objective. For one, it has a global assessment system in which positions are categorized based on clear job descriptions unrelated to specific individuals or business sites. All facilities of the Lenzing Group have entry-level wages above the minimum wages in the region. With this policy, Lenzing ensures that all employees receive fair and just pay in accordance with local circumstances. At the same time, the company offers its employees global and local bonus systems as additional compensation. Depending on a person's position, these bonus payments might be geared to the financial results of the Group, the pertinent business unit or the site and/or to the attainment of individual or team goals. The bonuses are also adapted to local wage scales and local law.

# Further Education and Training

Eager to remain the industry's innovation and technology leader, Lenzing puts heavy emphasis on continuing education and training.

To operate the best possible initial and continuing education and training programs for its employees, the Lenzing Group runs two of its own training centers. One is in Lenzing, Austria, and the other is in Purwakarta, Indonesia. With the help of these centers, the Group can adapt training programs to meet the specific interests of employees and the company.

Lenzing is aware of the importance of well-trained skilled workers and takes its role as an apprenticeship training company very seriously.



The contents of training range from technical aspects of mechanics or chemistry to soft skills such as coaching or presentation techniques.

In 2011, the training center in Lenzing, Austria, alone conducted 94 different courses with a total of 1,050 participants. The scope of the courses varied depending on needs and aspirations from a matter of days to training courses spanning a week or training programs lasting several months.

Lenzing is convinced of the benefit of on-the-job training. This is the fastest and most practical way to have experienced and highly qualified employees convey their expertise to inexperienced employees. The Lenzing Group therefore takes apprenticeship training seriously. At the end of 2011, a total of 196 apprentices were undergoing training. Of that total, 188 were at the site in Lenzing, six at the site in Heiligenkreuz and two at the site in Grimsby, United Kingdom. Besides technical expertise, Lenzing considers it essential to train people in personal and social skills as well. The modules on social skills contained in training were expanded and additional modules were integrated on topics such as "Using the Internet safely", "Smoking is uncool" or "Careful, debt traps!". To find suitable apprentices, Lenzing staff visited numerous schools and gave career orientation presentations there.

The Lenzing training center had never seen so many participants in adult courses, who, after leaving school, were returning to receive vocational education and training for an occupation (complete with final apprenticeship examination). There are currently twelve such vocational training courses underway with about 20 participants each.



The Lenzing Training Center (BZL) handles the overall apprenticeship training of about 180 apprentices, making it one of the largest apprenticeship training centers in Austria.  
[www.bzl.at](http://www.bzl.at)

## Guest Commentary: Coaching – the Art of Creating Sustainable Relationships



Contact:

Ian McGarry M.Sc. B.Sc. (Hons)  
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Ian McGarry is a well-known consultant in business psychology. He has broad international experience in management, team development and sales training in Europe, Asia and the United States. He has assisted many blue-chip companies and high-caliber government organizations in the United Kingdom, including the London police (Met) and the National Health Service (NHS). In addition, he is an associate lecturer on psychology at the Open University and author of “Wow factor learning and facilitation programs”.

According to Wikipedia the definition of sustainability is “the capacity to endure through renewal, maintenance, sustenance or nourishment”.

Whilst we naturally associate sustainability with ecosystems and protection of the environment, it also carries much wider implications. Perhaps it is unusual to think of professional relationships in this way but despite all our technology and innovations, most ventures (if they are to be successful) rely on the quality of relationships; not just customers but vendors, employees and even competitors. The reality is that business relationships are just like any other; they require effort to maintain and must be mutually beneficial to be effective in the long term. One relationship that comes under pressure in the sometimes hectic and stressful work environment is that of the manager and employee.

A recent survey published in “Personnel Today” magazine reported that one manager in four has a “catastrophically” bad style of leadership that could damage productivity in their teams. Almost half (47%) of the 2,000 workers surveyed said their managers made them feel threatened, rather than rewarded, and 85% said that their managers cared more about what they did than what they were feeling. Often such appraisals of managerial relationships are a prelude

to a demotivated employee leaving the organization.

Smart companies are beginning to see the light and in the new global and rapidly changing business world, they realize they can't afford to lose the will and spirit of their people through poor management and old hat leadership styles. Many realize the benefits of training and developing coaching abilities in their management teams and consequently are experiencing improvements in both relationships and performance. Coaching can be described as "unlocking a person's potential to maximise his or her own performance. It is 'helping them to learn rather than teaching them'." (Gallwey 1975)

Coaching can lead to more effective people management, better relationships with managers and an improved capacity to relate to direct reports, internal customers and managers. This mobilizes others to improve productivity and effectively achieve corporate goals (Kombarkaran et al 2008). Lenzing is successfully placing sustainability at the heart of the business. Continued development of a coaching culture is likely to contribute to this, nourishing performance, renewing employee satisfaction, and ultimately enhancing competitiveness in the marketplace.

**“ Despite all our technology and innovations, most ventures (if they are to be successful) rely on the quality of relationships. ”**

Traditionally, Lenzing has always developed and sustained great customer relationships. Whilst good employee relations are nothing new in the organization I have been particularly impressed with the company's commitment to developing a new and vibrant coaching

culture. Currently there are 21 delegates on the supportive leadership program and 49 managers have completed or are in the final stages of the coaching foundation program.

This represents a significant investment in people development that the business is sure to benefit from. Some research suggests that apart from the positive effects coaching has on relationships, it also yields a good return on investment (ROI) (De Meuse et al 2009) and increased productivity (Olivero 1997).

# Employee Communication

Interaction between employees and their direct superiors is one of the most important aspects of daily work. To ensure that this communication is effective and well-structured, regular performance reviews are conducted with 90% of all employees.



In addition, a program was started in 2011 to improve communication between employees and their immediate superiors. In it, managers are taught how to take a supportive leadership approach. This training program lasts four months and consists of five modules. Its goal is to improve managers' communication behavior toward employees in specific ways through practical training. Eight basic courses for more than 100 participants took place in 2012. Moreover, an advanced coaching program was started in order to improve coaching skills among managers. There are plans to introduce these continuing training programs at the US site in Mobile, Alabama, in 2013.

Managing directors, too, are “only” human. Peter Untersperger made this fact clear to new apprentices during his Apprenticeship Talk. This event gave future skilled workers the opportunity to get to know the CEO of the Lenzing Group on a personal level. The young employees asked the CEO questions about a wide variety of personal and professional topics. They were interested in questions ranging from “How much does a member of the Lenzing Management Board earn?” to “How ecologically friendly is production at the Lenzing Group?” These types of events are crucial for emphasizing the importance of training skilled workers and promoting a sense of closeness between the workforce and top management.



# Parental Leave

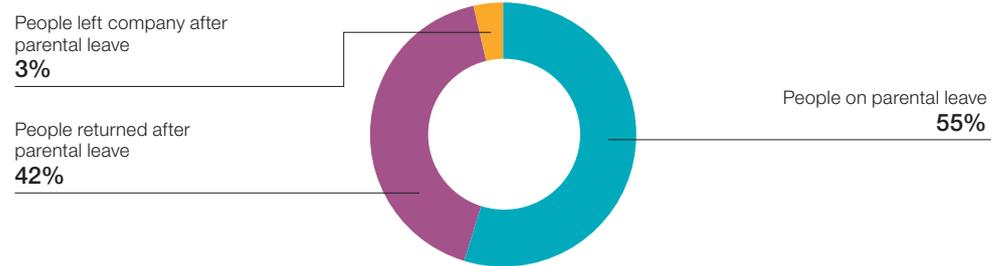
The Lenzing Group enables its employees to take advantage of parental leave in all regions where it is part of government benefits.

**T**his offer is equally available to male and female employees. The site in Lenzing is an example showing that both genders really do take advantage of parental leave and that it is supported by the company. 25% of employees granted parental leave in the year under report were men, a figure that would have been unthinkable even a few years ago.

Most employees return to the company after their parental leave. This fact shows the significance of this issue for the Lenzing Group and its efforts to keep employees over the long term.

## Parental leave\*

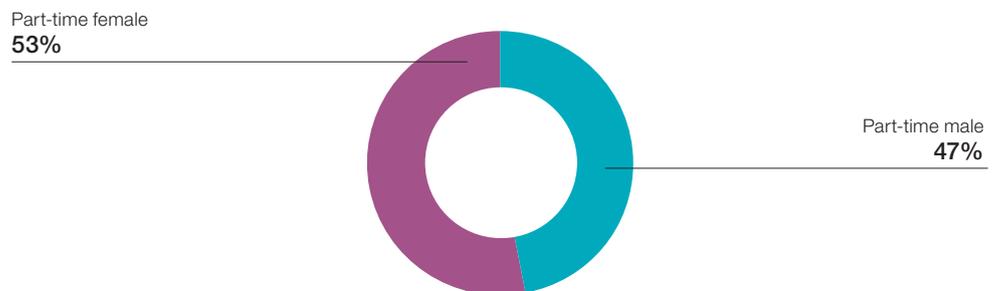
### Lenzing Group



\* Divided amongst employees on parental leave in 2011

## Part-time work

### Lenzing Group



Part-time employment is a way of making re-entry and reconciliation of family and career easier.

In this case, too, male and female employees took advantage of this time model to almost the same extent as measured in absolute numbers.

## Turnover

The turnover rate\* at the Lenzing Group in 2011 was 6.5%. It was largely evenly balanced between the sexes.

In keeping with the growth course of the Lenzing Group, the number of newly hired employees was about twice that of the employees leaving. The growth rate among female employees in the Lenzing Group in 2011 was 10% higher than for their male colleagues.

## Employee Benefits

The Lenzing Group offers various benefits for its employees at all its sites.

They include, among others, the provision of health insurance benefits (for 95% of the employees in the Lenzing Group), entry into a retirement benefits scheme (90% of employees), protection against occupational disability and incapacity (80% of employees) and the possibility of taking out a life insurance policy (80% of the employees).

## Equal Treatment

All sites in the Lenzing Group have specified contact persons to whom employees can turn in the event of discrimination.

These contact persons are either union members, members of the works council or managers from Human Resources. No complaints about discrimination were filed with these contact persons in 2011.

Nor were any complaints about human rights violations submitted in the Lenzing Group in 2011.

\*1 Number of employees leaving over the course of the year divided by the total number of employees at the end of the year

# Social and Community Involvement

In its charitable and sponsoring activities, the Lenzing Group expresses a clear commitment to long-term partnerships and continuity.

Once an agreement is made, the Lenzing Group makes sure that its partners can rely on its support. In return, Lenzing expects the money it donates to be used for the intended purpose and as effectively as possible so the support really arrives where it is needed.

The clients of Lebenshilfe, an organization to help the intellectually challenged, run regular quality checks on Lenzing fibers.

Lenzing follows a clear-cut course in these activities. Financial assistance is supposed

to benefit a community; individuals are given aid only in exceptional cases. Lenzing does not support political parties or political clubs or organizations with ethically unacceptable values or unclear goals either directly or indirectly.

At least EUR 500,000 is spent annually on donations and sponsoring. The Group's social and community involvement is geared to the regional and cultural conditions on-site.

The Lenzing Group concentrated in 2011 particularly on the projects indicated below.

## Health and social projects

Lenzing is funding a freely accessible health center at the Purwakarta site that people utilize about 1,500 times a month. Besides co-funding local educational institutions such as schools and daycare centers, Lenzing promotes further education for pupils from impoverished backgrounds all the way to university level and supports social and cultural events in the region.

Lenzing also relies on long-term partnerships when it comes to charity efforts. At the Lenzing site, the Group has a long-term relationship with an SOS Children's Village and with Lebenshilfe Oberösterreich, an organization that attends to the needs of the intellectually challenged. It goes beyond financial assistance in its support of cooperation projects, for example by outsourcing regular quality testing procedures to clients of Lebenshilfe.



## PEOPLE

The site in Mobile, Alabama, is dedicated especially to promoting volunteer work by its employees. There is a long-term commitment for the United Way, an organization aimed at giving a wide variety of assistance to local individuals and families who have fallen onto hard times. The support could involve promotion of education and training, help with debts or health care services. The company matches any employee donations to United Way and gives volunteers time off to collect donations and do other volunteer work.

The site in Nanjing, China, has forged a partnership with the Amity Foundation, an NGO located in Nanjing. The declared goal of this NGO is to improve the supply of education, health services and infrastructure for the regional population in China. It launched its first project at the end of 2011, which involves support for orphan children. There are plans to expand this collaboration gradually.

## Sports and culture

The site in Lenzing, Austria, gives wide-ranging support to cultural and social activities in the region. Many clubs have been able to rely for decades on annual donations to support regional culture and a variety of events.

Culture and sports are both major priorities for financial support at the site in Heiligenkreuz, Austria. The annual "JOPERA" festival is a wonderful addition to regional culture and has become an established highlight on the cultural calendar of the region. In

sports, the biggest share of donations goes to an organization called Sportpool Burgenland. This non-partisan development organization has the task of giving regional athletes the best possible support to help them realize their aspirations of national and international success. Financial support from Sportpool has benefited not only national, European and world championship title holders but also Olympic and Paralympic medal winners.

The Lenzing Group also contributes to sports and cultural development in the regions surrounding its sites in Grimsby, United Kingdom, and Paskov in the Czech Republic.

## Community development

The Lenzing Group has already been active at its site in Purwakarta, Indonesia, for three decades. There has been intensive interaction between the company and the local community since the very beginning. Lenzing provides and maintains a residential development ("colony") complete with corresponding infrastructure for about 600 people or 160 families in the immediate vicinity of its production facility.

A separate Community Development Department makes efforts to improve living conditions in the neighborhood. Construction measures are undertaken to push the development of local infrastructure. Besides the health and education services already mentioned, the Lenzing Group co-funds infrastructures such as roads, water supply

## Allocation of microcredits

The extending of microloans helps the local population to attain independence. The borrowers use the money they are lent for a variety of purposes.



Many people find opening their own small business or snack stand to be a good opportunity for making a living.



Craftspeople such as carpenters also benefit from this project.



Sewing and garment making are two other sources of income for borrowers.

“ Lenzing does not give indirect or direct support to political parties or political organizations or to organizations with ethically unacceptable values or unclear goals. ”



The Community Development Program in Purwakarta has a number of priorities including free health care for the inhabitants of the neighboring village, microlending, school scholarships and the improvement of local infrastructure.

or waste disposal systems. Since 2008 the local population has been given microloans that enable even people with no resources to maintain their own trades or businesses. This assistance paved the way for 69 projects in 2011 and has resulted in 158 new businesses since 2008.

The site in Paskov, Czech Republic, earmarks much of its charity spending to support projects in the surrounding region. In 2011 cooperation agreements were renewed with surrounding municipalities and cities to gear the support payments more effectively to the region's specific needs.

Lenzing AG has supported a development project in South Africa since 2010 jointly with its partner HUMANA People to People Österreich. Child Aid Tubatse (CAT) is a community development project in the South African mining district of Tubatse, Limpopo, where 72% of the population live below the poverty line. Basic social institu-

tions are rare here. The construction of this community center and the associated child aid programs are laying the foundation for further development. People will not be able to take their fate into their own hands until the impoverished community receives fundamental aid and assistance for education, infrastructure and the fighting of diseases.

## REPORT PARAMETERS AND BOUNDARIES

This report is based on figures and information from business year 2011 and partly 2012. The Lenzing Group intends to issue a report at intervals of every two years in the future. The next Sustainability Report will therefore be published in 2014 based on business figures from 2013.

This report focuses on Fibers, the core segment of the Lenzing Group, which accounts for 90% of consolidated sales. The contents of the report are geared for the first time to the standards in the Global Reporting Initiative (GRI). In our own estimation, our report satisfies the requirements of Application Level B in accordance with the GRI requirements.

| No.       | General Indicators  | Page  | Status                   |
|-----------|---|---|--------------------------|
| 1,1       | Statement from the most senior decision-maker of the organization | 3   | <input type="checkbox"/> |
| 1,2       | Description of key impacts, risks, and opportunities              | AR* 19-21, AR 46-51                                   | <input type="checkbox"/> |
| 2,1-2,10  | Organization profile  | 8-12, 19-22, 65, AR 19-21, AR 76-81, AR 175           | <input type="checkbox"/> |
| 3,1-3,11  | Report parameters   | 78-79, Imprint, AR 175                                | <input type="checkbox"/> |
| 3,12      | GRI Content Index   | 78-79   | <input type="checkbox"/> |
| 3,13      | External assurance  |   | <input type="checkbox"/> |
| 4,1-4,12  | Corporate governance and commitment                               | 6-7, 13, 35, 46, 51-53, 60, 64-67, AR 46-51, AR 76-81 | <input type="checkbox"/> |
| 4,13      | Memberships and associations                                      | 22, 60  | <input type="checkbox"/> |
| 4,14-4,17 | Stakeholder engagement  | 6-7, 13, 21-23, 72, 75-77                             | <input type="checkbox"/> |

| No.    | Economic Indicators   | Page                                  | Status                              |
|--------|---|---------------------------------------|-------------------------------------|
| DMA EC | Management approach: economy  | 6-7, 18-19, 28-30, AR 19-21, AR 46-51 | <input type="checkbox"/>            |
| EC1    | Direct economic value generated and distributed                                       | 28-30                                 | <input type="checkbox"/>            |
| EC2    | Financial implications and other risks and opportunities due to climate change        | 16, 24-25, AR 19-21                   | <input type="checkbox"/>            |
| EC3    | Coverage of the organization's defined benefit plan obligations                       | 74                                    | <input type="checkbox"/>            |
| EC4    | Significant financial assistance received from government                             |                                       | <input checked="" type="checkbox"/> |
| EC5    | Range of ratios of standard entry-level wage by gender compared to local minimum wage | 68                                    | <input type="checkbox"/>            |
| EC6    | Policy and practices of spending on locally-based suppliers                           | 31, 44-45                             | <input type="checkbox"/>            |
| EC7    | Procedures for local hiring   |                                       | <input type="checkbox"/>            |
| EC8    | Infrastructure investments and services provided primarily for public benefit         | 26-27                                 | <input type="checkbox"/>            |
| EC9    | Understanding indirect economic impacts   | 26-27, 75-77                          | <input type="checkbox"/>            |

| No.       | Environmental Indicators  | Page                | Status                              |
|-----------|---|---------------------|-------------------------------------|
| DMA EN    | Management approach: environment  | 6-7, 34-35, 48-53   | <input type="checkbox"/>            |
| EN1       | Materials used by weight or volume  | 40-53               | <input type="checkbox"/>            |
| EN2       | Percentage of materials used that are recycled input materials  | 42-44, 48-51        | <input type="checkbox"/>            |
| EN3       | Direct energy consumption by primary energy source  | 57                  | <input type="checkbox"/>            |
| EN4       | Indirect energy consumption by primary source   |                     | <input type="checkbox"/>            |
| EN8       | Total water withdrawal by source  | 54                  | <input type="checkbox"/>            |
| EN9       | Water sources significantly affected by withdrawal of water   |                     | <input type="checkbox"/>            |
| EN10      | Percentage and total volume of water recycled and reused  | 54                  | <input type="checkbox"/>            |
| EN11-EN12 | Protected areas and biodiversity  |                     | <input checked="" type="checkbox"/> |
| EN16-EN17 | Direct and indirect greenhouse gas emissions  |                     | <input type="checkbox"/>            |
| EN19      | Emissions of ozone-depleting substances by weight   |                     | <input checked="" type="checkbox"/> |
| EN20      | NO <sub>x</sub> , SO <sub>x</sub> , and other significant air emissions by type and weight              | 52                  | <input type="checkbox"/>            |
| EN21      | Total water discharge by quality and destination  |                     | <input type="checkbox"/>            |
| EN22      | Total weight of waste by type and disposal method   | 42-43               | <input type="checkbox"/>            |
| EN23      | Total number and volume of significant spills   |                     | <input type="checkbox"/>            |
| EN26      | Initiatives to mitigate environmental impacts of products and services, and extent of impact mitigation | 24-25, 34-35, 48-53 | <input type="checkbox"/>            |
| EN27      | Packaging materials that are reclaimed  |                     | <input type="checkbox"/>            |
| EN28      | Fines for non-compliance with environmental laws and regulations  |                     | <input type="checkbox"/>            |

| No.    | Indicators on Labor Practices  | Page       | Status                   |
|--------|--|------------|--------------------------|
| DMA LA | Management approach: labor practices and decent work                       | 6-7, 64-67 | <input type="checkbox"/> |
| LA1    | Total workforce by employment type, employment contract, gender and region | 65, 73     | <input type="checkbox"/> |
| LA2    | Rate of employee turnover  | 74         | <input type="checkbox"/> |

| Legend                              |              |
|-------------------------------------|--------------|
| <input checked="" type="checkbox"/> | Fully        |
| <input checked="" type="checkbox"/> | Partially    |
| <input type="checkbox"/>            | Not          |
| <input checked="" type="checkbox"/> | Not relevant |

| No.  | Indicators on Labor Practices   | Page     | Status                              |
|------|---|----------|-------------------------------------|
| LA3  | Benefits provided to full-time employees that are not provided to part-time employees                     | 74       | <input checked="" type="checkbox"/> |
| LA15 | Return to work after parental leave   | 73       | <input checked="" type="checkbox"/> |
| LA4  | Percentage of employees covered by collective bargaining agreements                                       |          | <input type="checkbox"/>            |
| LA5  | Minimum notice period(s) regarding significant operational changes  |          | <input type="checkbox"/>            |
| LA6  | Percentage of total workforce represented in formal joint management-worker health and safety committees  | 66       | <input checked="" type="checkbox"/> |
| LA7  | Rates of injury, occupational diseases, lost days, and absenteeism, and number of work-related fatalities | 66       | <input checked="" type="checkbox"/> |
| LA8  | Risk-control programs in place to assist workforce members regarding serious diseases                     |          | <input type="checkbox"/>            |
| LA10 | Average hours of training per year per employee   | 69       | <input checked="" type="checkbox"/> |
| LA13 | Composition of governance bodies and breakdown of employees per employee category                         | AR 76-81 | <input checked="" type="checkbox"/> |
| LA14 | Ratio of basic salary of women to men by employee category  | 68       | <input checked="" type="checkbox"/> |

| No.    | Indicator on Human Rights  | Page      | Status                              |
|--------|--|-----------|-------------------------------------|
| DMA HR | Management approach: human rights  | 64-65, 67 | <input checked="" type="checkbox"/> |
| HR1    | Investment agreements that include human rights clauses  |           | <input type="checkbox"/>            |
| HR2    | Suppliers and contractors that have undergone human rights screening   | 31, 46-47 | <input checked="" type="checkbox"/> |
| HR4    | Total number of incidents of discrimination  | 74        | <input checked="" type="checkbox"/> |
| HR5    | Right to exercise freedom of association and collective bargaining   |           | <input type="checkbox"/>            |
| HR6    | Operations and significant suppliers identified as having significant risk for incidents of child labor                | 64-65     | <input checked="" type="checkbox"/> |
| HR7    | Operations and significant suppliers identified as having significant risk for incidents of forced or compulsory labor | 64-65     | <input checked="" type="checkbox"/> |
| HR10   | Number of operations that have been subject to human rights reviews  |           | <input type="checkbox"/>            |
| HR11   | Number of grievances related to human rights filed   | 74        | <input checked="" type="checkbox"/> |

| No.    | Indicators on Society   | Page                    | Status                              |
|--------|---|-------------------------|-------------------------------------|
| DMA SO | Management approach: society  | 6-7, 75                 | <input checked="" type="checkbox"/> |
| SO1    | Percentage of operations with implemented local community engagement  | 28-30                   | <input checked="" type="checkbox"/> |
| SO9    | Operations with significant potential or actual negative impacts on local communities   |                         | <input type="checkbox"/>            |
| SO10   | Prevention and mitigation measures implemented in operations with significant potential or actual negative impacts on local communities |                         | <input type="checkbox"/>            |
| SO2    | Percentage and total number of business units analyzed for risks related to corruption  |                         | <input type="checkbox"/>            |
| SO3    | Percentage of employees trained in organization's anti-corruption policies and procedures   |                         | <input type="checkbox"/>            |
| SO4    | Actions taken in response to incidents of corruption  |                         | <input type="checkbox"/>            |
| SO5    | Public policy positions and participation in public policy development and lobbying   | 60, 64-65, 75, AR 76-81 | <input checked="" type="checkbox"/> |
| SO6    | Total value of financial and in-kind contributions to political parties   | 75-76                   | <input checked="" type="checkbox"/> |
| SO8    | Fines for non-compliance with laws  |                         | <input type="checkbox"/>            |

| No.    | Indicators on Product Responsibility   | Page           | Status                              |
|--------|--|----------------|-------------------------------------|
| DMA PR | Management approach: product responsibility  | 6-7, 35, 46-53 | <input checked="" type="checkbox"/> |
| PR1    | Life cycle stages in which health and safety impacts of products and services are assessed                   | 45, 51-53      | <input checked="" type="checkbox"/> |
| PR3    | Type of product and service information required by procedures   | 42-45, 48-53   | <input checked="" type="checkbox"/> |
| PR5    | Practices related to customer satisfaction, incl. results of surveys measuring customer satisfaction         | 21-22          | <input checked="" type="checkbox"/> |
| PR6    | Programs for adherence to laws related to advertising  | 64-65, 75      | <input checked="" type="checkbox"/> |
| PR9    | Fines for non-compliance with laws and regulations concerning the provision and use of products and services |                | <input type="checkbox"/>            |

<sup>\*)</sup> AR = Annual Report 2011

## GLOSSARY

### Alpha cellulose

Alpha cellulose is a technical term referring to pulp purity and describing the portion of the cellulose that has not decomposed and that is insoluble in 17.5% and in 9.45% sodium hydroxide solution at 25 °C.

### Cellulose

The raw material of pulp production. Cellulose is a component of all plants. The cellulose content of wood is about 40%.

### COD

Chemical oxygen demand. A further method for assessing the organic load of wastewater (besides BOD/biological oxygen demand). It measures the degree to which the wastewater can undergo chemical oxidation.

### Co-product

By-products recovered during pulp and fiber production.

### Debottlenecking

Increasing the production capacity of existing plants by eliminating bottlenecks.

### Dissolving pulp

A special kind of pulp with special characteristics used to manufacture viscose, modal and lyocell fibers and other cellulose-based products. This grade of pulp is characterized by higher alpha cellulose content and by a high degree of purity.

### Fiber finishing

Soap-like substances added in the final washing cycle. Finishing agents are used in the production of TENCEL®, viscose and modal fibers.

### FSC

The Forest Stewardship Council (FSC) is an international non-profit organization for wood certification.  
<https://ic.fsc.org>

### Furfural

A clear yellowish liquid with a characteristic scent of almonds. During viscose fiber production, beech wood is cooked and furfural is released in a double distillation process.

### Hemicellulose

The designation for carbohydrates that are contained in wood but that are not cellulose. They can have the widest variety of compositions depending on the type of wood involved, e.g. xylan (in beech wood).

### Hydrophobe

Hydrophobes are substances that do not mix with water but instead usually cause water to bead-up on surfaces.

### Integration

All stages of fiber production are concentrated at one and the same site, from wood, the raw material, to pulp and fiber production.

### ISO 14001

An international standard for the certification of environmental management systems.

### ISO 9001

An international standard for the certification of quality management systems.

### Lignin

A polyaromatic component of wood that cannot be used for fiber production. It is used to generate power and to recover co-products.

### Lignosulfonate

The decomposition products of lignin from wood after pulping.

### Lyocell fibers

A new type of cellulose fiber developed by Lenzing and produced in a very environmentally friendly solvent process. Lenzing markets these fibers under the brand name TENCEL®. Their properties enable new and innovative products to be developed and produced.

### Magnesium bisulfite process

This is an acidic single-step process for recovering cellulose from wood while at the same time separating out lignin and hemicellulose.

### Man-made cellulose fibers

A fiber industrially produced from raw materials of plant origin (e.g. wood).

### Modal

Modal is a viscose fiber refined under modified viscose production conditions and spinning conditions. It stands apart for its softness and is the preferred fiber for high-quality underwear and similar products. The fibers have improved use characteristics such as tenacity, dimensional stability, and so forth. Lenzing markets these fibers under the brand name Lenzing Modal®.

### NMMO

NMMO (N-Methylmorpholine N-oxide) is a water-miscible organic solvent that is non-poisonous and biodegradable. It is used in the TENCEL® process.

### Nonwovens

Nonwoven materials, fleece. Nonwovens made from Lenzing fibers are used for sanitary, medical and cosmetics applications.

### OHSAS 18001

Occupational Health and Safety Assessment Series (OHSAS) is a certification system for management systems pertaining to work safety.  
[www.ohsas-18001-occupational-health-and-safety.com](http://www.ohsas-18001-occupational-health-and-safety.com)

### PEFC

The Program for the Endorsement of Forest Certification Schemes (PEFC) is an international non-profit organization for wood certification.  
[www.pefc.org](http://www.pefc.org)

### Stakeholders

All internal and external persons or groups affected directly or indirectly by business activities currently or in the future.

### Vapors condensate extraction

A process for recovering volatile substances from the condensed vapors of evaporation units by means of extraction.

### Vinçotte

The Belgian certification company Vinçotte tests and certifies products suitable for industrial compostability and for proper disposal in a garden composter.

### Viscose fibers

A regenerated cellulose fiber produced from raw materials of plant origin (e.g. wood) using the viscose process. Lenzing markets these fibers under the brand name Lenzing Viscose®.

### Xanthate

A precursor or an intermediate product in viscose production.

### Xylose

Wood sugar, component of thick liquor and base material for xylitol (sweetener that inhibits tooth decay).

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# From Wood to Fiber



Wood



Pulp



Fiber



Yarn



End product



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