3. ENVIRONMENTAL DIMENSION
“In running its operations the Pirelli Group is mindful of the Environment and public health. A key consideration in investment and business decisions is environmental sustainability, with the Group supporting eco-compatible growth, not least through the adoption of special technologies and production methods (where this is operationally feasible and economically viable) that allow for the reduction of the environmental impact of Group operations, in some cases even below statutory limits. The Group has adopted certified Environmental Management Systems to control its operations, chooses production methods and technologies that reduce waste and conserve natural resources, and assesses the indirect and direct environmental impact of its products and services. The Group works alongside leading national and international organizations to promote environmental sustainability both on a local and a global scale.”

(The Values and the Ethical Code – Environment)

The Pirelli approach to sustainable environmental management is set forth in accordance with the Sustainability System envisaged in the United Nations Global Compact, signed in 2004, and the “Rio Declaration on Environment and Development.” The above principles are illustrated in the Group Social Responsibility Policy for Occupational Health, Safety, Rights and Environment, according to which Pirelli undertakes to:

- assessing and reducing the environmental impact of their own products and services throughout their entire life cycle;
- promote use of the most advanced technologies to achieve excellence in environmental protection;
- manage its environmental activities in compliance with the highest international standards;
- communicate and provide material information to internal and external stakeholders;
- use material resources responsibly, in view of achieving sustainable growth that respects the environment and the rights of future generations;
- establish and maintain appropriate procedures to evaluate and select suppliers and subcontractors on the basis of their commitment to environmental accountability.

In its Group Quality Policy, Pirelli specifies that continuous innovation, product excellence and safety, and environmental protection throughout the product life cycle represent one of the principal sources of sustainable competitiveness on the global market. Through adoption of the Green Sourcing Policy, all Group employees undertake to consider environmental aspects in all of their design choices and sourcing of goods and services. The documents cited above have been distributed to all employees in their local languages and are published in the Sustainability section of the Pirelli website, and not just in the languages spoken by employees but also in those that are most representative of the panel of suppliers.
THE PIRELLI GROUP ENVIRONMENTAL STRATEGY

Management of environmental issues has always played a key role in business strategy at Pirelli. Indeed, by having a long-term perspective, which is the first priority of sustainability, Pirelli has always considered control over the environmental impact of its own industrial activity to be fundamental.

Given the intrinsic complexity of managing the reduction of its own environmental impact with targets that are contextualised only in specific parts of the tyre life cycle, the Group has implemented a control system that can display, analyse, decide and manage all of its own activities, with a 360° view. This makes it possible to identify the materiality of the impacts and, therefore, the consequent action plans. In accordance with the target set in its Industrial Plan, in 2013 Pirelli has calculated the carbon footprint and water footprint of its entire organisation.

The infographic illustrated on the following pages aims to give a unified and comprehensive view of the Pirelli approach to environmental management, which aims at reducing its impact on resources, the climate and ecosystems. It may be read both horizontally, following the phases of the tyre life cycle one by one, and vertically. This offers the possibility of grasping all the qualitative and quantitative elements related to each individual phase in the life cycle.

These life cycle phases have been analysed by using the Life Cycle Assessment, as defined by the ISO 14040 family of standards. This latter method is capable of validating the results and strategic decisions related to it as objectively as possible. Moreover, reporting of the emissions impacts also complies with the provisions of the GHG Protocol GRI-G4 Guidelines. All those impacts that are listed by the standard but that are not mentioned, both upstream and downstream from the industrial activity of Pirelli, are not applicable or are not material. Moreover, the Pirelli calculation model uses the ISO-TS 14067 technical specification and the draft ISO-DIS 14046 to determine its carbon footprint and water footprint, respectively.

In the upper part of the infographic, the drivers that exert pressure on the environment show how two principal actors alternate at Pirelli, the suppliers and the customers. The principal impact is generated at every stage by different types of activity. In the case of raw materials, their production and distribution – and so the natural resources consumed with this aim – are discussed. In the case of tyre manufacturing, the discussion focuses on the consumption of electric power and natural gas. The greatest amount of environmental pressure has to be attributed to these energy sources, and specifically in terms of atmospheric emissions and water consumption. In the case of distribution of new tyres and their use by customers, the environmental impact results from vehicle fuel consumption. In the specific case of customers, only the fuel consumption related to the power absorbed by the rolling resistance of the tyres themselves is allocated. Finally, in the last considered phase of life, the impact deriving from the preparation of end-of-life tyres for recovery in the form of energy or recycled raw material is calculated.

In regard to the carbon footprint, the drivers category also contains the breakdown of emissions in the three scope categories in relation to the GHG Protocol principles.

The central part of the infographic shows the actual quantification, in percentage terms, of the carbon and water footprint. These two aspects are summarised by four principal indicators: Primary Energy Demand (PED), Global Warming Potential (GWP), Blue Water Consumption (BWC) and Eutrophication Potential (EP).

The values are managed in terms of GJ of energy, tons of CO₂, cubic metres of water and kilograms of equivalent phosphates.

The Primary Energy Demand (PED) refers to the quantity of energy that is taken directly from the hydrosphere, the atmosphere or the geosphere, be it renewable or non-renewable energy.

The Global Warming Potential (GWP) refers to the effect of anthropic activities on the climate, and is calculated in tons of CO₂ equivalent. This means that the potential...
### LIFE CYCLE STAGES

**RAW MATERIALS**

**MANUFACTURING**

### DRIVERS

**SUPPLIERS**

Raw materials production and transport; the impact is due to resources use by suppliers' plants

Scope* 3

**PIRELLI**

Tyre manufacturing: in Pirelli’s plants the impact comes mainly from electricity and natural gas consumption

Scope 1+2+3

### IMPACT:

**CARBON & WATER FOOTPRINT**

<table>
<thead>
<tr>
<th>PED</th>
<th>GWP</th>
<th>BWC</th>
<th>EP</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.9%</td>
<td>4.5%</td>
<td>23.4%</td>
<td>5.1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PED</th>
<th>GWP</th>
<th>BWC</th>
<th>EP</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1%</td>
<td>2.4%</td>
<td>1.2%</td>
<td>2.3%</td>
</tr>
</tbody>
</table>

**PED > Primary Energy Demand**  
**GWP > Global Warming Potential**  
**BWC > Blue Water Consumption**  
**EP > Eutrophication Potential**

### MATERIALITY

**Economical**

- High

**Environmental**

- Medium

### RESPONSE STRATEGY

**Raw materials innovation**

SILICA: expansion of the Pirelli technology to produce silica from rice husk also for Premium tyres

NATURAL RUBBER: research on alternative sources; Guayule project with Versalis (ENI Group)

FUNCTIONALIZED POLYMERS: research on innovative polymers that guarantee reduced environmental impact, greater driving safety and improved production efficiency

**Green Sourcing Policy**

Green Engineering Procedure  
Engagement to reduce supply chain carbon & water footprint

**Process efficiency**

Targets 2020 vs 2009

-18% Energy spec. consumption  
-58% Water spec. withdrawal  
-15% CO₂ spec. emissions  
>95% Recovered waste

ISO 14001 in all plants

Scrap Reduction Program
**Distribution**

**Suppliers**
Production and use of fuel by trucks and ships of logistic suppliers, delivering Pirelli tyres all around the world

**Use**

**Customers**
Production and use of fuel of customers’ cars due to rolling resistance

**End of Life**

**Waste Recovering Actors**
End of life tyre management: old tyres are prepared by specialized companies to be reused as both energy or regenerated raw material

---

**Green Sourcing Policy**
Green Logistic Procedure
Engagement to reduce supply chain carbon & water footprint

**Product Efficiency**
*Targets 2020 vs 2007*

- RR -40% car
- -20% truck
- -10% moto

**Cyber Tyre development**

**CAR:** “Base” System to manage tyre performance through pressure

**CAR:** “Premium” System with management of static load, tear consumption, hydroplaning alert, road surface alert and tyre vectorial strenghts

**TRUCK:** System to manage the tyres of whole fleets, to minimize fuel consumption

**Regenerated raw materials**
Study projects with universities in order to enhance the quality of regenerated materials in order to increase their presence in new compounds

---

**Economical | Environmental**
- **Medium** | **Low**

**Economical | Environmental**
- **High** | **Low**

**Economical | Environmental**
- **Low** | **Low**

---

**Green Performance revenues 48% on total revenues by 2017**

*According to GHG Protocol*
greenhouse effect is given in relation to CO₂. The calculation assumed that the CO₂ would stay in the atmosphere for 100 years.

Blue Water Consumption (BWC) is given by the volume of consumed surface and underground water in consequence of the production of a good or service. Consumption refers to the fresh water used and then evaporated or incorporated in the product.

The Eutrophication Potential (EP) is the enrichment of nutrients in a specific aquatic or terrestrial ecosystem. Air pollution, water emissions and agricultural fertilizers all contribute to eutrophication. The result in aquatic systems is accelerated growth of algae, which does not allow sunlight to pass beyond the surface of water basins. This reduces photosynthesis and thus reduces the production of oxygen. Low concentrations of oxygen may cause mass death of fish and anaerobic decomposition of organic material, seriously compromising the entire ecosystem.

Consistently with the product environmental footprint, as already shown in the sustainability reports for the previous years, the tyre use phase is the most significant one for each of the four indicators.

The environmental materiality deriving from this type of analysis, which would logically lead to concentrating all actions on improvement of the product characteristics that determine the use phase, flanks economic materiality. The latter is identified on the basis of different management elements such as, for example, the amount of corporate spending and thus the level of opportunity in reducing and avoiding costs, as in the case of investments in energy efficiency. In its response strategy, which may be consulted in the lower part of the infographic and corresponding to what has also been stated in the Industrial Plan, Pirelli has adopted adequate management models for monitoring and managing environmental issues, and has also voluntarily adopted specific targets to reduce its impact in each phase of the product life cycle.

All the models, projects and targets mentioned above and indicated in the infographic are discussed in the continuation of this chapter.
RESEARCH AND DEVELOPMENT OF RAW MATERIALS

The research and development of innovative materials are key to the design and fabrication of ever-more sustainable tyres that guarantee reduced environmental impact, greater driving safety and improved production efficiency. For this purpose, Pirelli has made Joint Development Agreements with leading suppliers for the study of new polymers to be used for rolling resistance, performance under low temperature conditions, durability and grip.

Pirelli Research & Development also focuses on:
- biomaterials, such as silica from renewable sources;
- high-dispersion silica for wet grip, rolling resistance and durability;
- high-performance carbon black derived from racing competition applications for extreme grip;
- nanofillers for more stable compounds, lighter structures and highly impermeable liners;
- new silanes to guarantee performance stability and processability.

The Consortium for Research on Advanced Materials (CORIMAV) and the University of Milan – Bicocca campus are studying a new selective vulcanisation technology for recycling materials derived from end-of-life tyre compounds. This would permit a significant reduction in production costs and the related environmental impact.

The three-year (2012-2014) JOINT LABS agreement made between Pirelli and the Milan Polytechnic for research and training in the tyre industry focuses its research on the de-vulcanisation of materials derived from used tyre compounds and on biopolymers. Pirelli is working with universities to develop a natural rubber obtained from sources other than the rubber tree. Research is aimed at diversifying the potential supply sources, thereby reducing pressure on the biodiversity of producer countries and allowing the Company to manage the potential scarcity of raw materials more flexibly.
RESEARCH ON ALTERNATIVE SOURCES OF NATURAL RUBBER

In March 2013 Versalis (Eni) and Pirelli signed an important Memorandum of Understanding to undertake a joint research project on the use of natural rubber from guayule in tyre production. The guayule (Parthenium argentatum) is a non-edible shrub that needs little water and no pesticides, and represents an alternative source to natural rubber thanks to its hypoallergenic properties, unlike the more common Hevea brasiliensis rubber.

This study will engage the two firms for a period of three years. During that time, and operating on an exclusive basis between the parties, Versalis will provide innovative types of natural rubber extracted from guayule that will be tested by Pirelli for use in tyre production.

On the basis of this new collaboration and, upon industrial scale production of rubber from guayule, Versalis may provide Pirelli with new products that will consolidate and round out the commercial range of synthetic rubber made by Versalis and already used by Pirelli for quite some time in tyre production.

The agreement with Versalis will complement and expand the commitment made by Pirelli to research on innovative materials from renewable sources, and particularly from biomasses. Pirelli, which already makes tyres using raw materials derived from rice husks (as discussed in the following section), aims at steadily reducing petroleum-derived components by replacing them with new raw materials that simultaneously guarantee constant improvement in the performance and environmental sustainability of processes and products.

SILICA FROM RICE HUSKS

Silica is used in tyres to reduce rolling resistance, improving vehicle efficiency without reducing its road hold, especially under wet conditions. In its research on ever-more sustainable materials, Pirelli has concentrated on this raw material by seeking an alternative source for traditional processing methods.

The Group has developed a process at its plant in Santa Catarina, a renowned rice producing centre in southern Brazil, which can extract silica from rice husks. Rice husks are the external shell of the rice grain. Rice husks account for 20% of the weight of raw rice, and represent the principal scrap material.
of rice processing. Given the volume of global rice production, rice husks are available in huge quantities in many areas of the world. Rice husks already have many applications that are more or less sophisticated: from bedding for livestock to organic fertilizer, to solid fuel for electric power generation. In fact, rice husks have a significant energy content, amounting to 14 MJ/kg. However, it is not yet appreciated in less developed areas of the world, and is burned in the field without exploiting its potential.

Aside from its interesting level of energy content, rice husks have another exploitable property, represented by its high silica content, which accounts for about 18% of its weight. In the traditional process, silica is made with a chemical process where crystalline silica, typically sand, is dissolved in a solution of water and caustic soda (NaOH). The result of this first step in the process is sodium silicate. Then an acid is added (typically sulphuric acid) to obtain silica precipitate as the principal product and sodium sulphate as the by-product. The reaction of crystalline silica with caustic soda requires a huge amount of thermal energy. But when rice husks are burned, the resulting ash is composed of non-crystalline silica that has a maximum residual carbon content of 8%. Compared with crystalline silica, this silica requires much less energy in the initial reaction. It is easy to imagine that this biomass may thus constitute an ideal raw material for the production of silica precipitate. All the thermal energy necessary for production can be generated if the rice husks are burned in the right way, and, at the same time, the non-crystalline silica reacts at far lower temperatures than in the traditional method.

Since the production process is thermally self-sufficient, the production of silica from rice husks not only allows energy recovery but also a significant reduction in CO₂ emissions, precisely because all the necessary thermal energy is derived from the combustion of renewable biomass. This processing activity has been included in the research project being conducted in collaboration with the Italian Environment Ministry. More information about this project may be found in the section ‘Relations with Institutions and Public Administrations’, in the Social Dimension chapter of this Report. Initial analyses show that this process offers a great advantage in terms of carbon footprint. Pirelli silica made from rice husks can reduce the carbon footprint by over 90% as compared with silica made with traditional processing techniques.

The production of silica from rice husks by Pirelli stands as a clear example of how innovations in the area of materials can be totally sustainable, contributing both to the exploitation of by-products that would otherwise be only partially reused, and the eco-sustainability of production processes. All of these benefits are accompanied by economic advantages that can be immediately related to the efficiency of the process. This project was also reported in one of the most prestigious newspapers in the world, The Economist, at the beginning of 2013. In an article dedicated to Pirelli, this periodical mentioned the environmental benefits resulting from use of a substance obtained from renewable sources. Pirelli has set itself the target of extending the use of silica obtained from rice husks to premium tyres by 2017.

ENVIRONMENTAL IMPACT OF PRODUCTION

As previously indicated in the introduction to this chapter, less than 5% of the environmental impact of the tyre life cycle results from the processing phase, where the principal component is the use of energy and production of related fuels. Nevertheless, this is precisely the phase when impacts occur due to activities directly operated by Pirelli (i.e. Scopes 1 and 2). Moreover, the economic materiality of this phase has led the Company to commit itself to specific targets in all impact categories. These targets were presented to the External Community in the Group Industrial Plan 2013-2017. The targets have a long-term time horizon (2020), are described in detail in the following paragraphs, and concern the Group’s specific energy consumption, specific water uptake, CO₂ emissions and waste recovery.
THE TYRE PRODUCTION PROCESS

Before describing process performance, the production phases involved in the creation of a tyre are described here. There are two principal phases:

- production of the rubber compounds used in the various components of the tyre: tread, sidewalls, liner, bead filler, etc.;
- construction of the base structure, an actual rubber “framework” that supports all the components.

The rubber part of the tyre (tread, sides and fabric) is a special mix, more commonly referred to as a “compound,” which is mainly composed of rubber (both natural and synthetic), binders (mainly carbon black and silica) and plasticizers. Taken together, these components constitute about 90% of the compounds, while the remaining 10% or so is comprised of other components with specific functions such as, for example, accelerants, antioxidants, vulcanising agents, etc. The plasticizing components, the carbon black and the silica are stocked in dedicated silos and sent to a closed mixer (banbury), in which the compound undergoes its initial processing. A computer monitors and manages the quantity of ingredients coming from the silos. The lighter ingredients are instead pre-batched with specific control systems. In a second phase of mixing, special ingredients, such as vulcanising agents and accelerants, are added. The compound is then unloaded onto an open mixer consisting of two big rollers in order to complete its mixing and optimise its dispersion. Next, the compound sheet is plunged into a vat (batchoff) for cooling.

The prepared compound is then used to make the tyre tread and/or other tyre components. It is then extruded and assumes the appropriate form for subsequent processing. The heart of the tyre structure is represented by the fabrics, which are formed by longitudinal threads (weft) and may be comprised of various materials. The fabrics are then cut at a certain angle with respect to the longitudinal direction (the direction of movement, of rolling or of the weft). Other key parts of the tyre are the tread and the sidewall. The first of these performs critical functions, such as stopping on dry and wet surfaces. The second is the area close to the metal rim, which is called the “bead.” The base of the bead is supported by the ring, comprised of a series of steel wires, which stiffens the part touching the wheel rim. The semi-finished components described thus far (tread, beads, rubberised fabrics, sidewalls, etc.) must be assembled together to make the finished tyre, using “building machines”. The resulting tyre (called a “raw tyre”) is then sent to be vulcanised, which involves a genuine solid state chemical reaction. After being cooled, the vulcanised tyre is deburred to remove any imperfections that might alter its appearance. Then it is subjected to visual inspection (both internal and external) which is then followed – in the case of truck tyres – by X-ray inspection in specially shielded areas. The uniformity and balancing of the tyres are then checked.
PRODUCTION PROCESS OF A TYRE

1. Steel Industries
2. Chemical Industries
3. Rubber Plantation
4. Textile Industries

- Wire Calender
- Extruders
- Fabric Calender
- Fabric Bias Cutter and Sheet Calender

- Bead, Belt, Carcass Wire Manufacture
- Bead Construction
- Wire Treatment Cutter

- Banbury Mixer

- Tires Building Machine
- Curing Press Nd P.C.I.

- Final Inspection

- Final Product
- X-ray
- Force Variation
- Balance
ENVIRONMENTAL MANAGEMENT SYSTEM AND MONITORING OF ENVIRONMENTAL PERFORMANCE

Pirelli has adopted ISO 14001 since 1997 as the benchmark standard for its Environmental Management Systems. In 2012 all Pirelli Tyre industrial production sites and the tyre testing ground at Vizzola Ticino have pursued continuous improvement of their environmental performance by using Environmental Management Systems certified in accordance with ISO 14001. The sole exception is represented by the Russian site at Voronezh, which entered the scope of reporting this year. Implementation of the Environmental Management System has begun at that site, and it will be certified in 2014. The international standard ISO 14001 was adopted by Pirelli in 1997, and since 2011 all certificates have been given further SAS international accreditation (the Swiss Accreditation Service that assesses and accredits compliance assessment entities – laboratories, inspection and certification bodies).

Group policy mandates implementation and certification in accordance with ISO 14001. As such, it is also applied to new facilities. The certification activity, together with control and maintenance of previously implemented and certified systems, is coordinated on a centralised basis by the Health, Safety and Environment Department.

The environmental, health and safety performance of every tyre business production site is monitored with the web-based Health, Safety and Environment Data Management (HSE-DM) system, which is processed and managed centrally by the Health, Safety and Environment Department. Pirelli has also completed the CSR-DM (CSR Data Management) IT system for managing Group sustainability information, which is used to consolidate the economic, environmental and social performance of all Group business units worldwide. Both systems support consolidation of the performance accounted for in this report.

SCOPE OF PERFORMANCE REPORTING

The described performance covers the three-year period 2011-2012-2013 and covers the entire scope of consolidation of the Group, consistently with the Annual Financial Report at December 31, 2013. The amount of finished product in 2013 was approximately 1,030,000 tonnes. This value also includes production by the steel cord business unit for the part sold to customers outside the Pirelli Group. The scope of reporting was expanded in 2013 upon inclusion of the Russian Voronezh plant. The entry of this site within this scope is instead classed as “acquisition” as this production unit was already in existence. As from 2013 Pirelli was in fact able to start work of modernisation and streamlining of that plant in order to bring production efficiency in line with the Pirelli Group standards. In accordance with the principles set out by the GRI, the historic value of the environmental indicators reported below has been recalculated by adding the Voronezh data from 2012 and 2011, regardless of the fact that that plant did not belong to Pirelli in those years. The purpose of doing so is to guarantee the comparability of the data on a like-for-like basis. Considering the reporting scope adopted following the “operational control” approach, the steel cord production site in Yanzhou (China) was not consolidated instead, as this is an associated company.

In light of the foregoing, the following figures comprise the impact of all Pirelli units, from industrial units to commercial and administrative sites.
Sandra Hofmann Boss, Assistant Professor in the Department of Biomedical Engineering at Eindhoven University of Technology, is also the leader of the Skeletal Tissue Engineering Group at ETH Zurich. Her main research interests are tissue engineering of skeletal tissues using human mesenchymal stem cells. She was awarded a prestigious 2013 European Research Council Starting Grant for her work and she also won the silver medal of the ETH Zurich for outstanding PhD theses in 2007. Her particular focus lies in the investigation of mechanobiological questions, such as how mechanical loads are applied to and sensed by cells in a 3D environment and how the cells react to these in terms of matrix production.
Sandra was able to speak captivatingly on an obscure and very sophisticated subject, and her natural intelligence was plain to see. Her work in mechano-biology is clearly a very important area of medicine and science, and I could only reel back in awe of her work.

This esoteric field of study was supplanted onto her understanding of the task of reinventing the wheel. By comparing the wheels at work within the human body, and the wheels of a vehicle, she was able to draw out the similarities in their formulation and in their occupation, the ways in which the mechanical and technological external world can be conceptualized in the biological world, and how the former might reflect the latter.

Sandra taught us all that in the same way a wheel will be acted on by forces in the world, and induced to roll, the body is acted on by similar forces. In the same way that a wheel will bear the weight of its vehicle, the bones are expected to withstand the load of the rest of the body’s framework, its nerves and blood, organs and tissues, but also the pressures put on them by the external world.

We found ourselves becoming more and more aware about the mechanical mastery of the body, but also how science and medicine can make it function even better, and last longer. Sandra’s talent then is at once esoteric and completely necessary, while it may not be immediately comprehended, once we had come to understand its importance to human biology we were enlightened.

[Hanif Kureishi]
Do you consider your talent a gift or a burden?
A gift, but not one I am conscious of.

What you would do if one day you woke up and discovered you had lost your talent?
I am curious about so many things, and I believe that curiosity is the way to discover one’s other talents.

Who is the living talent you most admire?
People who have a positive attitude no matter what.

What do you like about your talent and what don’t you like?
Like most: I really like doing my work and often feel “in the flow”
Like worst: it keeps me busy and I spend too much time at work without even noticing, therefore neglecting other nice things around me.

When or where does your talent make you happy?
At work, in discussions, and if it can help someone.

If you could change your talent, how you would change it?
As the future aim of my research is to improve people’s health situation, I would like my research to be faster, so that we can help people sooner.
My wheel is inspired by nature and depends not only on its shape, but also on other aspects such as surface topography, and especially also the function it is required to fulfil.

In my work, I try to adapt the strategies that nature uses in order to heal people.
IS A BONE
PERFORMANCE INDEX TREND

The economic performance of Pirelli was positive again in 2013 in terms of net sales, as fully discussed in its Annual Financial Report 2013. This result is accompanied by the increase in production volumes that occurred from the previous year. The number of tons of finished product in 2013 was up by about 4.5% (increase calculated on a like-for-like basis). In regard to the performance of conventional indices based on this latter parameter, the increase in volumes has made it possible to increase the rate of use of manufacturing sites by interrupting the previous negative trend and improving the energy efficiency of investments that are made. In any case, it must be remembered that, in regard to the Group strategy of continuous pushing towards premium products, the latter are characterised by significant earnings margins but, on the other hand, also by extremely intense energy use. This stems from very stringent quality standards, smaller production lots than those for products made for the medium-low end segment, and obviously on more complex processing in a greater number of phases.

From this it is inferred that indices generally improved in 2013, when they are calculated according to the number of tons of finished product, even if the trend of standardised operating income indicators worsened instead. This was due not so much to the efficiency of Pirelli production processes but to stabilisation in PBIT when production volumes increase. However, if the view is expanded to the last three years, the performance of this last KPI is even more positive.

ENERGY MANAGEMENT

Pirelli monitors and reports its own energy consumption by using three principal indicators:

- **absolute consumption, measured in GJ, which includes the total consumption of electrical energy, thermal energy, natural gas and petroleum derivatives (fuel oil, gasoline, diesel, and LPG);**
- **specific consumption, measured in GJ per tonne of finished product, which indicates the energy used to produce a tonne of finished product;**
- **specific consumption, as measured in GJ per euro of Operating Income.**

In November 2013 the Pirelli Industrial Plan was revised and extended to 2017, with Vision on certain issues to 2020. This long-term strategy has renewed the specific energy consumption target, by reducing it to 18% in 2010 as compared with 2009 values. In 2013 the energy efficiency plan continued at all Group plants continued in 2013. This had already been undertaken over the last several years and has been characterised by the following actions:

- improving energy management systems, by exactly measuring consumption and focusing daily on technical indicators;
- improving the quality of energy transformation by streamlining resource and plant use;
- improving the efficiency of distribution plants;
- improving the efficiency of production plants;
- recovering energy for other uses;
- applying targeted maintenance plans in order to reduce energy waste.

The efficiency improvement actions follow internal assessment rules. In the case of investments, these comply with the criteria of economic benefit normally applied to Pirelli industrial projects. The economic aspect is also completed by assessment of its environmental impact, in accordance with the reporting rules applied to this Sustainability Report. The areas for technical action both concern the traditional themes applied to each industrial area, such
as modernisation of thermal insulation, maintenance of distribution plants, use of technologies using inverters, and special projects assessed according to the needs of each manufacturing site.

The actions undertaken in 2013 include the new thermal power plant at one of the Russian plants and start-up of the thermal recovery operations that provide energy for heating the Settimo Torinese plant. The first project will make it possible drastically to reduce thermal energy consumption through the reduction of nearly five kilometres of distribution networks. The second project will provide nearly one third of heating through the recovery of thermal wastes both from the manufacturing cycle and from the new cogeneration plant.

As explained in the paragraph “Performance Index Trend”, the weight of the energy index on tons of finished product fell slightly by -1%, as compared with 2012. In contrast, the weight of the energy index on operating income grew by 4% from 2012, although the trend was still in steep decline over the past three years (-27% since 2011). The reported data were calculated by using direct measurements according to procedure and were subsequently converted into GJ by using heating values from official IPCC sources.

<table>
<thead>
<tr>
<th>Energy</th>
<th>2011</th>
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<tr>
<td>Absolute</td>
<td></td>
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<tr>
<td>consumption</td>
<td>GJ</td>
<td>15,169,730</td>
<td>14,563,789</td>
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<td>Specific</td>
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<tr>
<td>consumption</td>
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<tr>
<td></td>
<td>GJ/k€</td>
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</tbody>
</table>
The energy efficiency plan applied to factories in 2013 made it possible to save about 190,000 GJ. This value was calculated on the basis of the production volumes of the reporting year and the change in efficiencies achieved in 2013 from the previous year.

The following graph illustrates the distribution of the energy sources used by Pirelli and reported overall in the previous graphs. The direct sources, all of fossil origin, include natural gas and, in smaller quantities, other liquid fuels such as oil, LPG and diesel (the last two classified as “others”). These direct sources constitute 31% of the whole. The remaining 69% is made up of indirect sources of purchased electrical energy and steam. On the basis of IEA (International Energy Agency) data, about 38% of electric power is generated by renewable sources.

Every industrial plant complies with local laws in regard to energy consumption and management. No substantial changes have been made since 2012. Certain countries are introducing incentive mechanisms for the firms that certify their own energy management system. For example, the Energy Efficiency Directive 2012/27/UE that was issued to accelerate achievement of the 20-20-20 targets in Europe requires that all large enterprises conduct an energy audit by the end of 2015. This obligation may be satisfied with the ISO 50001 certification. Likewise, the rate subsidies for high-energy consuming plants, according to the different definitions that are locally given, are increasingly conditioned on performance of energy audits or certification of the management system.

GREENHOUSE GAS EMISSIONS MANAGEMENT

Pirelli has monitored and reported on its CO₂eq emissions since 2002. The expression CO₂eq is used, which accounts for the contribution, albeit marginal, of methane (CH₄) and nitrous oxide (N₂O). Greenhouse gases are generated by the combustion of hydrocarbons at production sites, mainly to operate heat generators that power Group plants, and particularly those that produce steam for vulcanisers, or by the consumption of electrical or thermal energy. The first are called “direct emissions” or Scope 1 emissions insofar as they are produced at company production sites, while the emissions resulting from electrical power or thermal energy consumption are defined as “indirect emissions”, or Scope 2 emissions insofar as they are not produced within the perimeter of company production sites but at the plants that generate the energy and steam purchased and consumed by Pirelli. Performance as measured by energy and greenhouse gas emissions is calculated on the basis of coefficients obtained from the following official sources:

- IPCC: Guidelines for National Greenhouse Gas Inventories (2006);
- IEA: CO₂ Emissions from Fuel Combustion;

and reported according to the scheme proposed by:


Specifically in regard to the CO₂eq emissions of Scope 2, the average national coefficients are defined in relation to the last available year in the aforementioned reports and are updated annually. It must be pointed out that tyre manufacturing industry is not carbon intensive, to the point that it is covered by the European Emission Trading Scheme only in reference to thermal plants having more than 20 MW of installed power. The Company is not subject to other specific regulations at the global level.

As in the case of energy, Pirelli monitors and accounts for its direct and indirect CO₂ emissions (either Scope
1 or Scope 2 as defined above) by using two principal indicators:
- absolute emissions, as measured in tons;
- specific emissions, as measured in tons per ton of finished product;
- specific emissions, as measured in tons per euro of Operating Income.

The Pirelli Industrial Plan has set a target to reduce specific CO₂ emissions by -15% by 2020 from its 2009 levels. The horizon for meeting this target has been extended from the previous goal (2015), due to the delay in production cycles that affected the previous Strategic Plan.

The close link between energy consumption and CO₂ emissions was confirmed again in 2013, with a decrease in specific emissions per tons of finished product down by -1% from the previous year. In contrast, the weight of the energy index on operating income grew by 4% from 2012, although the trend was still in steep decline over the past three years (-24% since 2011).

Biogenic CO₂ generated by the small rice husk silica manufacturing site, Pirelli emitted about 5,300 tons of CO₂ equivalent in 2013. This amount is not counted in the absolute emissions of the Group mentioned above. The Pirelli greenhouse gas emissions management, calculation and reporting system was certified by an independent third party that implemented ISO 14064-1. This audit satisfies the criteria of materiality, competence, independence, terminology and methodology.

<table>
<thead>
<tr>
<th>GHG</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute emissions</td>
<td>ton</td>
<td>1,083,392</td>
<td>1,076,361</td>
</tr>
<tr>
<td>Specific emissions</td>
<td>ton/tonFP</td>
<td>1.00</td>
<td>1.09</td>
</tr>
<tr>
<td></td>
<td>ton/k€</td>
<td>1.86</td>
<td>1.36</td>
</tr>
</tbody>
</table>
Pirelli participated in the Carbon Disclosure Project (CDP) again in 2013. The company reached the top positions in the ranking, obtaining a disclosure score of 96 points out of 100, falling in the top scoring bracket: Senior Management. In consequence of this score, and recognising the transparency and reporting quality of the information that relate to climate change, the CDP added Pirelli to the CDLI 2013 (Carbon Disclosure Leadership Index).

As from 2014 Pirelli became Member of the CDP Supply Chain, activating the monitoring of the Climate Change performances of its own key suppliers at Group level, identified with environmental and economic materiality criteria. Pirelli is the first Company among the competitors in engaging this extensive approach, aligning itself to the best practice of the most advanced automobile companies.

**CARBON ACTION PLAN**

As part of the Carbon Action Plan, the conversion of the Egyptian manufacturing site to natural gas was completed in 2013, while its effects on the emissions intensity of this factory will be seen beginning in the next year. In regard to the supply of electric power from renewable resources, the opportunity sought last year found that the contract-making phase was still open. However, the Company is working to extend this opportunity to other Group affiliates as well. A 500 kW photovoltaic energy plant was installed at the United States manufacturing facility in 2013, with the aim of generating more than 13,000 MWh of clean energy over the next 20 years. This project will make it possible to reduce emissions at the affected manufacturing plant by 5%.

With the collaboration of the Forum das Américas, Pirelli and the Italian Environment Ministry presented a project in 2013 to build the first large solar energy plant in the world at the Pirelli Feira de Santana, Brazil plant for the direct production of medium temperature steam to serve the production process of a factory.

Construction of the plant implements the collaboration agreement signed in January 2012 by the Ministry and Pirelli to reduce carbon dioxide emissions, and falls in the context of environmental cooperation between Italy and Brazil, reinforced in June 2012 by the agreement signed by the Italian Environment Minister and the Brazilian Energy Minister. In particular, the Group will implement the most advanced technologies and know-how in the sector. The Milan Polytechnic as well as Italian and Brazilian firms assisted with the design of the plant, which is expected to be built in 2014. With this pilot plant, it is estimated that CO₂ emissions will be reduced by 2,000 tons over five years, avoiding the use of natural gas. The new Pirelli Tyre plant at Settimo Torinese started up its cogeneration plant to produce electricity, steam and hot water. There are two cogeneration modules, yielding a total of 6 MW in electric power. A 4.8 MW turbine fed by natural gas, and a 1 MW endothermic engine fuelled with vegetable oil will thus guarantee that 20% of energy comes from renewable sources. The generated electricity is used for the internal power needs of the plant. Thermal energy is used primarily to generate high pressure steam used by the production plant. Low temperature recoveries are instead dedicated to the production of hot water, used to improve the efficiency of the thermal power plant and to supplement plant heating. The plant is completed with an approximately 1.2 MWe photovoltaic plant, thereby complementing the generation of renewable energy at the Italian plant. The benefits expected from the actions listed hitherto will have an impact on the trend in the indices in coming years. The actions taken over the past years, especially those related to energy efficiency, have helped to reduce emissions of CO₂eq by about 9,815 tons in 2013. This value was calculated on the basis of the production volumes of the reporting year and the change in efficiencies achieved in 2013 from the previous year.
EMISSIONS OFFSET ACTIVITIES

A new internal policy covering management of the company car fleet in Italy was drafted at the end of 2011. It applies to Italy, the Pirelli Group centre where most vehicles owned by the Group are concentrated. The policy affects all cars assigned to managers and the sales force, by calling for the complete offset of CO₂ emissions by each fleet vehicle with forest protection and development work.

Aside from being an incentive to choose more sustainable cars, the new policy has the merit of spreading the culture of environmental responsibility in a simple, tangible way, through the direct participation of employees. The calculation model used took account of the emission factors of each individual vehicle and of the miles covered. In 2013 about 1,290 tons of CO₂ were released, nearly 8% less than in 2012, when about 1,400 tons were released. In 2012 the Company had offset its consumption by purchasing credits from ARBoLivia, a project associated with the reforestation of an area in Latin America, where Pirelli has a strong, recognised presence. By pursuing this philosophy, half the 2013 amount will be offset by an Italian forestry conservation project, while the other half will be offset by a Brazilian reforestation project.

The Brazilian project is named Climate Protection Acacia. Its overall goal is a 3.7 million ton reduction in CO₂ through reforestation with *Acacia mangium* of 3,507 hectares of land in the far north of the South American nation, in the Boa Vista region. The project, aimed at sustainable production of wood and capture of CO₂, generates numerous benefits for local communities, such as the creation of over 200 permanent jobs, the construction of a new school and the implementation of professional courses. The project also respects the rights of local populations to collect non-wood materials from the forests, improves water and soil quality and secures over 15,000 hectares of bordering forest areas with great benefits for local biodiversity. The plantings are carried out in accordance with the principles and criteria set out in the Forest Stewardship Council (FSC) certification, which guarantees appropriate environmental management of forests, social benefits and economic feasibility. The project is audited by an independent certifying entity, using recognised standards. The Acacia Brazil project is developed according to the ACR (American Carbon Registry) standard and certified by SCS (Scientific Certification System).

Just as it has done every year, in 2013 Pirelli offset the CO₂ emissions at its Vizzola Ticino testing ground, corresponding to its 2012 test activities (about 20 tons...
of CO₂ with work to protect 3,704 square metres of forest in Italy, at the Rio Vallone park and in Costa Rica, with 6,300 square metres of growing forest. Pirelli is again committed to the Impatto Zero (“zero impact”) project that, through LifeGate, assigns a proportionate area of forest to be protected according to the CO₂ that is produced.

WATER MANAGEMENT

Efficient and conscious water use is one of the principal components of the Pirelli environmental strategy, which has undergone numerous improvements over the last several years. These activities have involved and still involve both the overall efficiency of production processes, from design of machinery to facility management, and the contribution which every employee can make towards reducing consumption of this precious resource.

Since 2009, the commitment made at all manufacturing sites has led to saving 14.5 million cubic metres of water. This amount is very close to the absolute volume of the annual water withdrawal by the entire Pirelli Group. This figure might be the one that best expresses the commitment of the Company to protection of water sources in the communities where it operates. In fact, aside from the quantitative and global aspect, Pirelli dedicates great attention to the local context of water resources, aware that any water savings or improvement in discharges immediately and directly benefits the local community.

In quantitative terms, there was an absolute withdrawal of 15 million cubic metres in 2013, with a reduction in the specific amount that was 10% higher than in 2012. Notwithstanding this tangible and significant saving, following the macroeconomic conditions and new scope of reporting, the goal of reducing specific water withdrawal was redefined and transferred to 2020. As compared with 2009, the specific withdrawal will be reduced by 50% by 2017 and 58% by 2020. Accordingly, to give a comprehensive overview of its water withdrawal, Pirelli monitors and reports on the following three indicators:

<table>
<thead>
<tr>
<th>Water</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute withdrawal</td>
<td>16,349,000</td>
<td>16,174,000</td>
<td>15,119,000</td>
</tr>
<tr>
<td>Specific withdrawal (m³/tonₚ)</td>
<td>15.0</td>
<td>16.4</td>
<td>14.6</td>
</tr>
<tr>
<td>Specific withdrawal (m³/k€)</td>
<td>28.1</td>
<td>20.4</td>
<td>19.1</td>
</tr>
</tbody>
</table>
absolute withdrawal, measured in cubic metres, which comprises the total uptake of water by the Group;

specific withdrawal, measured in cubic metres per ton of finished product, which indicates the withdrawal of water used to make one ton of finished product;

specific withdrawal, as measured in cubic metres per euro of Operating Income.

All the figures reported in this section have been collected by taking direct or indirect measurements, and are communicated by the local units.

The two graphs below show the weight of the water procurement per type of source and the distribution of absolute withdrawals per type of production business. More than half the water drawn is taken from wells within the plants and authorised by the delegated authorities. Furthermore, Pirelli obtains about one fourth of its requirements from surface water, while dedicating special care to guaranteeing that this volume is marginal in relation to the volume of the affected water bodies (always less than 5%). In particular, about 10% is taken from water bodies located in Brazil and protected by national laws and regulations. Finally, about 700,000 cubic metres of water used are obtained from treatment of waste water generated by its own manufacturing processes.

A total of about 10 million cubic metres of water were discharged, with about 70% of this into surface water bodies, but always in quantities that are marginal in relation to the volume of the capture basis (always less than 5%) and without significantly impacting biodiversity.

The remaining amount was discharged into sewer networks. Before being discharged into the final recipient, industrial waste water – adequately treated as necessary – is periodically subjected to analytical tests that certify compliance with locally applicable statutory limits. Specifically in regard to the quality of industrial discharges at the Tyre sites, indicative values of the total average are: 8 mg/l of BOD5 (Biochemical Oxygen Demand), 41 mg/l of COD (Chemical Oxygen Demand) and 23 mg/l of Total Suspended Solids.

WASTE MANAGEMENT

The aim in this section is to complete the overview of the environmental sustainability process by describing the approach adopted to improve environmental performance resulting from the production and management of waste, pursued through the following activities:

• innovation of production processes, with the aim of preventing the production of waste at the source, progressively reducing processing rejects and replacing current raw materials with other new ones that have a lower environmental impact;

• operating management of generated waste, aimed at identifying and ensuring the selection of waste treatment channels that can maximise recovery and recycling, gradually eliminating the amount sent to the landfill with the Zero Waste to Landfill vision;
streamlining packaging management, both for the packaging of purchased products and the packaging for products made by the Group.

Pirelli monitors and reports on its own waste production, as measured and communicated by all operating units, using three key indicators:
- absolute production, as measured in tons;
- specific production, as measured in kilograms per ton of finished product;
- specific production, as measured in kilograms per euro of Operating Income.

The Industrial Plan that was presented to the international financial community in November 2013 has redesigned the strategy to reduce the impact associated with wastes generated by Pirelli Group manufacturing activities, focusing attention on the value of wastes as a resource and then on its development through recovery activity. By 2020, more than 95% of waste products will be sent for recovery, with Vision Zero Waste to Landfill, extending the approach previously adopted.

<table>
<thead>
<tr>
<th>Waste</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ton</td>
<td>141,000</td>
<td>149,000</td>
<td>163,000</td>
</tr>
<tr>
<td>Specific production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>kg/ton</td>
<td>130</td>
<td>151</td>
<td>158</td>
</tr>
<tr>
<td>kg/k€</td>
<td>242</td>
<td>188</td>
<td>206</td>
</tr>
</tbody>
</table>
handling of packaging

Different procedures for handling packaging materials exist for different types of products. While tyres are products generally sold without packaging materials, steel cord involves specific packaging. In this respect it should be pointed out that tyre sales account for over 99% of all Group sales in 2013. To reduce the waste from packaging of the products sold, the Steel Cord Business Unit manages and streamlines the use of packaging materials, in collaboration with its own customers. The purpose of these actions is to increase the quantities of reusable packaging materials, both through their being returned to production sites and through replacement of certain types of packaging with more resistant models that are less subject to wear and tear and thus having a longer life.

More specifically, attention was focused on the replacement of traditional wood pallets with new plastic or metal versions, which have a high rate of reusability. A plastic pallet can be reused about ten times, compared with one or at most two times for a traditional wooden pallet. Reducing waste generates obvious benefits. The data received by the Steel Cord Markets and Logistic Department confirm that beginning in early 2013, 100% of the pallets used in reverse logistic circuits are made of plastic or metal, covering 95% of sales volumes. For the remaining 5% wooden pallets are used, where they are more easy to reuse and recover in the areas where they are dispatched.

other environmental aspects

solvents

Solvents are used as ingredients in processing, mainly to reactivate vulcanised rubber, during the fabrication and finishing of tyres. The Pirelli strategy is focused on steady reduction of these substances, both through streamlined use of solvents and dissemination of solvent-free technologies for those operations that may be carried out even without the use of these substances. This strategy has translated into a more than 30% reduction in the specific consumption of solvents, and the related emission of volatile organic.
For Pirelli, the responsible integration of its sites within the local territorial context is an essential cultural aspect. The greatest care is taken to guarantee that the corporate activities do not interfere with the typical biodiversity of the local environments. There are currently two Pirelli sites located inside protected areas that are extremely valuable in terms of biodiversity: the Vizzola Ticino site and the Gravataì site.

The Vizzola Ticino site, which has an area of 0.26 square kilometre, is part of the Parco del Ticino in Lombardy, an MAB (Man and Biosphere, a collection of 425 biosphere reserves located in 95 countries around the world) area of UNESCO. It features 27 species included on the IUCN Red List. In view of better guaranteeing protection of the natural environment where the Vizzola test track is located, Pirelli has implemented an ISO 14001 certified Environmental Management System in accordance with the Parco del Ticino. The environmental impact on the biodiversity of the area is not significant; nevertheless, various activities have been undertaken to mitigate and improve the interaction of Pirelli activities with the natural context, performed directly both by the park administration, as agreed in writing in 2001, and aimed at improvement of the landscape and ecosystem functionality of the neighbouring areas or where the test track is located.

The Gravataì site in Brazil, measuring 0.57 square kilometre, including 0.16 square kilometre of land ecosystem protected under federal law. Here again, Pirelli has implemented an ISO 14001 certified environmental management system to guarantee that all potential impact on the environment and on biodiversity, while deemed relatively insignificant, be duly considered and managed in every case to reduce all possible interference to a minimum.

### BIODIVERSITY

<table>
<thead>
<tr>
<th>Solvent</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute consumption (ton$_{trans}$)</td>
<td>3.435</td>
<td>2.826</td>
<td>2.496</td>
</tr>
<tr>
<td>Specific consumption (kg$<em>{trans}$/ton$</em>{trans}$)</td>
<td>3.2</td>
<td>2.9</td>
<td>2.4</td>
</tr>
</tbody>
</table>

compounds, as compared with the forecast 15% reduction from 2009 levels, with aggregate related emissions slightly lower than total consumption.
NOx EMISSIONS

The NOx emissions derive directly from the generation of energy used. For this reason they are impacted, both in absolute terms and in relation to the unit of finished product, by energy consumption trends, to which a specific section has been dedicated elsewhere in this report.

The graph on the right shows the weight in 2013 of the direct and indirect emissions of NOx out of the total NOx emissions. The emissions have been calculated by using the emission factors defined BUWAL 250 and IDEMAT 2001.

OTHER EMISSIONS AND ENVIRONMENTAL ASPECTS

The production process does not directly use substances that are harmful to the ozone layer. These are contained in certain closed circuits of the cooling and air conditioning plants. Therefore, except for accidental and unforeseeable losses, there are no free emissions into the atmosphere that can be correlated to Pirelli manufacturing activities.

Direct emissions of SOx, caused by the combustion of diesel and fuel oil, was estimated to be about 325 tons in 2013 (U.S. EPA emissions standards).

The environmental management systems implemented at the production units have assured constant and prompt monitoring and intervention in potential emergency situations that may arise, as well as the reports received from stakeholders.

No significant environmental spills occurred in 2013, no complaints occurred in relation to significant environmental reasons, and no fines connected with them have been recorded.
EXPENSES AND INVESTMENTS
In 2013 environmental expenses and investments related to the manufacturing process totalled over euro 15 million. About 85% is covered by normal management and administration of factories, while the remaining 15% is dedicated to preventive measures and improvement in environmental management.

To complete the picture, it must be pointed out that, consistently with the materiality analysis at the beginning of this chapter, the most important expenses dedicated by Pirelli to the environment are definitely those related to product research and development. In 2013 the Company invested euro 199 million in research and innovation of its own products, with a constant focus on safety performance and reduction of environmental impact and, at the same time, production efficiency.

PRODUCT AND USE PHASE
The impact of the use phase is completely indirect in relation to the industrial activity of Pirelli, there is no doubt that this is the phase that makes the greatest contribution by far during the tyre life cycle. The carbon and water impact varies from 75% to 90% of the total. This is due almost entirely to the power absorbed by the tyres, which deform by absorbing energy to guarantee road hold and braking performance. Rolling resistance is the characteristic that determines the level of energy absorption, and it precisely on this environmental performance that Pirelli is intensifying its own research. The reduction in rolling resistance entails lower fuel consumption by the vehicle system. This consumption, which is realised with combustion in vehicle heat engines, combined with production of the fuels themselves, results in the impact of this phase in the life cycle.

GREEN PERFORMANCE TARGETS
The decision to focus on the premium segment forces Pirelli to develop and introduce increasingly sophisticated products on the market in a macroeconomic scenario that is undergoing constant, rapid evolution.

The major corporate investment in research and development on ever-more innovative compounds, structures and tread patterns allows Pirelli products to achieve extremely high performance in terms of braking under dry and wet conditions and, at the same time, improved environmental performance such as:
- less rolling resistance – lower CO₂ emissions;
- less noise – reduced noise pollution;
- increased mileage – lengthening of tyre life and reduced exploitation of resources;
- improved rebuildability – less waste to be disposed;
- reduced weight – less use of raw materials and lower impact on natural resources.

The new EU environmental and safety tyre labelling regulation applicable to tyres for sale in the replacement segment came into force on the European market in 2012. This regulation requires that tyre makers apply a label (the “Eurolabel”) informing consumers about key product characteristics, such as rolling resistance (an indicator of energy efficiency), wet grip (a safety indicator) and external rolling noise (environmental impact indicator). Energy efficiency and safety are ranked by classes that run from “A” to “G”, while external noise is measured in decibels and is shown with the sound wave symbol. The Eurolabel is applied to car tyres (C1) and light and heavy commercial vehicle tyres (C2 and C3). During presentation of the Industrial Plan 2013-2017, Pirelli Research and Development committed itself by adopting targets to improve the environmental performance of its own products in an objective, measurable and transparent manner. In particular, the Group focused its commitment to the parameters of the European labelling — Rolling Resistance, Wet Grip and Noise — without neglecting all the other fundamental parameters in the Green Performance strategy. They will be presented in the following paragraphs.
CAR TYRES

Pirelli is one of the most sustainable manufacturers of car tyres, with two outstanding products: the Cinturato™ P7™ Blue and the Winter Sottozero™ 3.

With the Cinturato™ P7™ Blue, Pirelli is the first tyre maker in the world that offers a tyre carrying a double A rating for certain sizes on the Eurolabel scale. According to its size, this tyre is sold either with a double A class rating or a class B rating for rolling resistance, while all sizes have an A rating for wet grip. On average, the Cinturato™ P7™ Blue guarantees 23% less rolling resistance compared with the Pirelli benchmark (class C rolling resistance), and thus lower fuel consumption and noxious emissions. Here is a concrete example: a sedan equipped with the Cinturato™ P7™ Blue tyre that travels 15,000 kilometres a year consumes 5.1% less fuel, equal to 52 litres of fuel, and reduces greenhouse gas emissions by 123.5 kilograms of CO₂. Its braking distance on wet surfaces is 9% less than the Pirelli benchmark (class B for wet grip) in the same segment. Moreover, the comparative tests by TÜV SÜD show that at a speed of 80 km/h on wet roads, P7™ Blue reduces braking distance by 2.6 metres as compared with a class B tyre. The Cinturato™ P7™ Blue has been developed for medium-high powered engines, as further evolution of the Cinturato™ P7™, the most famous Pirelli Green Performance tyre presented in 2009. The evolution of the Cinturato line became necessary to meet drivers’ growing need for safety and economy. The Cinturato™ P7™ Blue is sold only on the replacement market, unlike the Cinturato™ P7™, which is sold mainly through the original equipment channel. This latter model has taken just a few years to become...
the benchmark tyre for the most prestigious car makers in the sedan, coupé and medium-high powered sedan segments.

In March 2013 the Winter Sottozero™ 3 tyres were presented in a preview offered to over 400 European dealers in Austria, between Seefeld and the Kühtai pass at over 2,000 metres. The third generation of ultra-high performance tyres for the winter season, it was conceived to equip sports cars and powerful sedans and offer maximum grip on water, ice and snow. Here are the principal characteristics of this new product line:

- an innovative compound made of functional polymers (that improve the mechanical, thermal and dynamic properties of the compounds), improving tyre performance;
- an improved profile to guarantee greater mileage through uniform contact with the ground;
- more ground contact for better road hold, rendered possible by the Lamella 3D.

The new line guarantees control, mileage and grip under wintry conditions. The Winter Sottozero™ 3 tyres are offered in bore sizes ranging from 16 to 21 inches and in 11 runflat versions.

The following infographic refers to the entire range of car products and illustrates the technological progress made from 2007 until now, and the targets for 2020. In its Industrial Plan 2013-2017, Pirelli has undertaken to reduce the average rolling resistance of its own products by 40% from the 2007 average.

**TRUCK TYRES**

The R&D objective for the Truck Business Unit is to strike the greatest possible balance amongst the top characteristics of a tyre: performance, safety and respect for the environment. In other words this involves reducing its overall environmental impact while remaining focused on improving the product’s performance.

From the design stage on, Pirelli takes account of all product use conditions, including abnormal ones. This permits the development of tyres that do not stop at compliance with legal regulations, but have all the characteristics necessary to guarantee complete safety, both for the customer and for the environment, in accordance with the highest Pirelli product standards. Numerous eco-compatibility features characterise the new generations of Pirelli truck tyres, beginning with the reduction in weight that in turn reduces both the quantity of raw materials used and energy needed to produce them. Furthermore the reusable materials that are employed and their durability are reflected in the duration of the “first life” of the tyre and the number of times that the same casing can be used for retreading the tyre.

The Serie 01 is the green performance range of tyres for industrial vehicles, launched by Pirelli in 2009. The Serie 01 tyres share the latest generation SATT™ structure, the most advanced for production of truck tyres, and constitutes the basis for lengthening product life, elevated rebuildability, extremely regular wear and tear, and better driving precision. Compounds and tread patterns are designed and optimised according to the performance requested for different uses. All Serie 01 product lines bear the Ecoimpact mark, which translates into:

- high mileage and uniform tyre tread wear, through the use of high specific yield compounds, the SATT (Spiral Advanced Technology for Truck) structure, and an optimised tyre tread profile;
- low rolling resistance (already in compliance with 2016 regulatory limits) and consequent reduction in fuel consumption and CO₂ emissions;
- highly retreadability, construed as the greater residual durability at the end of the tyre’s first life thanks to the new SATT structure combined with compounds having low hysteresis (i.e. generating less heat), with the hexagonal flush ring and reinforced bead;
- low noise, construed as quiet ride and driving comfort, consistent with European regulations governing noise limits.

The ST:01™ Neverending Energy™ stands out among the top products. Developed specifically for equipping trailers and semi-trailers, ST:01™ Neverending Energy™ is the first line of truck tyres to be awarded the double class “A” of the European label, and thus both for rolling
The product line dedicated to the medium and long-distance transport segment has also been rounded out by a new tyre that enhances safety and minimises operating costs, by means of energy efficiency, high mileage, possibility of reconstruction, reduced noise and use of innovative materials. With the new ST:01™ Neverending Energy™ line – characterised by innovative materials, optimal reduction of wear and tear and use of a Pirelli patent – all different types of transport operator requirements are covered.

The following infographic refers to the entire range of car products and illustrates the technological progress made from 2007 until now, and the targets for 2020. In its Industrial Plan 2013-2017, Pirelli has undertaken...
to reduce the average rolling resistance of its own products by 20% from the 2007 average.

**MOTORCYCLE TYRES**

Pirelli confirms its competitive advantage in terms of performance and safety on the motorcycle tyre market, characteristics that have made our Company the best tyre maker in this segment. However, by anticipating market demand, Pirelli is also focusing its research on the environmental performance of its motorcycle tyres, by equipping the innovative BMW C Evolution electric scooter. Engineers at Metzeler (the 100% Pirelli owned brand) are developing the new Feelgreen project, which will lead to marketing a product that, in comparison with the present standard, will reduce weight by 13% and rolling resistance by about 25%. However, the driving performance of the Feelgreen maintains the characteristic elements for which this brand’s products are famous: fast warm-up and handling, which are essential for city driving conditions. Feelgreen was designed with the support of the FEA (Finite Elements Analysis) technique. It a high silica content compound, new tread design and new profile that were specifically designed to reduce rolling resistance.

The following infographic refers to the entire range of car products and illustrates the technological progress made from 2007 until now, and the targets for 2020. In its Industrial Plan 2013-2017, Pirelli has undertaken to reduce the average rolling resistance of its own products by 10% from the 2007 average. For the overall efficiency of motorcycles, the influence of this tyre characteristic is less significant than it is in the four-wheel vehicle world.
functions, such as the amount of vertical static force to optimise tyre pressure according to load, and the RFID, or electronic tag that uniquely identifies the tyre. The Pirelli Cyber™ Tyre system, which is at an advanced stage of development and testing with certain prestige and premium car makers, constitutes the technological breakthrough that can significantly improve the performance limits of road hold and driving safety. This is accomplished on account of the sensor’s capacity to transmit data and information to the vehicle in real time, being updated at every revolution of the tyre, in contrast with the previous methods used until now to make indirect and relatively inaccurate estimates. The Cyber™ Tyre technology was developed entirely at Pirelli, from the electronics, the heart of the system, to the algorithms for extraction of parameters, the basis for creating new vehicle control systems.

The integration of electronics in tyres is one of the cornerstones of Pirelli’s premium innovation strategy, aimed at guaranteeing continuous monitoring of key physical parameters, particularly tyre pressure. The use of tyres whose pressure is 20% less than its recommended pressure may result in up to 3% higher fuel consumption, with a correspondingly greater environmental impact in terms of CO₂ emissions. National Transportation Safety Board studies have shown that for every 20 kPa of under inflation, there is an average increase in fuel consumption of 1%. Furthermore, tyre pressure that is 20% below what it should be causes irregular wear on the tyre tread and consequently increases wear and tear by 25%, which translates into a 30% reduction in the lifetime of the tyre. Pirelli is able to offer its customers a family of Cyber products for monitoring tyres:

- the CyberFleet™ TPMS (Tyre Pressure Monitoring System) for truck use;
- the Cyber™ Tyre TMS (Tyre Mounted System) for car use.

In particular the CyberFleet™ technology, already available on the Brazilian market for end users (fleets of trucks, buses and dealers) since 2012, uses an electronic sensor embedded in the tyre to dialogue with the fleet management centre, reporting tyre pressure and temperature in real time. The new system is designed to keep tyres under continuous control by measuring any faults to assure proper maintenance. This leads to a significant reduction in the environmental impact from tyre use, by lengthening its useful life and limiting fuel consumption, as well as having a big impact on fleet safety.

The Cyber™ Tyre system of monitoring tyre dynamics, initially applied to car use, can interact in real time with the systems for controlling vehicle dynamics, benefitting driving safety, performance and fuel consumption. The TMS technology is a high performance solution of the TPMS system that is already widely used on cars in the United States. It can integrate additional
END-OF-LIFE MANAGEMENT OF TYRES

About 1.5 billion tyres are sold worldwide every year (IRSG Report 2010), and they are naturally destined to become end-of-life tyres. In 2011, about 2.9 million tons of tyres were manufactured in Europe. In the United States, 4.6 million tons of tyres were made in 2007, and 800,000 tons of tyres were produced in Japan. These numbers clearly indicate the dimensions of the phenomenon and its potential environmental impact. In these three cases, the efforts made by institutions, producers and recovery chains have made extremely positive results possible. In 2011, 95% of end-of-life tyres (ELT– End-of-Life Tyres) were recycled in Europe. In the United States, the figure is around 90%, while in Japan the percentage is slightly higher (ETRMA ELT 2011 data). Pirelli has been committed for years now to the management of ELTs both internally, through the research and innovation activity of Pirelli Labs, and by collaborating with major national and international organisations in the sector. Pirelli is in fact active in the Tyre Industry Project (TIPG) of the World Business Council for Sustainable Development (WBCSD), in the ELTs working group of ETRMA (European Tyres and Rubber Manufacturers’ Association) and, at the national and local level, it interacts directly with leading organisations active in the recovery and recycling of ELTs. As a member of TIPG, Pirelli Tyre has collaborated on the publication of a report on the management of ELTs, taking a proactive approach to raising the awareness both of emerging countries and those that do not yet have a system for recycling ELTs, and to promote their recycling and reuse according to defined management models, which have already been launched successfully.

TREND IN DISPOSAL OF END-OF-LIFE TYRES IN EUROPE

Source: ETRMA ELT 2011
RECOVERY OF A TYRE AT END OF LIFE

1. **Energy Recovery**
   - *Tyres are used as fuel thanks to easy combustion and high heat value*
   - **Cement works**
   - **Thermal power stations**
   - **Paper mills**

2. **Recovery of Material**
   - *Tyres can be broken down into the various components (rubber, steel, textiles) to obtain new materials which can be used in various areas of production*
   - **Asphalt**
     - Paving with durability, low noise levels and braking grip
   - **Sports playing surfaces**
     - Fields of artificial grass, athletics tracks, surfaces for riding, paving for preventing injury
   - **Building**
     - Materials for sound insulation
   - **Street furniture**
     - Speed bumps, traffic demarcations, kerbs
   - **Civil engineering**
     - Soundproofing barriers, anti-erosion barriers, stabilisation of slopes, coastal protections, road drainage and heat insulating embankments
   - **Miscellaneous manufactured items**
     - Car accessories and components, straps and wheels for suitcases, skates, wheelbarrows
   - **Tyres**
     - As the regenerated part of the compounds
   - **Stationery**
     - Items of stationery
   - **Footwear**
     - Soles for footwear

95% IS THE PERCENTAGE OF RECOVERY OF TYRES AT END OF LIFE IN EUROPE
PRODUCTS THAT CAN BE OBTAINED FROM RECYCLING ELTS

Tyres are a mix of numerous materials that influence how they are recovered:

- material recycling: the tyre can be used as-is, or after physical treatment in countless applications, from civil engineering works to the production of asphalt and compounds ready to be reused in production processes;
- energy recovery: due to the high energy content that characterises ELTs, higher even than coal, ELTs are used as fuel in thermoelectric plant ovens and in cement manufacturing plant ovens, guaranteeing a reduction in greenhouse gas emissions due to their biomass content resulting from natural rubber, which is close to or greater than 20% of their weight.

In regard to material recovery, recycled rubber is already reused by Pirelli in the compounds of new tyres. Together with traditional recovery and disposal methods, this contributes to reducing its environmental impact. Through research in collaboration with various university centres, in the near future it will be possible to improve the quality of compounds in terms of the affinity of their ingredients, thereby increasing the quantity of recoveries introduced with another environmental benefit. All this in addition to a positive drop in the consumption of non-renewable materials.

OTHER BUSINESSES

PIRELLI AMBIENTE

This business operates in the field of sustainable mobility and renewable energy sources. This entity results from merger of the activities of Pirelli Eco Technology S.p.A. and Pirelli Ambiente S.p.A. In regard to the activities contributed by Pirelli Eco Technology, Pirelli makes, sells and markets products developed for the control of pollution emissions: FEELPURE™ anti-particulate filters and systems. The activities taken over from Pirelli Ambiente offer solutions for sustainable development as part of energy issues. In this sector, Pirelli produces CDR-P, a quality fuel derived from solid urban waste. Pirelli also owns an indirect minority stake in the listed Danish company Greentech Energy Systems A/S, which operates in the renewable energy sector – wind power and photovoltaic energy.

PZERO

With the PZero project Pirelli decided in 2002 to enter the world of industrial design of clothing. The attention and care dedicated to researching cutting-edge materials and technological solutions, both in terms of design and eco-friendliness, represent the Pirelli Premium and green performance strategy also within PZero.