WHAT MATTERS 2016

↗ The price of beauty ↗ Money and the environment
↗ Sustainable consumption

Annual Report of the German Environment Agency

For our Environment

Umwelt Bundesamt

WHAT MATTERS 2016

↗ The price of beauty ↗ Money and the environment
↗ Sustainable consumption

Annual Report of the German Environment Agency

Climate change mitigation and Sustainable Development Goals: it's all about implementation.

Maria Krautzberger
President of the German Environment Agency (UBA)

If you ask a child in a Bolivian village in the Andes what it wants for the future, its answers will differ in a number of ways from the responses given by a German child living in a big city. But they will both agree on one essential point: they both want to grow up in a liveable world without hunger, without poverty and without environmental destruction – but with access to high-quality education, health care and a pristine natural environment.

Over the course of the past year, the international community has taken decisive steps on the path to making a future like this possible. It has set itself essential ecological, social and economic development goals by agreeing to the 2030 Agenda for Sustainable Development and the Paris Agreement on climate change. In September 2015, the United Nations Sustainable Development Summit adopted the 2030 Agenda, which was followed a little more than three months later in December 2015 by the passing of the global climate change mitigation agreement in Paris. Together, these two international agreements are the provisional culmination of developments resulting from the Rio Conference.

The overarching goal of the 2030 Agenda is to initiate an overdue global process of transformation toward a sustainable future. Governments have agreed to address the issue of more sustainable development in order to combat poverty, hunger, climate change, diminishing biodiversity and high resource consumption, and thus to make it possible for both today's and future generations to lead fulfilled lives. The 2030 Agenda has formulated 17 universal goals, which apply to all member states, and 169 targets, most of which signatories are to achieve by the year 2030. One of the decisive differences between the 2030 Agenda and the Millennium Development Goals that were in force until 2015 is that the global Sustainable Development Goals were formulated for all countries – that is to say, to the same degree for developing countries and newly industrialised countries as for industrialised countries, including Germany. They do not just target "poor" countries, as had been the case up until now. Another difference is that both developmental policy and environmental policy goals have been brought together as "transformative goals for more sustainable development". Humankind has recognised that these two goals cannot be viewed separately, as they are closely intertwined in reciprocal exchange with one another.

By adopting the 2030 Agenda in autumn of last year, Germany, together with the other UN member states, committed itself to contributing its share to global development before an international audience. Germany also needs to make some progress in order to uphold this commitment and will face major challenges on its way to implementing the global Sustainable Development Goals by 2030. The objects of these goals are already key focal points of the work done by the UBA. Three essential examples of this work are: conserving natural resources, establishing sustainable patterns of consumption and production, and investigating the connections between the environment and human health. The main challenges posed by the 2030 Agenda relate primarily to each state's global responsibility. This means that Germany is not just responsible for protecting the environment in Germany and the EU, but also for the effects that its patterns of consumption and production have on people and the environment in countries far away. You will find more detailed information about this in the sections titled "The price of beauty" and "Sustainable consumption". Moreover, another emphasis of the 2030 Agenda is fighting climate change and helping the states most affected by it to adapt to it, which forms an important basis for sustainable development.

The adoption of the global Sustainable Development Goals as an action plan for human welfare, increasing opportunities and preserving the planet, laid the foundation for the climate change agreement in Paris. The 2030 Agenda forms a strategic framework for sustainable development, of which climate change mitigation and climate change adaptation form an elemental part. The Paris Agreement marks the provisional culmination of an international process that had already been in motion for over 25 years, in particular after the failure of the Copenhagen climate summit. As an expression of unprecedented international unity, over 150 heads of state and government convened in Paris – more than had ever been in attendance at an international conference before. The goals set in the agreement are just as historic: for the first time, all states committed to taking steps to mitigate climate change, not just industrialised countries as had been the case until then. In order to prevent the dangerous effects of climate change, they pledged to restrict the increase in global mean temperature to well below 2°C above pre-industrial levels. For the first time, they also committed to make efforts to restrict global warming to below 1.5°C, which will play a decisive role in the survival of many island states. Alongside the long-term goal of achieving net-zero greenhouse gas emissions, they also decided to strengthen climate change adaptation measures and to channel the finance flows in a more climate-friendly direction. The adoption of the Paris Agreement on climate change in December 2015 therefore sends an important message to the international community and economy: starting now, it is our joint goal to decarbonise economic and social activity.

The order of the day for Germany, other states and alliances is to now implement the decisions and commitments made – in both the 2030 Agenda and the Paris Agreement – by initiating specific measures. Germany is assuming a major responsibility and a key role in this process, as the utilisation of fossil carbons was what enabled Germany to reach its high level of development as an industrialised country in the first place. Due to its ability to find technical and social solutions to environmental problems, Germany must now be prepared to assume this responsibility and become a trailblazer of sustainable development on its journey to becoming a decarbonised, state-of-the-art industrialised nation. From a German perspective, the first important step is to uphold the financial commitments made to developing countries regarding development, climate change mitigation and climate change adaptation, and to ensure that a transfer of knowledge and technology takes place. The world is watching the German energy transition as an important process of transformation. We are committed to implementing this transition quickly and successfully.

In Paris, it was determined that the climate protection measures announced by the states are not yet sufficient to prevent a dangerous change in climate. For this reason, all states pledged to review and improve their climate change mitigation goals regularly. Germany will also contribute to the global reduction of greenhouse gas emissions. We must ask ourselves about the specific consequences this will have for us and what impact our goals arising from the international obligations set in the Paris Agreement will have on German climate change mitigation goals, because now the time has come to initiate the upcoming processes of transformation and consistently further develop them. By adopting the 2030 Agenda and the Paris Agreement, the international community of nations has set itself ambitious goals. It is important that the international community demonstrates unity and proves that multilateral processes can work, especially in times of global crises. We now need to tackle these tasks, and the UBA will also do its part.

Contents

We are using too much of this world. We are using it up. Steel, oil, cement, aluminium – we consume all of this and much more every day in construction, as fuel, as goods. The environmental impact is immense. And our consumption keeps increasing because more people are living in the world and we humans keep consuming more and more. We urgently need to reduce the amount of resources we consume in order to preserve our world for coming generations. The circular economy is already making a significant contribution in this regard.

The concept of the circular economy means preventing the dangerous impacts of waste production and waste management as far as possible, or at least extensively reducing them. This includes, above all, not producing waste in the first place. If the production of waste cannot be avoided, waste must be used as a material if possible by harmlessly recycling it – where recycling makes ecological sense. In this way, materials can be used repeatedly and do not have to be mined or harvested anew or reproduced. If this is no longer possible, waste can also be utilised in an environmentally friendly way as energy, i.e. as fuel. Compared with disposing of waste, this reduces the use of fossil energy sources and emissions of fossil CO_2.

Since its inception, the German Environment Agency (UBA) has been working on reducing the amount of waste generated, and ensuring the highest quality possible when recycling and reusing waste. This is why we also keep up with these developments on both a European and a domestic level, critically and constructively.

The circular economy in Europe

The European Union is currently discussing how to continue developing a Europe-wide circular economy. A new Circular Economy Package has been available since December 2015. Its objective: to promote the circular economy, to improve international competitiveness, to generate sustainable economic growth – and to create new jobs.

The package is made up of two elements: recommendations for waste legislation and an action plan.[1] One core element comprises regulations that limit the amount of waste that is still being disposed of in landfills. In Germany, it has been illegal to landfill untreated municipal solid waste since mid-2005. This has strengthened recycling and resulted in the continued development of waste treatment technologies.

At a UBA event in Brussels in March 2016,[2] participants discussed the huge potential of a complete implementation of a circular economy in all member states, also in light of the implementation of the Paris Agreement on climate change mitigation. The first important step towards achieving this is also among the Commission's proposals: a complete break with landfilling untreated municipal solid waste. It is especially important to stop disposing of organic waste in landfills, as organic waste – for example from kitchen waste or grass cuttings – primarily generates methane while it decomposes in landfills, which is a greenhouse gas 25 times stronger than carbon dioxide. If we were to expand the utilisation of organic waste throughout Europe as both a material and a source of energy, we could significantly reduce uncontrolled methane emissions. The second important point: more recycling. Recycling reduces the need for primary raw materials, and thus does not just make an important contribution to resource efficiency, but also – and in particular – to climate change mitigation. It does so by cutting down on huge volumes of greenhouse gases that are emitted, above all, during the extraction, transportation and processing of raw materials. Whatever cannot be recycled should ultimately be incinerated in efficient plants, and the waste heat should then be used to generate energy (energy recovery).

We therefore welcome the Commission's recommendation to restrict landfilling in favour of optimally utilising resources and an effective circular economy. In order to continue strengthening this approach further, it would be expedient to set quality criteria – i.e. standards for the quality of the waste that can be dumped – instead of the specifications envisioned up until now for the maximum possible amounts of waste destined for the landfill. This would mean that components that could still be utilised are sorted out from the rest, that more organic waste is composted and that residual waste is utilised to generate energy.

Utilising more plastics as materials

In Europe, and in Germany, there is still a lot to be done in some respects with regard to

the recirculation of plastics – or, to be more precise: their separate collection and recycling. The plastics strategy being planned by the European Commission could provide a number of important impetuses in this regard: it should improve the separate collection of plastics waste, significantly increase recycling volumes and strengthen recycling in comparison to incineration and landfilling as a waste disposal method. We take a positive view of the Commission's plan to create EU-wide quality standards for secondary plastics and, alongside the issue of waste, to pay more attention to product design as well.

This means that, in future, factors such as recyclability will be examined and relevant product specifications will be created within the framework of the Ecodesign Directive. However, the package does not contain any specific targets or measures for reaching the goal of improved recyclability. We therefore recommend that the Commission's strategy paper stipulate that specific measures be examined. This concerns firstly strengthening recycling, i.e. through plastic-specific quotas in non-packaging applications, and secondly strengthening demand for plastics recyclates, e.g. by way of specifications for minimum recyclate content in certain suitable products, such as waste bins (these specifications will initially be implemented on a voluntary basis). These goals were discussed during a UBA event in Brussels, titled "Plastics waste management and prevention of marine littering in a circular economy", which was attended by both EU and business representatives. They were also considered in relation to the issue of plastic waste polluting the oceans.

Preventing waste

Another important starting point for the EU Circular Economy Package is the incorporation of waste prevention measures into every step of the product life cycle. The example of food waste illustrates the reasons for this particularly well, as it is an area where measures like these need to be implemented throughout the value chain: during production, processing and manufacturing, retail, distribution and the consumption of foodstuffs both at and away from home. The UBA has helped to shape a process of dialogue between various stakeholders from politics, business, public institutions, and environmental and consumer protection agencies, who are currently discussing approaches for taking action to prevent food waste. The UBA has published guidelines for preventing food waste in the catering industry as a result of these discussions.[3]

The measures for reducing food waste from the Circular Economy Package also make reference to the global Sustainable Development Goals of the United Nations. However, because they have not been adopted in legislative text, this goal remains legally nonbinding. In addition to this, the focus has shifted, in particular, to consumers and potential changes to their behaviour, whereas other stakeholders are not being held to account as clearly.

Designing better products

Another important area in which action needs to be taken in order to strengthen the circular economy is product design, which forms an important basis for the lifespan of technical products in particular. The Circular Economy Package contains a range of recommendations for improving products' reparability. In particular, the UBA supports the recommendation of entrenching the availability of spare parts for all products in particular in the Ecodesign Directive. Unfortunately, further demands such as access to information about repairs, and spare parts for free repair shops were not taken up. From our perspective, it would be important to hold manufacturers to account. One idea, for example, would be to require manufacturers to provide mandatory information about the product lifespan which they guarantee in order to provide consumers with a better basis to for making a decision before they purchase a product. The general framework for independent repair shops also needs to be improved. Specifically, spare parts retailers and repair shops that are not directly affiliated with manufacturers should also have constant access to spare parts, basic repair manuals and tools under appropriate conditions.

Recycling in Germany – good, but not good enough

Germany is considered a world champion when it comes to recycling. And it's true: with regard to the utilisation of waste, Germany is already complying with the 2031 targets recommended by the European Commission for iron, aluminium, glass and paper, and we have already met the 2026 target for the overall packaging quota. However, there is still room for improvement in the area of plastics to leverage technical, ecological and economic resource potential. An increase in the amount of recycling being carried out, which is included in the plans for the German Packaging Act (Verpackungsgesetz) and the amendment to the Commercial Waste Ordinance (Gewerbeabfallverordnung), will help us to reach this goal.

From the view of the UBA, the planned Packaging Act will provide some important focal points for strengthening the circular economy, including an urgently needed increase in material-specific recycling quotas and the creation of an agency responsible for registration and standardisation. In future, licence fees for dual systems will be more closely linked with ecological criteria such as recycling and sorting properties, which will create incentives to design packaging that is more compatible with recycling.

Plans for the mandatory joint collection of packaging and what is referred to as similar-material non-packaging items made of metal or plastics (e.g. toys, pots, kitchen sieves etc.) in yellow bins could not be politically enforced. Such comprehensive collecting of the recyclable materials named has the potential to add an extra 5 kilograms of plastics and metals per resident per year to the amount of materials collected in the yellow bins, and could thus make an important contribution to the conservation of resources. According to the current draft of the bill, municipalities are able to introduce "recycling bins" voluntarily, as many already have. This means that there is still potential in Germany to keep reducing the consumption of primary resources by substituting them with secondary raw materials. At the present time, people who are able to should already be preventing as much waste as possible and feeding recyclable leftovers back into systems for separate collection.

The lifespan guaranteed by manufacturers should be visible on the product.

1 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Closing the loop – An EU action plan for the Circular Economy COM(2015) 614 final

2 High-level Panel Discussion – Circular Economy: The European Union's Potential for Climate Change Mitigation. 2 March 2016, North Rhine-Westphalia Representative Office to the European Union, Brussels.

3 Download the catering guideline here (German): https://www.umweltbundesamt.de/publikationen/leitfaden-zur-vermeidung-von-lebensmittelabfaellen

The price of beauty

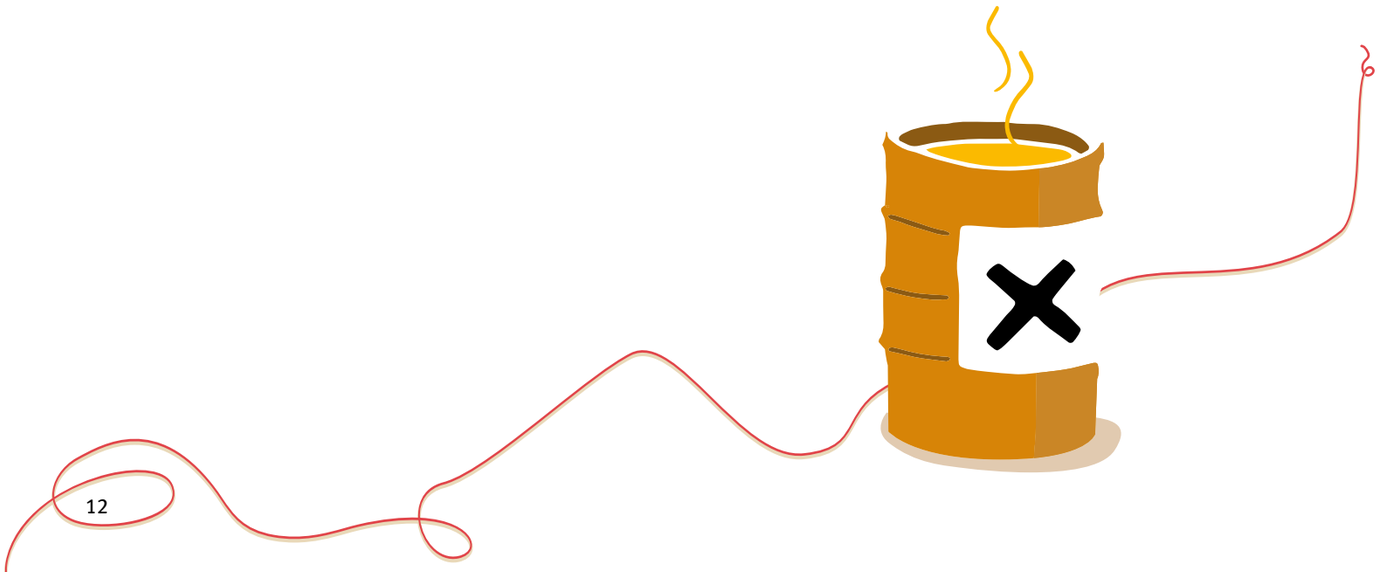
Every year, there are up to twelve new collections in the clothing stores in Germany’s high streets. But this “fast fashion” is having a huge impact on the environment and on the people who live in manufacturing countries.

Fashion and its consequences

“The purple waves of the narrow river flow sometimes swiftly, sometimes sluggishly between smoky factory buildings and yarn-strewn bleaching-yards. Its bright red colour, however, is due not to some bloody battle … but simply and solely to the numerous dye-works using Turkey red. Coming from Düsseldorf, one enters the sacred region at Sonnborn; the muddy Wupper flows slowly by and, compared with the Rhine just left behind, its miserable appearance is very disappointing. The area is rather attractive: the not very high mountains, rising sometimes gently, sometimes steeply, and heavily wooded, march boldly into green meadows, and in fine weather the blue sky reflected in the Wupper causes the red colour to disappear completely.”[1]

In his letters from Wuppertal – this one is dated March 1839 – Friedrich Engels gives a striking description of the ecological impact of the early industrial textile industry along the Wupper, between Elberfeld and Barmen. Since the collapse of the traditional German textile industry in the early 1970s and thanks to the development of German environmental law, this play of colours on the Wupper has drawn to an end, and the sky above it has become blue again, just like German chancellor Willy Brandt (SPD) promised. In the former East Germany, colourful streams became clean once again after 1989.

But in other parts of the world, the rivers still take on a different hue every day. Experts from the UBA have observed this in the Indian state of Gujarat, for instance, where there are over 7,700 textile mills. Together with local environmental authorities, the UBA is working on reducing the environmental impact of sectors such as the textile, paper and chemicals industries.[2]



The textile industry today

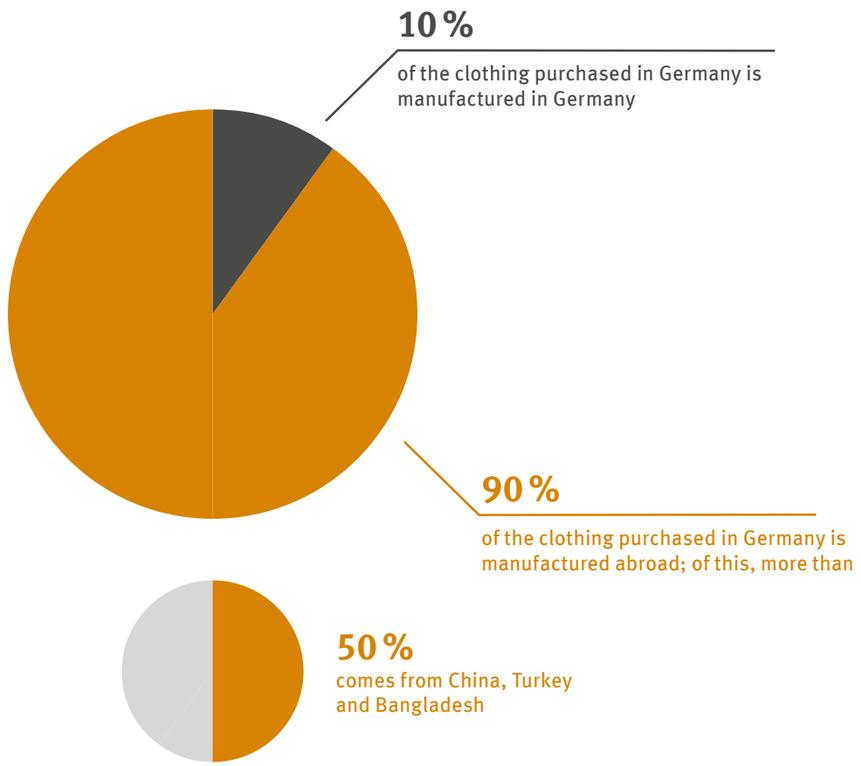
The German textile and clothing industry currently comprises 1,400 companies that employ 132,000 people.[3] About half of their annual revenue of EUR 32 billion is generated from technical textiles. Technical textiles are textiles that are used in special areas of technical application, for example in agriculture, as contract and construction textiles, in the automotive industry and in medical and hygiene products.

Market globalisation has had a considerable impact on the textile industry. For example, about 90 per cent of the clothing purchased in Germany originates abroad; more than 50 per cent comes from China, Turkey and Bangladesh. The division of labour is very pronounced in textile manufacturing. A t-shirt can travel up to 20,000 kilometres before it is bought in a German store, possibly for as little as EUR 4.00. With such prices despite a large number of processing steps, it is plain to see that there is little left over for cotton farmers or seamstresses at the end.

“Fast fashion” is making the clothing carousel spin faster and faster. Fashion stores now have up to twelve collections on offer every year; a few decades ago it was just two: a spring collection and an autumn collection. On average, Germans buy 12 kilograms of clothing per capita per year.

Textile manufacturing leaves behind visible traces in the environment at every stage of processing. Cotton cultivation and the processing of fibres alike pollute the air and water everywhere. The UBA is developing approaches to make textile manufacturing more environmentally friendly by introducing mandatory minimum standards in Germany and the European Union. This includes regulating how facilities are licenced on the basis of the Industrial Emissions Directive[4] as well as regulations for the European Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) directive.

However, because the majority of textile manufacturing still takes place outside of the European Union, the UBA is also promoting the application of ambitious environmental standards within the global supply chain, for example, by collaborating with Indian environmental authorities and working together with retailers and brands as well as non-governmental organisations in the Partnership for Sustainable Textiles.



Manufacturing fibres

Cotton

Cotton is a natural fibre. Worldwide, about 250 million people in roughly 80 countries make their living from farming it. In the 2013/2014 season, 25 million tonnes of cotton were grown on 33 million hectares of land.[5] But cotton farming causes enormous damage to the environment. The working conditions are tough and have considerable effects on the health of workers. The farming of this natural fibre is of the highest importance for the textile industry. However, the extremely high amount of water required for cotton production has had a politically destabilising effect in some of the farming regions in Central Asia, the Middle East and North Africa. Conflicts over natural resources are exacerbated by cotton production.

In a global context, cotton only grows on 2.5 per cent of the total surface area used for agriculture.[6] It is cultivated almost exclusively in monoculture and is therefore extremely vulnerable to pests and pathogens. Alongside a loss of soil fertility, soil salinisation, diminishing biodiversity, water pollution, contamination and long-term changes to the natural water balance, the use of pesticides is one of the most serious issues: one-quarter of the insecticides and almost 7 per cent of the herbicides used globally are sprayed on cotton fields. Although insecticides do kill all cotton pests, like the cotton bollworm, they also kill all beneficial insects. This intense use of agricultural chemicals endangers the environment and has dramatic consequences for the health of the people working in the fields. Depending on the irrigation techniques used and precipitation patterns, agricultural chemicals leach out into rivers, lakes and groundwater, poisoning insects and other creatures, as well as the drinking water of the people whose livelihoods depend on cotton. According to estimates by the World Health Organization (WHO), roughly two million people die worldwide every year after being poisoned by agricultural chemicals. It is not possible to ascertain precisely how many people involved in cotton farming are being affected. In dry areas such as China, Uzbekistan, Mali and India, the amount of water required has increased to up to 26,900 cubic metres of water per tonne of cotton. Since 1980, the Aral Sea in Central Asia, once one of the largest lakes in the world, has shrunk to 15 per cent of its original size – because its water is being used to irrigate the cotton fields.

Two-thirds of the cotton farmed worldwide has been genetically modified. The US, India and China – the main cotton farming countries – are now almost exclusively using genetically modified cotton. For example, the genes of the soil bacterium Bacillus thuringiensis (Bt) are transferred into cotton. The cotton plants are then poisonous to certain pests. But the cotton bollworm caterpillar has managed to develop resistance to this bacterium, which means that farmers now have to spray even stronger insecticides than before.

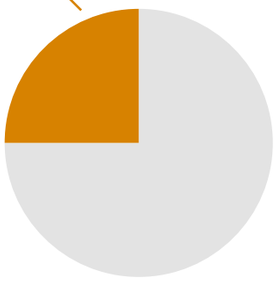
For this reason, the UBA recommends using certified organic cotton, where the use of synthetic pesticides and fertilisers is prohibited in farming, thus minimising the associated environmental damage. Organic farming also prohibits the use of genetically modified plants. In order to protect organic cotton from pests, it is farmed in rotation with other types of plants, which also improves soil fertility. Farmers use manure and compost to fertilise their fields, which increases the proportion of humus in the soil. This means that it can store more water and CO_2, and it also leads to a decrease in its vulnerability to erosion. For this reason, the UBA, together with the Blue Angel for Textiles, is calling for the farming and sourcing of natural fibres under organic conditions. Ecologically produced cotton currently only makes up 1 per cent of global production – which averages around 20 million tonnes per year.

Although other initiatives like “Cotton made in Africa” (CmiA)[7] are not yet aiming for anything as ambitious as certified organic cultivation, they are still taking steps in the right direction. Cotton made in Africa is an initiative of the Aid by Trade Foundation and is being funded by the German Federal Ministry for Economic Cooperation and Development (BMZ). Non-governmental organisations in the initiative, such as the environmental foundation World Wide Fund for Nature (WWF), work together with companies to find solutions to the environmental and social problems caused by cotton farming. CmiA provides training to teach cotton farmers about efficient and environmentally friendly farming methods. It prohibits the use of certain pesticides and the farming of genetically modified plants.

Amount of pesticides used globally

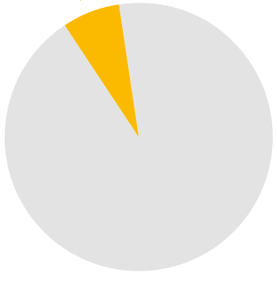
25 %

of the insecticides used globally are sprayed on cotton fields to eradicate pests like the cotton bollworm.



7 %

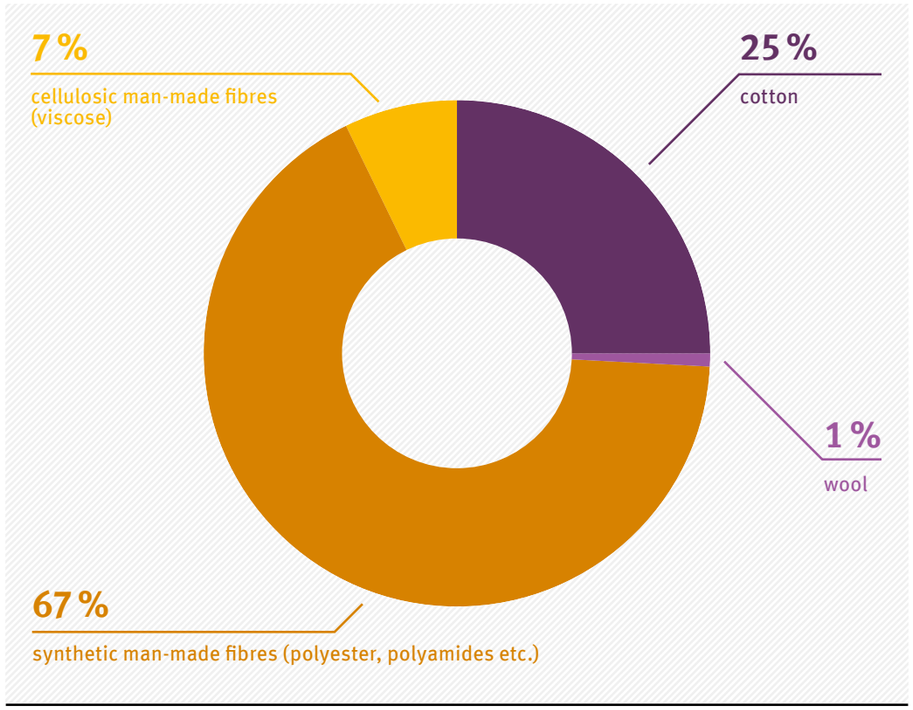
of the herbicides used globally are sprayed on cotton fields.



Cotton from organic farms is grown without using pesticides, but only has a market share of 1 per cent.

Figure 1

Global fibre manufacturing 2015



Source: Industrievereinigung Chemiefaser e. V.

Man-made fibres

Man-made fibres are much more significant than cotton in terms of volume. They make up more than 70 per cent of the global fibre market. Cotton accounts for approximately 25 per cent. Man-made fibres include synthetic fibres such as polyester, polyamides and polyacrylic fibres, as well as cellulosic fibres such as viscose.

Manufacturing these fibres also causes environmental problems. Roughly 0.8 per cent of the global crude oil extracted annually is used as a raw material. From the extraction of the crude oil up to the finished synthetic fibres, a range of manufacturing stages are required during which the environment is put under strain by effluent, energy requirements and emissions of volatile organic compounds.[8] For example, the production of adipic acid – a monomer used in the production of polyamide fibres – has a significant environmental impact. Each tonne of adipic acid produced generates on average 0.3 tonnes of the greenhouse gas nitrous oxide (NO), which is equivalent to almost 90 tonnes of CO_2. By utilising emission reduction technology, however, these emissions could be lowered by at least 98 per cent, as German adipic acid manufacturers have proved.[9] Solvents that have been classed reprotoxic, such as N,N dimethylformamide and N,N dimethylacetamide, are used during the manufacture of polyacrylic fibres. These solvents can also have an effect on the levels of exhaust emitted during the subsequent textile finishing stage.

Man-made fibres are currently the subject of a new environmental discussion. During debates about the origins of small plastic and microplastic parts found in the oceans, fleece fabrics that are used to manufacture pullovers and blankets have been identified as a possible source. Fleece fabrics[10] are a recycled product manufactured from PET bottles. Because fibres can break during wear and washing, there are fears that these microparticles are finding their way into the environment and, in the process, into the food chain, for example. However, there are currently no reliable data on this issue. The UBA believes that it is necessary to collect more precise data to find out which particles are finding their way into the environment and thus also into bodies of water, and how this is happening. If they make their way into waste water systems, microplastics – just like other particles – can be filtered out in waste water treatment plants, which is why these plants have a range of different purification stages. In order to further improve purification efficiency, the UBA is currently involved in a research project being carried out by the German Federal Ministry of Education and Research (BMBF).[11]

Manufacturing textiles

Yarn is produced from raw fibres during the spinning process. The textile industry uses methods such as weaving and knitting to manufacture textile surfaces from these yarns. Non-woven fabrics are fabrics made of fibres that are bonded together by their own adhesion to one another or by interlocking the fibres using serrated needles. The fibres and yarns are subjected to high levels of stress during the mechanical processes involved in textile manufacturing. To protect them and make them easier to process, they therefore need to be prepared using agents such as spinning oils and sizing agents.

Textile finishing refers to the stages during which colourful textiles and textiles with special characteristics are manufactured from raw textiles. Finishing can take place at a number of different stages during the manufacturing process: at the fibre, yarn, grey good or finished product stage. Finishing fundamentally comprises the main stages of pre-treatment (desizing, bleaching, washing, mercerising), dying, printing and final finishing (including bonding and coating).

During textile finishing, up to 1 kilo of chemicals can be used per kilo of processed textile.[12] This includes the use of a large array of textile auxiliaries. The International Textile Auxiliaries Buyers' Guide lists approximately 6,500 commercial products manufactured using 400 to 600 active substances. A large number of textile auxiliaries end up in waste water. Some of these substances are not easily biodegradable and can only be removed in biological waste water treatment plants to a certain extent. This is why in some countries, such as China and India, these chemicals end up in the rivers, as the waste water treatment is often insufficient or waste water is not treated at all.

Some of the chemicals – such as nonylphenol ethoxylates (NPEs), perfluorinated and polyfluorinated compounds, and some phthalates – are substances of high concern. NPEs are broken down in waste water treatment plants into nonylphenol, which can accumulate in the environment. It is considered to have hormonal effects: it can cause malformations in the reproductive organs of fish, thereby having an impact on their procreation. In higher concentrations, nonylphenol can stop male fish from growing. In Germany, the industry adopted a voluntary agreement to stop using NPEs in cleaning agents and as auxiliary agents in 1992. Its use in the EU textile and leather industries has been restricted since 2005. In 2013, the EU put NPEs on the REACH list of substances of very high concern (SVHCs). However, these substances can still be found in imported goods and in bodies of water today. In 2021, a regulation restricting the NPE content in textile products to less than 0.01 per cent will come into effect, which will also cover imported goods. The EU Commission is currently working on further restricting the use of substances with problematic properties in textiles.

Performance textiles, which are also manufactured using SVHCs, are being increasingly used in the manufacturing of sports and outdoor attire. In a number of studies conducted on outdoor jackets, Greenpeace and the UBA found perfluorinated and polyfluorinated chemicals (PFC), which evaporate and are emitted by the jackets. These chemicals remain in the environ-

Up to one kilo chemicals are used in processing one kilo of textiles.

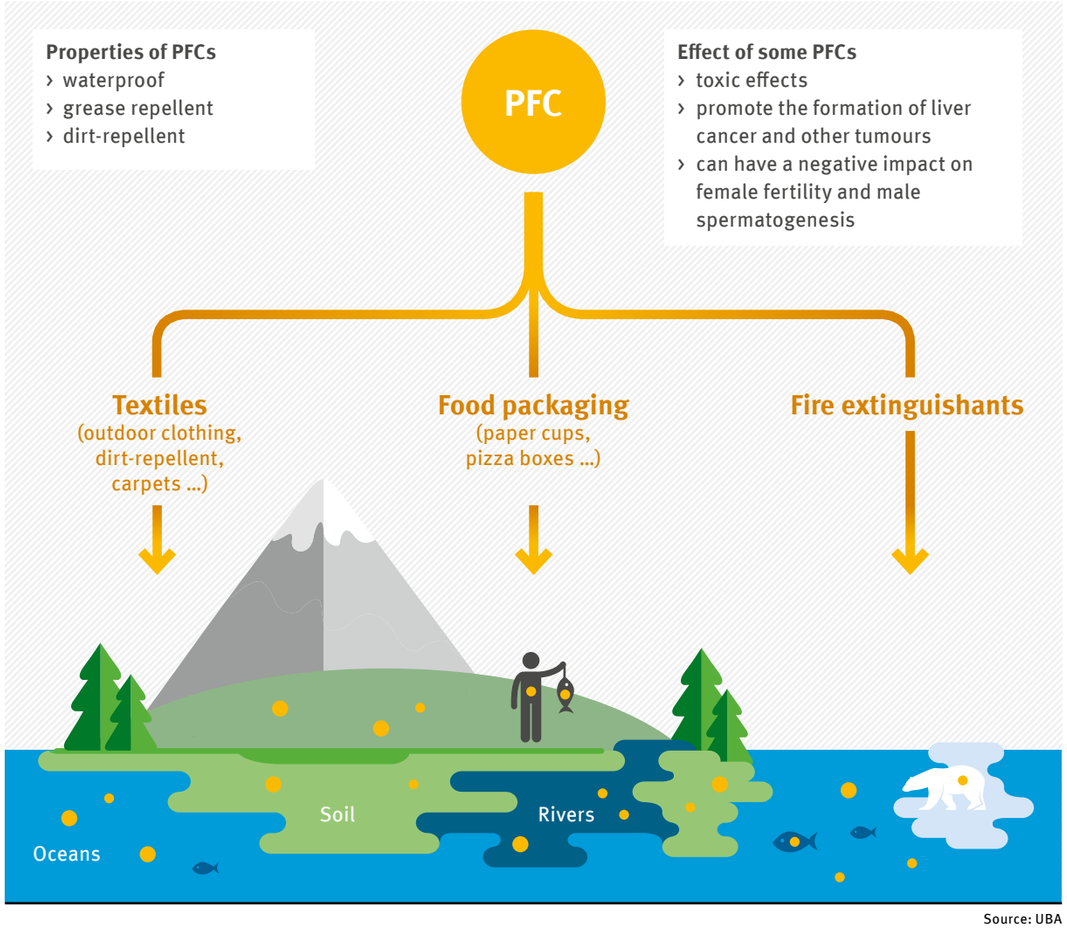
ment permanently. Some PFCs are a danger to human health and accumulate in organisms.

PFCs are found above all in stain-resistant and waterproof clothing. The UBA advises purchasing PFC-free jackets[13], because high-tech materials with extreme functionality are not necessary for everyday use. Do you really need a jacket that would be suited to an Arctic expedition for a stroll through town? However, everyday textiles can also contain PFCs, because PFCs are not just used to manufacture outdoor textiles. Other textiles that have waterproof and dirt-repellent qualities can also contain PFCs. There is a wide range of applications for PFCs, from tablecloths and cushion covers to protective work clothing.

Phthalates are added to polyvinylchloride (PVC) as a plasticizer and are found primarily in PVC textile prints, in rainwear and in faux leather. But many of these plasticizers behave like hormones and can harm reproduction. The use of certain phthalates in children's toys and products is now regulated by EU directives. On the other hand, they are still often used in artificial leather, which is used in manufacturing children's shoes, for instance. Phthalates are used in concentrations of 20 to 30 per cent of the PVC weight. For this reason, the UBA advises consumers against buying clothing that contains PVC.

Figure 2

PFCs – of very high concern and found everywhere



Source: UBA

Harmful PFCs often make their way into the environment via rainwear.

A clean textile industry

Chemicals legislation

The European chemicals regulation REACH aims to protect people and the environment from harmful chemicals. It regulates the use and marketing of all chemicals in the EU. For the first time, REACH is recording all of the chemicals that can be found in the market as well as their properties. In future, this will enable REACH to provide a systematic understanding of the impact chemicals have on people and the environment.

REACH
Registration Evaluation Authorisation and Restriction of Chemicals

As mentioned, large amounts of various, sometimes very poisonous or long-lasting chemicals are used during textile manufacturing. “Fast fashion” reinforces this effect. There is a clear correlation between the textiles we buy on the one hand, and chemical consumption and the release of chemicals into the environment on the other.

REACH gives all citizens the right to inform themselves about SVHCs in a range of different products. The list of SVHCs now includes 169 different substances, such as phthalates, alkylphenol ethoxylates and perfluorinated compounds.[14] If you want to avoid buying clothing that contains chemicals like these, you can direct an enquiry to the manufacturer or retailer. The right to information applies as soon as the concentration of particularly alarming chemicals in the product exceeds 0.1 per cent by weight. The enquiry must then be answered within 45 days.

The UBA provides assistance in making such enquiries on its website and is currently developing an app that consumers will be able to use to make enquiries more easily and quickly.[15] Thanks to this right to information, it is now possible for the first time for consumers to consider a product’s chemical impact when they are making purchasing decisions and thus to send a signal in favour of products that are free of SVHCs.

Industrial legislation

The Industrial Emissions Directive sets the leading environmental standards in the European Union for industrial manufacturing – and thus for textile manufacturing too. The directive lays down the basis for approving environmentally relevant industrial plants. It aims to prevent and minimise environmental pollution by applying the best available techniques (BATs).

Member states, industry and environmental groups exchange information in order to work out BATs for each of the industries concerned, which are then laid down in BAT reference documents.

The UBA is actively involved in this European exchange of information and the creation of BAT reference documents. BAT reference documents provide a detailed collection of information about all processes and techniques in each industry. At the same time, they investigate their environmental impacts and provide information about techniques that can contribute to the reduction and prevention of emissions. The BAT reference document for the textile industry mainly deals with textile finishing (pre-treatment, dyeing, altering fibre properties). It contains detailed information about roughly 130 techniques that can be used to reduce the textile industry’s impact on the environment.

Provided that no stricter national regulations are already in force, the BAT conclusions are implemented in subordinate regulations in Germany, in particular in the technical instructions for air quality control (TA Luft) and in waste water regulation (Abwasserverordnung). These regulations provide general and consistent limits on air and water emissions. They take the information from the BAT reference documents into account directly.

The BAT reference document for the textile industry was published in 2003. The EU Commission is planning to begin work on the new edition of the BAT reference document in 2016.

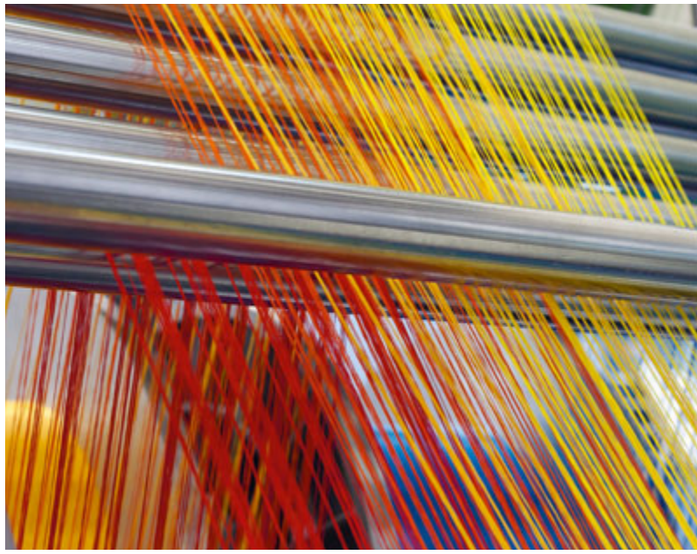
Collaboration with India

Further developments in environmental standards have significantly increased the quality of our environment – and our quality of life too. For example, environmental conservation measures taken in the textile industry have contributed to considerable improvements in water quality in the past. But hardly any such improvements have been made in developing and newly industrialised countries – the main manufacturing locations for environmentally relevant processes in the textile chain. This is why the UBA is now supporting the implementation of advanced environmental standards in countries like India, in order to significantly reduce global environmental harm. Within this context, the UBA is campaigning for stakeholders to exchange information on BATs and to use BAT reference documents to set environmental standards.

In 2012, the UBA signed a cooperation agreement with the environmental authority of the Indian state of Gujarat that aims to help the authorities there to carry out a similar information exchange on BAT for the first time. The UBA experts realised during their visits to Gujarat that the national limits – for example, for waste water – are very demanding and are in many cases all but impossible to achieve using existing technology. With so many companies, it is almost impossible for authorities to monitor every single one. This is why all stacks are monitored online using cameras. However, it is not clear how this data is being assessed. Companies often lack specialist personnel capable of analysing waste water samples, for instance.

A huge obstacle to making any improvements is a lack of trust between companies and authorities. An organised exchange of information between authorities, industry and non-governmental organisations has never taken place. However, this will be the basis for improving the situation by taking a constructive approach to finding solutions to problems step by step.

The first successful effects of this long-term collaboration can already be felt: authorities and the textile industry have begun exchanging information and working on a joint understanding of BAT, and mistrust is being tackled. This means that the basic preconditions have been created for improving relationships in this industry.



The UBA is promoting the implementation of advanced environmental standards in India.

BAT guidelines

As “advertising” for BAT, the UBA has developed the “Environmental Standards in the Textile and Shoe Industry” guidelines together with a number of retail and brand companies as well as non-governmental organisations.[16] These guidelines identify specific savings potential for all relevant resources and shows that the application of BATs does not necessarily mean high investment costs or huge efforts on the part of staff. In particular, small and medium-sized enterprises (SMEs) with low environmental standards can take simple measures to considerably improve their environmental footprint. For example, good management alone – including staff training and regularly maintaining operating facilities – can lead to an immediate increase in resource efficiency during manufacturing and can cut considerable costs in the process. In order to simplify the application of BATs, the UBA has created checklists on the basis of the BAT reference documents[17]. By using these checklists, manufacturers and external consultants can find out which of the measures to reduce their impact on the environment they have already taken and where they have room for improvement. Together with the “Environmental Standards in the Textile and Shoe Industry” guidelines, these checklists are a joint offering of information and support for the textile industry’s supply chain.

Manufacturing

When the Rana Plaza – an eight-floor sewing factory in Sabhar, about 25 kilometres away from the Bangladeshi capital of Dhaka – collapsed on 24 April 2013, it sparked a global debate about working conditions in the textile industry. It seemed that the reinforced concrete building had been built using low-quality materials. The ground was unsuitable for such a tall building, and there were not enough escape routes for people to leave the building quickly. On 23 April, cracks had already been discovered in the building, and the police had forbidden access to it. But more than 3,000 young people were working in the Rana Plaza when it collapsed. A total of 1,127 employees were killed during the accident, and 2,438 were injured.[18]

The Textile Partnership

In reaction to Rana Plaza, Federal Minister for Economic Cooperation and Development Gerd Müller initiated the Partnership for Sustainable Textiles. The goal of the partnership is to constantly improve social, ecological and economic sustainability throughout the textile chain. Two years after it was founded, about half of the German textile industry had joined. Non-governmental organisations such as Oxfam and Inkota are working with authorities

like the UBA, standards organisations like the Global Organic Textile Standard (GOTS) and the industry to introduce practical measures to promote sustainable textile manufacturing. In order to implement these measures, every member is currently developing its own specific implementation plans and time frames. This is the beginning of the step-by-step implementation of the partnership's goals. The UBA is contributing its experience to the drafting of implementation requirements.

The UBA regards the Textile Partnership as a great opportunity to make far-reaching improvements to general conditions in manufacturing countries. The partnership has the potential to help the industry to face challenges more effectively and to utilise synergies in joint local projects.

Member of the Partnership for Sustainable Textiles

Socially and environmentally – we're on our way

Member of the Partnership for Sustainable Textiles
Socially and ecologically – we are on our way.

Sustainable fashion is now available in cool too.

Moreover, the Textile Partnership aims to set up international partnerships in order to increase its effect on the textile manufacturing chain. During the 2015 G7 summit in Elmau, the seven most important industrial countries in the western world agreed to work on boosting the sustainability of all globally traded products throughout the supply chain. The European Union wants to set up a textile trailblazer initiative. The members of the Textile Partnership hope to find ways to get the partnership suitably involved with these international initiatives.

The public procurement of sustainable textiles could make a substantial contribution to its practical implementation. On average, the German Federal Government spends almost EUR 105 million on textile products every year. The largest proportion of this at EUR 95.7 million goes to clothing. Furniture with a textile component, such as seating, accounts for roughly EUR 5 million. The Federal Government aims to source at least 50 per cent of its textiles (excluding special textiles such as protective clothing) according to ecological and social criteria by 2020. Labels such as the Blue Angel, the EU Ecolabel, GOTS and Fairtrade play an important role in this respect. The next bulk order for Bundeswehr or federal police uniforms could then meet sustainable criteria. The market power of the public authorities can be leveraged in this way to sustainably reconfigure the textile chain.

Both the eco labels and the social labels can also be important guides for procurement in the textile retail sector, making it easier for retailers to measure up to their responsibility for the entire textile chain. Until now, retailers have often had little knowledge about their producers and have seldom reviewed manufacturing conditions. But not every label lives up to its promises. As a result, the BMZ has commissioned Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) to develop the portal Siegelklarheit.de.[19] In comparison with other label portals, it provides access to more far-reaching information. All relevant Federal Government departments are involved in compiling label assessments. The Federal Government also supports some labels directly. The oldest and most well-known is the Blue Angel, which was introduced in 1978. The development of criteria specific to each of the product groups is a task that has been handed over to the UBA. The EU Ecolabel was started by the European Commission. In Germany, the UBA is utilising its expertise to help the EU make labelling decisions.

Used textiles

The German Waste Management Act (Kreislaufwirtschaftsgesetz) defines used textiles from containers or street collections as waste. Collectors sort the collected used textiles manually based on need, purpose and quality. Of used textiles, 54 per cent are reused in their original form; for clothing, this figure is as high as 72 per cent. The amount of used textiles collected exceeds the need for social purposes in Germany many times over. Items of clothing that are given to non-profit collectors are therefore sold on to sorting plants. Many non-profit collection agencies use the profits to carry out their social work. Excess textiles are marketed worldwide, with Asia, Africa and Eastern Europe the preferred markets. A total of 44 per cent of used textiles are sold in Europe and the former Soviet Union; 28 per cent go to Africa, and 10 per cent to India and Pakistan.[20]

Sometimes there is a lack of transparency about the collection of used clothing. For this reason, consumers should make sure that collection agencies can be identified. Serious collection agencies should provide transparent information about what happens to both used clothing and profits. Caution is advised in the case of collections where the collection agency cannot be identified or if only a mobile telephone number is provided. These collections could be illegal, and it cannot be verified that the used textiles are being processed in an environmentally friendly way.
One guide for identifying serious collection agencies is the symbol of the umbrella organisation FairWertung e.V. Municipal waste authorities provide information about which local collection sites and containers are serious, who is carrying out the collections and how the used clothing collected is recycled afterwards.[21]

What can consumers do?

The mass production of clothing has a huge, negative impact on the environment and on social structures in manufacturing countries. And despite the Rana Plaza tragedy and occasional reports on the consequences of cotton farming, consumers in Germany are hardly aware of how much environmental destruction and injustice they are buying into with a cheap (or sometimes even an expensive) item of clothing. People who want to do something good for the environment through how they dress should therefore switch from fast fashion to slow fashion – and start wearing clothes longer. Buying fashion in second-hand stores is also a good idea from a sustainability point of view, as it also extends the 'lifespan' of clothes. Other possibilities include clothes swapping – which is becoming increasingly popular among young people – making clothing yourself or sometimes even just getting it repaired more often.[22] It also helps to buy clothing that was produced under sustainable conditions. Environmental labels can provide guidance when making purchasing decisions. At Siegelklarheit.de, consumers will find label recommendations.

In 2012, the German Federal Ecodesign Award was initiated by the Federal Environment Ministry, the UBA and the Berlin International Design Centre. The Ecodesign prize recognises products, services and concepts that are of the highest ecological and design quality (see also

the section on “Sustainable consumption”). In the last few years, these have also included excellent, trend-setting prize winners from the fields of fashion and textiles.[23] In 2012, the Berlin label “Bis es mir vom Leibe fällt” received the award. The company repairs and redesigns clothing, thereby contributing to a longer product lifespan. In 2013, Pyua Ecorrect Outwear was awarded the prize. The Kiel-based company manufactures skiing attire without using harmful PFCs. In order to waterproof its clothing, the company uses a polyester laminate waterproofing agent. The repair service it offers also extends the product’s lifespan. In 2014, the Federal Government honoured “Wunderwerk”, a design label that consistently uses ecologically produced materials. “This is one of the few absolutely ecological fashion collections that has made it to large-scale production,” the jury said in praise of the company. And in 2015, the jury ultimately awarded two prizes to initiatives in the field of fashion. One went to Engel Sports performance clothing, which is made of a wool-silk fibre mix and is manufactured by Engels Sports GmbH in the Swabian Jura. The other prize went to the fashionable and environmentally friendly F-ABRIC collection by the Swiss company FREITAG.

So it is possible to wear clothing that protects the environment. But the same applies to sustainably produced clothing as it does to all clothing: please wear your clothing for as long as possible. Even sustainable clothing can put unnecessary strain on the environment if it is thrown away soon after – in the worst case, unworn.

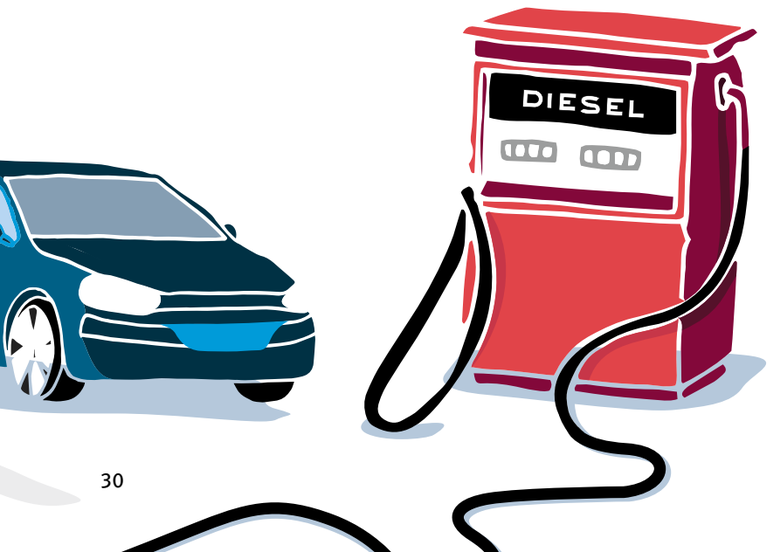
Performance clothing that
does not contain harmful
PFC compounds is also available.

1 Karl Marx / Frederick Engels – Collected Works. Progress Publishing, Moscow. Volume 2. Frederick Engels 1838-1842. Moscow/USSR. 1975 p. 7.
2 Joint Declaration of Intent for promoting the Best Available Techniques (BAT) not entailing excessive cost. German Environment Agency, Gujarat Pollution Control Board, Gesellschaft für Internationale Zusammenarbeit, 2013.
3 According to information supplied by the German Textile+Fashion Confederation.
4 https://www.umweltbundesamt.de/themen/wirtschaft-konsum/beste-verfuegbare-techniken/industriee-missions-richtlinie
5 https://baumwollboerse.de/2014/07/02/jahresbericht-2013-baumwolle-eine-weltumspannende-faser/
6 Pesticide Action Network. Konventioneller Baumwollanbau. Problematisch für Mensch und Umwelt, Hamburg, no date.
7 Cotton made in Africa, http://www.cottonmadeinafrica.org/de/
8 German Environment Agency: Integrierte Vermeidung und Verminderung der Umweltverschmutzung. Referenzdokument über die besten verfügbaren Techniken für die Herstellung von Polymeren, Dessau 2006.
9 Berichterstattung unter der Klimarahmenkonvention der Vereinten Nationen und dem Kyoto-Protokoll 20166 National Inventory Report for the German Greenhouse Gas Inventory 1990 - 2014, Climate Change series 02/2016, German Environment Agency, Dessau. ISSN 1862-4359.
10 UBA-Koordinierungsgruppe “Kunststoffe in der Umwelt“. AL talk 16 March 2016: Kunststoffe in der Umwelt. Fakten und Herausforderungen.
11 http://www.siwawi.tu-berlin.de/fileadmin/fg118/bilder_team/20160520_Poster_IFAT_OEMP_A4_ven_final.pdf
12 BAT reference document for the textile industry.: http://eippcb.jrc.ec.europa.eu/reference/BREF/txt_bref_0703.pdf
13 UBA tests outdoor jackets: Weather-proofing is harmful to waters, 2014. https://www.umweltbundesamt.de/en/press/pressinformation/uba-tests-outdoor-jackets-weather-proofing-is
14 http://echa.europa.eu/en/candidate-list-table
15 German Environment Agency: https://www.umweltbundesamt.de/themen/chemikalien/chemikalien-reach/reach-fuer-ver-braucherinnen-verbraucher
16 German Environment Agency: Environmental Standards in the Textile and Shoe Sector. A guideline on the basis of the BREFS – best available techniques reference documents of the EU. Dessau, 2011.
17 Checklist based on best available techniques in the textile industry. Dr. Norbert Reintjes GmbH Institute for Environmental Strategies, Hamburg Dr. Claudia Schafmeister CS Research, Dachau Ismene Jäger Hydrotox GmbH, Freiburg on behalf of the German Environment Agency, Dessau 2011.
18 Rana Plaza three years on. Clean Clothes Campaign, http://www.cleanclothes.org/news/press-releases/2016/04/22/rana-plaza-three-years-on
19 Portal Siegelklarheit. https://www.siegelklarheit.de/home
20 Julia Korolkow: Konsum, Bedarf und Wiederverwendung von Bekleidung und Textilien in Deutschland, im Auftrag des bvse-Bundesverband Sekundärrohstoffe und Entsorgung.
21 https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/uba_abfall_web.pdf
22 Greenpeace: Wegwerfware Kleidung Repräsentative Greenpeace-Umfrage zu Kaufverhalten, Tragedauer und der Entsorgung von Mode, Hamburg 2015.
23 Ecodesign Prize: prize winners, https://www.bundes-preis-ecodesign.de/en/wettbewerb.html

Money and the environment

A flight to Barcelona for EUR 20, a kilogram of pork for EUR 3 – we're still miles away from full ecological prices. This might cost us dearly in the future. What should the state do?

If companies and consumers were charged for all of the consequences of their actions, we would not be in the midst of a global environmental crisis. Neither industrialised nations nor most industrialising and developing countries would be faced with the challenge of having to adapt their economic activity to observe ecological limits. Although there have been significant reductions to much of the immediately visible environmental damage in Germany since the introduction of systematic environmental policies almost half a century ago, dominant patterns of production and consumption are still a threat to both people and the environment. In many places, lakes, rivers, groundwater, oceans, soil and terrestrial ecosystems are being overstrained by nutrients, primarily from agriculture.[1] Emissions, predominantly from diesel-fuelled cars, are causing nitrogen oxides in concentrations dangerous to health to make their way into the air in urban areas.[2] The state of biodiversity is "alarming", as is that of the forest, even today.[3] The amount of space dedicated to human settlement and transportation is growing, more commodities are being consumed than around ten years ago, and waste is piling up.[4] Meanwhile, emissions of greenhouse gases are only falling slowly. In 2015, they once again even increased somewhat.[5] German citizens emit twice as much CO_2 per capita as the global average[6] – multiple times the amount that would be sustainable to contain global warming.



The climate crisis demonstrates the dimensions of global environmental destruction. However, it is not the only expression of overstrain. Three further planetary limits have also been exceeded by human impact:[7] together with climate change, the extinction of species, land use and alterations to the cycle of matter are threatening the conditions for life on earth.

Global overexploitation also has consequences for domestic policy. Environmental policy cannot be allowed to simply act as society's repair service; it has to fight to restructure our economy both ecologically and socially. Transforming our economy into a green economy means ensuring that we remain within ecological limits. It is about preventing harmful emissions and pollution and achieving a circular economy that is based exclusively on renewable energies, which reduces the amount of resources consumed in absolute terms and preserves biodiversity and ecosystems.[8] Since the financial crisis and preparations for the 2012 Rio+20 conference, the green economy model has gained in political significance. The challenge now is to develop the economic regulatory framework in such a way that, in future, producers, consumers and the state can manage their affairs in a way that is climate-friendly, keeps emissions low and does not consume extensive resources.

The state has to send signals and act as a role model through its procurement and infrastructure policies, for example. But critical leverage must come from ecological financial reform that ensures prices that tell the ecological truth. This requires two things: the internalisation of environmental costs and dismantling environmentally harmful state subsidies.

Climate change can lead to more frequent heavy rainfall.

Dismantling environmentally harmful subsidies

In December 2015, the 21st Conference of the Parties of the Framework Convention on Climate Change in Paris passed a resolution to keep global warming "well below two degrees" above pre-industrial levels. In spite of this, patterns of production and consumption that harm the climate are still being subsidised on a large scale – worldwide. According to current estimates by the International Monetary Fund (IMF), tax concessions and direct transfers for fossil energies alone add up to USD 646 billion,[9] which results in the massive misallocation of capital.

Environmentally harmful subsidies in Germany

There are a large number of environmentally harmful subsidies available in Germany too, even though environmental conservation has been one of the most important issues for the German population for years now. According to the UBA report "Environmentally Harmful Subsidies in Germany", the government rewarded environmentally harmful activities with more than EUR 52 billion in 2010. Because the report only takes into account the Federal

Government's most important environmentally harmful subsidies, which are not always possible to quantify, their actual volume could be considerably higher. These are accompanied by environmental costs that have not or have only been insufficiently internalised, which additionally facilitates environmentally harmful behaviour.

Almost 50 per cent of environmentally harmful subsidies flow into the transport sector, with EUR 7 billion for kerosene tax exemptions alone and almost EUR 8 billion for diesel fuel, which, due to its higher energy content, releases more CO_2 per litre than petrol fuels.

Companies in the manufacturing and extracting industries and in the agriculture sector enjoy energy taxation benefits on a similar scale. The latest subsidy report by the Federal Government shows that the general tax benefits for electricity and energy tax in 2014 ran to EUR 1.2 billion. This is accompanied by a peak equalisation scheme for eco tax totalling EUR 2.2 billion.[10] In contrast, the federal funds allocated to the promotion of energy-efficient renovations in 2014 were downright modest at just EUR 1.1 billion.

Energy tax exemptions were introduced in order to avoid endangering companies' international competitiveness. But the costs per unit for energy in the manufacturing and extracting industries in Germany (energy costs in relation to gross production value) are low compared to other European countries.[11] In addition, cost differences due to different environmental standards only have a minimal impact on trade and do not destroy value creation chains[12], unlike what the interested parties claim.

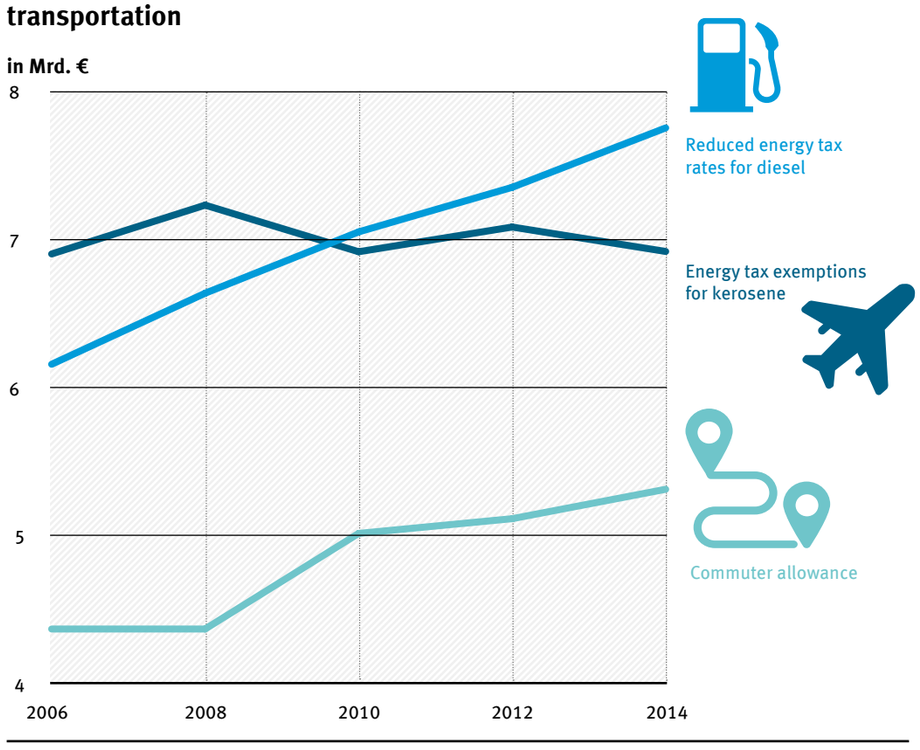
In spite of this, German tax law still gives preferential treatment to companies that neither conduct their business particularly efficiently with regard to energy costs nor compete internationally.[13] Revenue authorities thus unnecessarily minimise the economic incentives to invest in increased energy efficiency. Ultimately, without an increase in energy efficiency, the energy transition will fail.[14] In 2035, power savings alone could achieve cost reductions of between EUR 10 and 20 billion in Germany. Even at energy-intensive companies, there are still potential for efficiency to be tapped. This is why this exceptional state of affairs must be reversed step by step in order to focus on a smaller group of exemptions and to ultimately replace them with regulations for cases of hardship.

Paths that can be taken to dismantle environmentally harmful subsidies

Dismantling environmentally harmful subsidies would relieve public budgets, giving rise to more financial leeway to promote more environmental conservation and climate change mitigation measures. Moreover, groups with lower incomes

Figure 1

Development of the three largest environmentally harmful subsidies in transportation



Source: UBA

that might be burdened by the transition to full ecological prices could receive financial aid. It would also be conceivable to utilise additional revenues for other important social goals, such as education. Or there could even be tax cuts.

The systematic dismantling of environmentally harmful subsidies requires environmentally oriented controlling that examines all subsidies and identifies (side) effects that are harmful to the environment. This kind of controlling would also need to investigate whether there are still areas pertaining to the funding objective that require funding, and whether there are potentially more suitable alternative instruments.[15] Recommendations for a more environmentally friendly subsidy policy would then have to be developed on this basis.

The Federal Government took a first step in this direction in January 2015 by passing a resolution to investigate subsidies in relation to whether or not they comply with the objectives of sustainability. In the 25th subsidy report in September 2015, the 63 financial aid programmes and 100 tax rebates examined were evaluated on the basis of the National Sustainability Strategy for the first time. This was a step in the right direction. However, the methods and procedures involved in the sustainability assessment need to be improved. Firstly, all negative environmental impacts should be identified on a scientifically sound basis and described in the subsidy report. The Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) should be in charge of this due to its staff's specialist expertise. In this way, conflicts of interest and specific approaches toward reforming environmentally harmful subsidies could be identified. Secondly, alternatives need to be assessed, as there is sometimes potential for eliminating or at least minimising negative environmental impacts by restructuring subsidies. One example is tax rebates for agricultural diesel – if they were granted on a flat-rate basis depending on agricultural acreage, there would be no more negative ecological incentive effects. And, thirdly, it is essential to address further subsidies. For example, neither the company car privilege nor the kerosene tax exemption for international aviation is included in the Federal Government's subsidy report at present.

Rapid action is needed to dismantle subsidies that are harmful to the climate, as the lower oil price is additionally curbing the profitability of investments in efficient and renewable technologies. In light of comparatively low market prices for petrol and fuel oil, subsidies for fossil energy sources could also potentially be dismantled without any great impact. [16] The Federal Government has also given to its word in this respect on an international scale: since the summit meeting in Pittsburgh in 2009, the state and government heads of the G20 countries have repeatedly promised to dismantle the "inefficient subsidisation of fossil fuels".

Electricity generated from coal is particularly harmful to the environment.

In order for the Federal Government to walk the walk, it needs to create a national roadmap for the dismantling of environmentally harmful subsidies. Provided that it can be legally implemented on a national level, one-third of all environmentally harmful subsidies could expire or be restructured in a way that they no longer have any fundamentally negative environmental impacts by the end of the next legislative period, at the latest, with the rest set to follow by 2025. In addition to this, the Federal Government needs to advocate the abolition of all regulations on an EU and international level that impede the dismantling of environmentally harmful subsidies. This also applies, for instance, to the tax exemption for kerosene in international aviation. On an EU level, progress needs to be made in the abolition of the EU-wide value-added tax exemption for international flights and the reform of EU agricultural policy. It is also necessary to dismantle environmentally harmful energy tax concessions by appropriately reforming EU energy tax guidelines.

Calls to dismantle environmentally harmful subsidies are not new, but their impact has so far been moderate.[17] This must change if we do not want to accept the failure of climate change mitigation goals. It is encouraging that many institutions are increasingly standing up for the dismantling of environmentally harmful subsidies, including the EU, the Organisation for Economic Co-operation and Development (OECD), the World Bank and the IMF.

Air pollution makes people ill – and society bears the cost.

Internalisation of environmental costs

The central mechanisms that drive our economy are prices and costs. People produced and sell goods, such as electricity, in order to create an individual "value added". The producer procures raw materials, employs people and converts coal into electricity at a power plant because it hopes to make profits – while consumers pay the price of electricity more or less willingly because the benefit of operating their coffee or washing machine outweighs the pain of paying the bill. However, the generation of electricity causes damages for which neither the electricity producer nor the consumer of the electricity have to answer: dirty air makes people sick, fauna and flora are endangered and species are going extinct, buildings are damaged, and even the global climate is being threatened. These too are costs. They are known as "external costs", because those who cause them are not held to account. They are therefore not or only insufficiently taken into consideration when people make decisions about production and consumption.

This "flaw" in the market mechanism leads directly to environmental destruction, as it distorts competition in favour of environmentally harmful products and production processes, and sends the consumer a false price signal that does not take into account the social costs of production that arise from environmental damage. It is not just a minor blemish, as claimed by the Federal Ministry of Economics almost a quarter of a century ago. It is a "massive misallocation that affects the core of a market economy's claim to efficiency" and, on top of that, sets a "hidden process of collective expropriation" in motion.[18]

In fact, "the world's natural capital has been experiencing annihilation on a large scale" for a long time now.[19] People sacrifice natural assets in their pursuit for income increases amounting to a few tenths of a percentage point, which, on top of this, is being increasingly unfairly distributed, and creates costs and welfare losses in other places.[20] In 2015, the IMF quantified the external environmental costs of energy use alone at roughly USD 4.7 trillion.[21] In 2006, Nicholas Stern called climate change "the greatest market failure the world has ever seen".[22] If the polluters had to pay for the damage they cause to the environment, many business models would prove to be unprofitable.[23] The fact that the victims of environmental destruction are predominantly members of poor demographic groups which do not have enough purchasing power to evade noise pollution, air pollution or the consequences of global warming that are already being felt today makes the ecological crisis an issue of justice as well.

This flaw could be minimised if the external costs were "internalised", i.e. charged to those who cause them. Then producers would not just have to pay for wages, raw materials and loans, but also for the environmental damage they cause. This could be achieved by taxing environmentally harmful activities, for example, or by making companies purchase emissions certificates. This "polluter principle" has been the Federal Government's official guiding policy principle since the first environmental programme in 1971.[24] At 8.9 per cent, however, the revenue from environmental tax in Germany made up a lower proportion of total tax revenue in 2014 than in 1995. This shows how large the implementation deficit still is.[25]

Calculating environmental costs – the first step to internalisation

The truth is always objective. Those who want to write the environmental invoice have to know and name the costs of damage.[26] Firstly, there are the costs of all of those measures that have to be taken to directly remedy or limit damage, such as water treatment costs or medical treatment costs. Secondly, there are the indirect costs that are incurred by reacting to an adverse effect, such as the installation of soundproof windows. Thirdly, there are preventative costs, such as the costs of flood protection. And, finally, the costs of unavoidable damages to the environment and human health need to be taken into account. In principle, this can all be calculated.

But actually determining environmental costs is a difficult business. How much of which substance is being emitted? How many people are exposed to pollutants? How can we assess damages that won't occur until the future – or in the far corners of the globe? These are just some of the questions that need to be answered. For this reason, the UBA has developed a Methodological Convention that makes it possible to calculate environmental costs using consistent and transparent criteria in line with the latest scientific findings. This convention identifies both the benefit of environmental policy measures as well as the costs of failing to protect the environment.

For greenhouse gases, for example, the UBA recommends that the average climate cost for the emission of 1 tonne of carbon dioxide be set at EUR 80. This is many times the amount that the certificates of the European Emission Trading Scheme specify, which already reveals the enormous amount of action that needs to be taken to internalise environmental costs.

Greenhouse gases are not the only emissions that incur environmental costs. Others involve significantly higher costs per tonne. For example, an EU project has calculated the costs for fine particulate matter and mono-nitrogen oxides (NO_x). The latter causes costs of EUR 15,400 per tonne. With emissions of more than 1.2 million tonnes in Germany, the NO_x costs alone add up to annual damages of almost EUR 20 billion.

Calculating environmental costs shows that neglecting to take environmental action is more than just a pardonable shortcoming. In the end, it results in a huge environmental bill to pay that curtails prosperity. According to estimates by the UBA, the costs incurred from emissions of air pollutants and greenhouse gases in German electricity generation alone added up to more than EUR 47.3 million in 2014. That is more than twice the amount of the additional costs created by expanding renewable energies within the scope of the German Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, or EEG), the scale of which is often cause for complaint. This is accompanied by the environmental costs of road traffic (EUR 52.2 billion) and heating (EUR 30.6 million). All in all, this adds up to EUR 130.1 billion, which is roughly 4 per cent of the gross domestic product (2015: EUR 3,025.9 billion), which does not include a number of environmental costs, such as those incurred due to water pollution, impaired ecosystem performance or the extinction of species.

Environmental costs and their internalisation in selected fields of action

Electricity generation

Most CO_2 is emitted during the generation of electricity. The amount of the climate costs incurred by electricity generation and refining alone runs to roughly EUR 27 billion annually. However, different amounts of CO_2 are produced per kilowatt hour (kWh) depending on the energy source being used. Electricity generated using hydropower, wind power and solar power is barely reflected in this calculation, and electricity generated using biomass incurs climate costs of barely EUR 0.0107 per kWh.

This is a mere fraction of the climate costs incurred from converting lignite (EUR 0.0868 per kWh) or coal (EUR 0.0738 per kWh) into power. Moreover, the environmental costs incurred due to the air pollution emitted while converting coal into energy are much higher than those incurred by generating electricity using wind or solar power.

However, the use of lignite and coal is not taxed, and emissions trading only charges energy producers with a fraction of their environmental bill. Coal mining will continue to be subsidised until 2018. Despite popular opinion, lignite is not an unsubsidised source of energy either. This massively distorts competition at the expense of environmentally friendly natural gas power plants and makes it necessary to promote renewable energies. If prices were calculated using environmental full-cost accounting, electricity generated using land-based wind power and solar power would already be competitive.

Coal power needs to be completely abolished in Germany in order to reach long-term, domestic climate change mitigation goals – i.e. reducing greenhouse gas emissions by 80 to 95 per cent by 2050 relative to 1990 and making a satisfactory contribution to global climate change mitigation. This is why there must be an end to coal subsidies and the introduction of a statutory time frame for phasing out fossil fuels. The German and international financing of coal projects in other states must also be abandoned[27], as such activity contradicts the commitment made by the treaty partner states in Paris to end climate change. There urgently needs to be an examination of the ways in which inevitable structural transformation in the German regions affected can be carried out in a way that is socially just and how energy supply in other countries, for instance in developing countries, can be organised in a way that is climate-friendly from the very beginning.

Heating buildings

Roughly 20.7 million central heating systems ensure that our homes are warm in winter too. There are also 10 million single-room fire places, most of them free-standing stoves.[28]

Every fossil-fuelled heater emits substances such as particulate matter, nitrogen oxide and sulphur dioxide. In addition to this, heating produces large volumes of carbon dioxide – around 85 million tonnes in 2014.[29] The social costs incurred by heat generation primarily depend on the energy source being utilised. Heating with coal, oil or gas creates significantly more pollution for the environment than heating with renewable energies. However, heat generation using biomass creates more or less greenhouse gas emissions depending on whether wood, vegetable oil or biogas is used. Electric heat pumps are important, forward-looking heating systems. They significantly decrease strain on the environment when the electricity they generate is sustainable – in other words, when it is generated completely from renewable sources.

Wood heating is currently experiencing a renaissance, as this renewable fuel is considered climate-neutral and the warmth from wood stoves particularly pleasant. However, wood-fired furnaces can contribute up to 25 per cent of the total amount of fine particulate matter pollution in the winter months. The emissions from wood heating thus exceed the amount of fine particulate matter emitted by road traffic exhaust fumes in winter.[30] In the last 20 years, comparatively environmentally friendly natural gases have replaced the dirtier energy sources coal and oil in the heating market. Today, almost every second home is equipped with a gas heater.[31] This is accompanied by a growing number of entirely or partially regenerative heaters, albeit on a small scale. These positive developments have begun faltering recently due to a drop in the oil price. Comparatively environmentally friendly heating techniques – heat pumps, solar-thermal plants and biomass boilers – lost market share in 2015. Sales of biomass boilers dropped by almost 18 per cent, and solar-thermal plants recorded a loss of 10 per cent, with heat pumps losing just 2 per cent.[32] Only around 86,000 of these devices were sold in total in 2015. In contrast, the market share of oil heaters increased.[33]

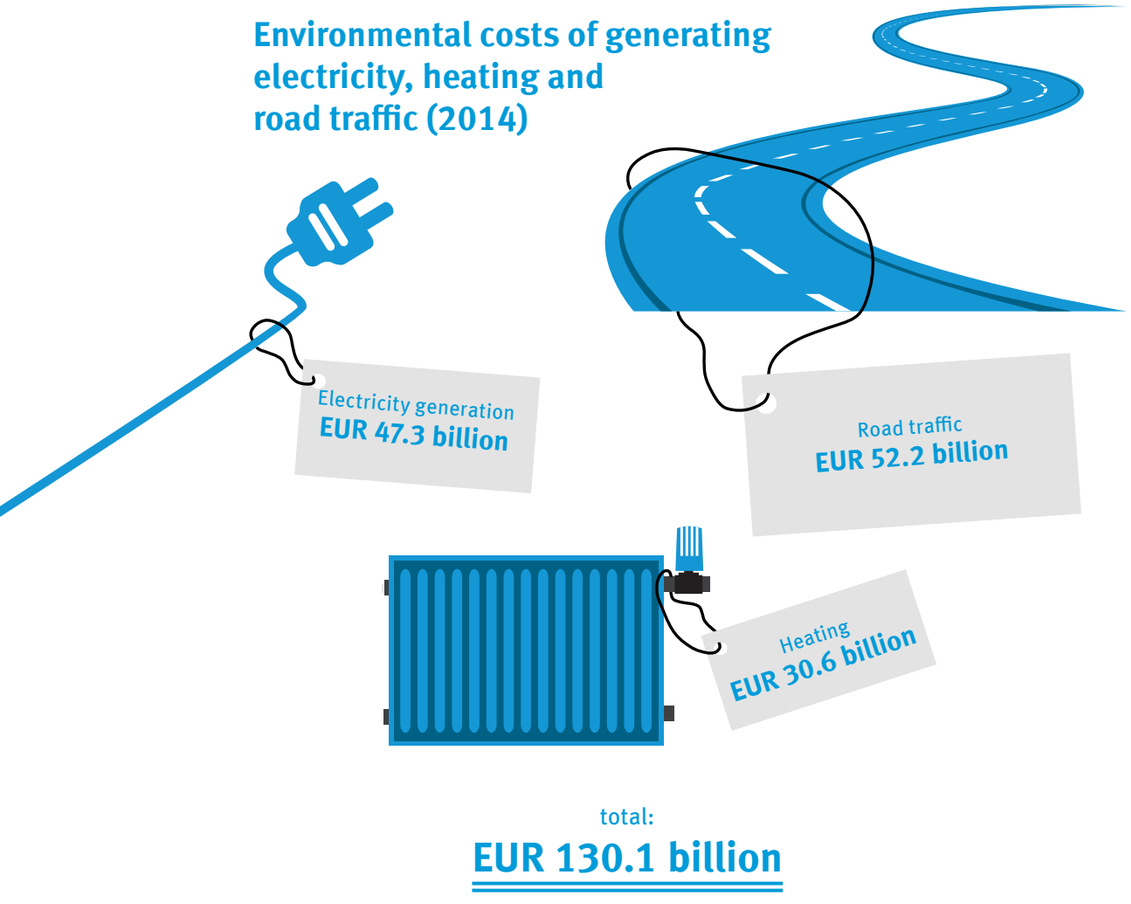
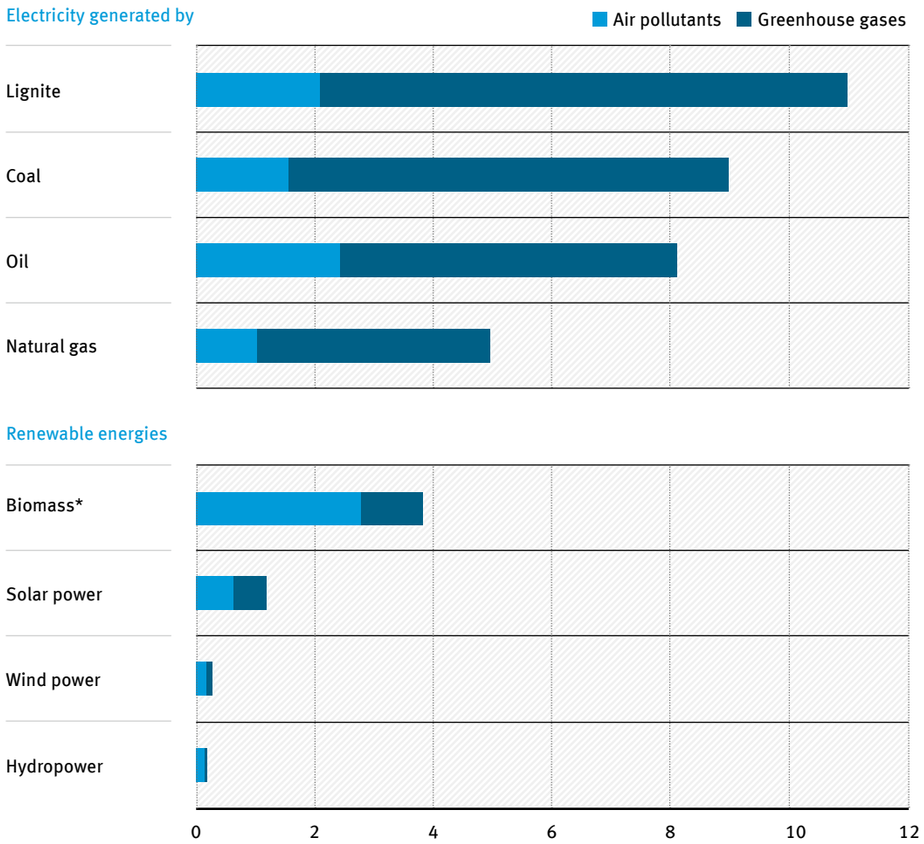


Figure 2

Environmental costs of electricity generation in Germany (in EUR cent$_{2010}$/kWh$_{el}$)



*Average value weighted by proportion of generation for gaseous, liquid and solid biomass (household and industry), range from EUR 0.03 to 0.072/kWh$_{el}$.

Source: UBA

Traffic is still emitting almost as much greenhouse gas as in 1990.

82 %

of the population is in favour of planning towns and communities in a way that minimises people's reliance on their cars.

It is the task of policymakers to prevent undesirable developments like these from having long-term negative consequences for climate change mitigation (lock-in effect). Tax policy provides some leverage in this regard. The energy tax on heating oil (EUR 0.06135) has remained unchanged for more than ten years. Adjusted for inflation, it has even dropped. Moreover, the tax on heating oil is comparatively low. In the Netherlands and in Denmark, nations with similar weather conditions, this tax is four or even five times as high as in Germany.[34] Income increases resulting from the heating oil tax could be channelled into subsidy programmes that could be used to improve energy efficiency in buildings.

In fact, the crowding out of heating oil (and later of natural gas) will not be nearly enough to ensure that existing buildings are almost climate-neutral by 2050. Only a combination of energy-efficient renovations combined with an increase in the use of renewable energies will lead to reductions in CO_2 emissions in the order of 80 per cent. The renovation of existing buildings needs to be sped up, which is why existing funding schemes must be expanded, for example by creating tax depreciation opportunities and climate levies for buildings. The extent of these renovations is another matter: the more building renovations reduce final energy requirements, the better natural gas' ability to cover remaining heating energy requirements – and the less extensively buildings are renovated, the more renewable energy is required to provide heat. Because there is barely any difference in the costs of these two variants, other selection criteria gain in importance, including social acceptance.

Transport

Today, around 27 per cent less greenhouse gas is being emitted in Germany than in 1990. Almost every sector has contributed to this result: the energy, industry and service sectors have significantly reduced their emissions, and so have private households. The only sector that has contributed almost nothing to the reduction of emissions since 1990 is the transport sector. With emissions of 163.6 million tonnes of CO_2 equivalents in 2015, it is only minimally below 1990 values.

The majority of CO_2 emissions come from road traffic, as do almost all of the air pollutants in the transport sector. Road traffic has even managed to become Germany's largest emitter of nitrogen oxides. The full environmental cost of road traffic in 2014 was EUR 52.2 billion, according to estimates by the UBA.

Freight traffic is responsible for a good two-fifths (NO_x and particulate matter) of the air pollution due to traffic, of which CO_2 traffic emissions make up around one-third. The main cause of the environmental cost of transport is, however, passenger car traffic. A study conducted on the topic of environmental awareness has shown how much of a burden people now consider passenger car traffic to be and how widespread demands are for changes to urban transportation policy: 82 per cent are in favour of targeted urban planning that minimises people's reliance on their cars.[35]

Both in the case of freight and passenger transport, the two most environmentally harmful means of transport – the passenger car and the truck – dominate, whereas the market share of comparatively environmentally friendly buses, trains and inland waterway vessels is more or less stagnating. Air transport, whose emissions have a particularly large impact on the climate, is growing very quickly. Emission-free transport on foot or by bike plays a minimal role.[36] Today, people take care of one-third less of their business on foot than they did 40 years ago.[37]

These unfavourable developments are the result of years of political decision making focused on promoting road traffic.

The political challenge is to liberate policy from the path dependence of past decisions and the compulsion that arises from a supposed lack of alternatives. It is about more than just

technical optimisation, such as more efficient and lower-emission vehicles. Instead, the infrastructure for each mode of transport must be coordinated and planned at federal, state and municipal levels in such a way that it does not inhibit sustainable mobility, but rather promotes it.[38] This process will take many years and is one step on the path to a green economy. At the end of this path, in roughly three decades, the transport sector needs to be able to manage without any greenhouse gases at all if climate change mitigation is to work.

For the time being, these conditions are being entrenched by the strong drop in the oil price. It signals to consumers that they should pay less attention to environmental factors and lowering fuel consumption when both purchasing and driving their cars. The trend toward increasingly high-performing engines, which is also promoted by the lack of a general speed limit in Germany, has immediate negative impacts on the environment. A study by the Federal Statistical Office shows that the CO_2 emissions of all cars in Germany could have dropped by 12 per cent between 2005 and 2013, in spite of increased car numbers. But, in fact, it only dropped by 1.6 per cent, as the engine output of newly registered passenger cars rose from 123 to 137 HP during the same period.[39]

Just as inappropriate as the lack of a speed limit is the fact that the diesel energy tax rate is still lower than that of petrol by EUR 0.1841 per litre. Furthermore, there is need for reform in the process of dismantling environmentally harmful subsidies like the commuting allowance, which promotes the trend toward long commutes, the spread of urban sprawl to the country side, noise emissions, air pollution and greenhouse gases. The cost to the state: more than EUR 5 billion annually.[40] This tax incentive must be gradually abolished, especially considering that it shows preferential treatment to people who are gainfully employed in high-income jobs. Unreasonable hardship could be avoided if revenue authorities recognised expenses beyond a certain breaking point.

The current company car allowance also has an environmental impact.[41] It favours frequent drivers by taxing the private use of company cars at a flat rate and provides no incentives to purchase low-emission vehicles. Owners of company cars receive support to the tune of at least EUR 3 billion. In addition to this, many employers assume fuel costs too, additionally benefiting frequent drivers. In order to prevent these negative environmental effects, the privileged status of company cars in comparison to privately purchased vehicles should be ended in favour of fiscal equality. This requires taking into account during taxation the extent to which the vehicle is used privately as well as the free provision of fuel by the employer. In addition to this, the tax burden should be staggered according to the company car's CO_2 emissions.

Tolls follow the logic of the "polluter pays" principle. They are a tool that is well suited to steering traffic developments according to ecological standards. The intended expansion of the HGV toll on all federal roads is therefore a positive development. It would be even better if it were to include the entire road network and vehicles whose permitted total weight is 3.5 tonnes or more. The toll amount should be more strongly based on the costs incurred for damage to health and the environment. It is also important to exclude intercity buses from the toll, as they would otherwise be charged the same amount as trucks.[42] The collection of toll revenues and the dismantling of environmentally harmful subsidies would make funds available for the required restructuring of traffic infrastructure on the path towards more rail-based transport and away from fossil-fuelled engines. Without this restructuring, the transport sector will continue to cause massive environmental problems in the future too.[43]

"The company car privilege shows preferential treatment towards high-income individuals. In contrast, environmental damage disproportionately affects households with lower incomes."

Diesel is subsidised with EUR 7.8 billion per year – and causes environmental damage to the tune of EUR 33 billion per year.

Agriculture

The European Union spends more public funds on its Common Agricultural Policy (CAP) – which has been the subject of controversy for many years due to its environmental impact, among other factors – than on anything else. Roughly EUR 60 billion has been allocated annually to this project for the period 2014 to 2020, which is almost 39 per cent of all EU expenditure for this period.[44] Around EUR 5 billion of that comes to Germany each year in the form of direct payments and market schemes (the first pillar of the CAP) as well as EUR 1.2 billion for rural development (the second pillar of the CAP).[45] The ecological effect of this subsidy policy is alarming: biodiversity is diminishing due to intensive farming; rivers, lakes, ground water and oceans are being contaminated by fertilisers; soil that is not used correctly is degrading; ecologically valuable pasture land is being ploughed into arable land; animal husbandry is harming air quality; and farming and the accompanying transformation of land-use remain significant sources of greenhouse gas emissions.[46]

Pesticides increase harvest yields, but often at the cost of diminishing biodiversity.

In the past 30 years, a diverse range of agricultural reforms have been intended to boost the importance of environmental conservation. This has only been partially achieved. Subsidies have been uncoupled from production, and farmers now instead receive direct payments based on the amount of land they cultivate. But since the last reform was passed in 2013, the joint agricultural policy has been far removed from any kind of economic or ecological rationality. [47] The majority of the payments do not have any guiding ecological effect[49] due to under-ambitious cross-compliance and greening requirements,[48] whereas subsidy programmes that target environmental conservation measures are chronically underfunded. Aiding agricultural producers whose actions continue to cause massive damage to the environment while not having enough funds available to support environmentally friendly subsistence strategies is not a rational utilisation of scarce public funds.

A rational course would be to establish sufficient, mandatory minimum standards using regulative law and internalise the environmental cost of agriculture, e.g. by introducing fees for nitrogen excess and pesticide use. At the same time, ecological agricultural achievements that exceed minimum standards should be honoured with premiums. In future, agricultural subsidies should be implemented according to the motto “public funds for public goods only”.

As a central factor in agricultural development, this needs to be the direction that CAP takes. But even before the next EU agricultural reform in 2020, there is a lot of room for improvement: for instance, by ambitiously reworking fertilisation regulations. Moreover, it would be wise to fully utilise the financial leeway granted by the EU for sustainable rural development within the scope of the second pillar of agricultural subsidies. In Germany, only 4.5 per cent of funds are being reallocated from the first pillar of agricultural funding to the second, but up to 15 per cent could potentially be redistributed. These funds would be available to more intensely fund ecological farming and agricultural environment and climate change mitigation measures.

Some bird populations have begun to dwindle because they can no longer find any food on sprayed areas of arable land.

Public expenditure as leverage for protecting the environment and climate

VIf the state provides consumers and private investors with incentives for observing environment and climate change mitigation objectives during decision-making processes, it needs to do more than simply apply the same standards to its own behaviour – it also has to set a good example. This is the imperative of credibility, and it is in line with economic reason. The Federal Government, states and municipalities are industrial consumers. If they purchase environmentally friendly goods and services, it has a positive effect on the state of the environment. On top of this, awarding public contracts can encourage innovation: manufacturers receive incentives to develop environmentally friendly products – and public authorities’ mass demand taps into economies of scale. This makes it cheaper to protect the environment.

The Federal Statistical Office has stated that the running administrative expenses and real investments of the whole public budget (excluding social security) amounted to a good EUR 170 billion in 2015.[50] This illustrates that the consistent implementation of environmentally friendly public purchasing programmes could give rise to substantial effects. One important precondition for this is a comprehensive monitoring system that includes environmental factors and indicators as the basis of intervention.

In 2007, the German Federal Cabinet decided to develop public procurement in a more energy-efficient direction by adopting the Meseberger Energy and Climate Programme. The first step was the General Administrative Regulation on the Procurement of Energy-Efficient Goods and Services (“Allgemeine Verwaltungsvorschrift zur Beschaffung energieeffizienter Produkte und Dienstleistungen”). Since then, important progress has been made. The Federal Government, states and municipalities have been working together in the “Alliance for Sustainable Procurement” since 2010. At the Procurement Agency of the Federal Ministry of the Interior, there is a competency centre for sustainable procurement; it provides targeted

The energy-efficient renovation of public buildings: beneficial for the environment, the climate and the public purse.

information, training and clarification to public contracting authorities. In some cases, it can be difficult to find out which product is more or less environmentally friendly, such as in the case of products that are entirely or partially imported from abroad.

Recently, significant improvements were made in the legal framework for environmentally friendly procurement by roughly 30,000 allocation boards. The Act Against Restraints of Competition (Gesetz gegen Wettbewerbsbeschränkgunen, or GWB), which was amended in April 2016, contains the provision that qualitative, environmental and social aspects, along with price and costs, "can" be taken into account when determining the most economical offer.[51] Pursuant to the GWB's additional procurement regulations, energy consumption and environmental impact "must" be "taken into account" during the procurement of road vehicles. For other goods, devices and equipment relevant to energy consumption, energy efficiency must be "taken into account to an appropriate extent" when determining the most economically advantageous tender.[52] Moreover, the public contractor "can" specify life-cycle costs when determining the cost of a product or a service. Within this context, there is even an explicit reference made to costs "incurred due to the external effects of environmental impacts".[53] However, there are also too many "can" provisions in the new procurement law. In light of the ecological challenges, this is just as inadequate as some of the procurement law's supposed trivialities. For example, it is problematic to base the calculation of emission costs in road traffic[54] on tariffs that are not even half as high as those suggested by the UBA in its Methodological Convention.

There is even talk of a conflict of interest between economics and environmental conservation. This is inaccurate. Companies that do not conduct their business in an environmentally friendly way are, in fact, not conducting their business economically, as environmental costs are and remain costs, even if they are not reflected in market prices – and public budgets in particular should be making calculations using "full" prices.

Even without taking environmental costs into account, environmentally friendly products are often more economical than conventional ones. The results of a study on behalf of the Berlin Senate demonstrated that an environmentally friendly approach to procurement was more affordable than the conventional alternative in ten out of 15 product groups calculated over the product's lifespan.[55] A similar finding was made in an evaluation of energy renovation projects at schools, hospitals, municipal administrative buildings, sports halls and day-care centres funded by KfW (Kreditanstalt für Wiederaufbau) between 2011 and 2014. "Based on conservative calculations", investment sums ran a profit over the course of a 30-year use period just by cutting energy costs alone.[56]

This information about the renovation of municipal buildings shows that public procurement is about much more than just purchasing textiles, furniture, power, computer and photocopying paper. It is also about state investment. One important area in this regard is infrastructure expenditure. It goes beyond the realm of public procurement and is also environmentally very relevant, for instance when it comes to mobility. For years, enabling mobility in Germany meant one thing: building roads. But this supposed certainty has now been shaken. Autobahn roads, for example, are neither in a position to significantly reduce deficits in accessibility nor to remedy sluggish growth.[57] If, in future, the majority of federal transport investments are made in the construction and development of roads as well as their maintenance, it will entrench structures that encourage further damage to the environment. This is why the UBA urgently recommends that the state make it a priority to invest in the maintenance of existing traffic networks and the development of railway infrastructure.

Need for reform in the financial system

Misguided investments endanger economic stability

Some truths are complicated; others are simple. Climate change mitigation policy is based on a very simple truth: if global warming is to be stopped at a maximum of 2 degrees, the majority of the still amply available stores of coal, oil and gas need to stay where they are – in the ground.

Goal of climate change mitigation policy: stop global warming at a maximum of

2 °C

According to current estimates, this affects around 80 per cent of coal reserves, 50 per cent of natural gas reserves and a third of oil reserves.[58] These reserves would be worthless if global warming was combated effectively. This would have far-reaching consequences, as it would mean that coal, oil and gas companies are being overvalued. Experts refer in this context to a "carbon bubble"; financial service providers predict income losses at astronomical levels (USD 28 trillion), which will threaten coal, oil and gas companies over the course of the next two decades alone if climate policy gets serious.[59]

In fact, it is not just commodities companies that are being threatened. Everybody who bases their business on fossil-fuel energies is exposed to increased risk, beginning with those who convert coal into electricity and the automotive industry, and continuing to all energy-intensive industries: segments of the chemicals and metals industry, the steel and glass industries, and the paper and cement industries.

In addition to this, investors who bank on companies in fossil-fuel-based industries are also in trouble – private investors, but also institutional investors such as banks, insurance companies and pension funds. If the financial markets' overvaluation of these companies is corrected, the "carbon bubble" will burst and shareholders will find themselves sitting on securities that are no longer secure. Mark Carney, Governor of the Bank of England, is another person now warning of the risks of the bubble, as is World Bank President Jim Yong Kim. He has already referred to the "systematic risk" confronting the financial system. The carbon bubble does not necessarily have to trigger a financial crisis, as the US property bubble did when it burst in 2007, but wise action must be taken in order to avoid it.

It would be unwise to let anxieties about systematic consequences cripple climate policy.[60] It would then be more likely than ever that share prices would collapse, and it would be more likely than ever that financial institutions would be thrown into turbulence due to the effects of climate change, which would also affect the economy: the accelerated rising of sea levels, extreme floods, droughts and other natural disasters triggered by climate change.

It would be just as unwise if climate policy were to act with indecision, as a tendency to "stop and go" causes uncertainty, and uncertainty is poison to investors. In this case, the economic consequences could be unpleasant, even if CO_2 emissions did not rupture the carbon budget framework in the end. For this reason, an old economic policy adage also holds true for climate policy: it needs to ensure stable expectations by signalising persistently and unmistakeably where the journey will take us in the medium and long term – and that is to a future of low CO_2 emissions. This reduces any incentives to invest in carbon-intensive companies and projects (such as the exploration of Arctic oil reserves), and protects investors from expensive surprises.

Daring to promote more transparency

Financial analysts focus on cyclic ups and downs and short-term developments. The medium and long-term effects of ambitious climate policy on company value do not register on their radars. This is why the burden now falls to financial market regulation to prevent massive misallocations of capital by ensuring that these risks for investors can be detected and assessed accordingly.

This does not just apply to businesses that no longer or should no longer have a future due to climate change mitigation. Aside from them, there are many business models that are only lucrative due to the fact that they are based on the "free" exploitation of natural capital. They only generate profits because it does not cost anything to pollute the air or the water or to wipe out biotopes and habitats. These business models only pretend to contribute to prosperity when they are actually diminishing it, and they do not have a future. Policy needs to ensure that investors realise that these business models are not sustainable. Creating more transparency about the damage companies are causing to the environment will be a central basis for reducing investments in unsustainable business models and avoiding the emergence of "stranded assets".

Initial approaches toward more transparency have already been developed: some stock markets demand that their customers disclose sustainability indicators, and some rating agencies have realised that climate change is a megatrend. According to the United Nations' environmental programme, the sum of existing activities has the quality of a "silent revolution".[67] It is now about achieving a consensus on the central criteria that need to be disclosed. A task force that was initiated by the Financial Stability Council, founded by the group of the 20 most important industrial and industrialising countries (G20), has been trying to do just this since the end of last year. It wants to create transparency about the risks of climate change so that lenders, insurers, investors and other stakeholders can make better informed decisions.[68] An interim report has already been published. It contains the finding that the opportunities and risks of climate change cannot be depicted correctly in existing investment analyses and loan decisions.[69] The final recommendations are scheduled to be published at the end of 2016.

The German Act to Strengthen the Disclosure of Non-Financial Information by Companies in their Management and Group Management Reports ("Gesetz zur Stärkung der nichtfinanziellen Berichterstattung der Unternehmen in ihren Lage- und Konzernlageberichten") is intended to act as a basis for better decision making. This act, which is based on the EU's "Corporate Social Responsibility Guideline" (CSR), must be implemented by the beginning of December 2016. The legislative proposal presented in spring, however, passed over some opportunities that still need to be seized. For the purposes of consistency and comparability, key indicators of environmental concerns should be laid down in a binding fashion for all larger companies with more than 500 employees, regardless of whether they are listed on the stock market or not.

However, more transparency about environmental impacts will not be enough to channel capital into environmentally friendly spending. Moreover, a basic change to the economic framework is required. As a result, we have come full circle: the financial markets will only respect environmental concerns if the state internalises environmental costs and dismantles environmentally harmful subsidies so that investments in companies with severely environmentally harmful business models become unappealing.

The trailblazing divestment movement

"If it's wrong to push forward climate change, then it's not right to earn money from it. Those who divest from coal, oil and gas are paving the way for a world that uses renewable energies instead of fossil energies."[61] This is the motto of a social movement that, going by its own statements, is now active in more than 188 countries.[62] It includes the San Francisco municipal pension fund, which has completely withdrawn from coal companies and is now investing the profits of selling those shares into companies in the renewable energies sector,[63] and the Norwegian central bank, Norges Bank, which manages the USD 851 billion state pension fund and has now declared it off-limits to invest in 52 named coal companies.64 Allianz has also announced that it is no longer financing coal-based business models, and the Rockefeller Family Fund "proudly" announced in spring 2016 that it would be withdrawing its investments from all companies in the fossil energy sector, beginning with Exxon Mobil.[65]

The reasons for making divestment decisions are not just of an ethical nature. Increasingly, one of the reasons being named is the economic risk involved in investing in companies whose business models are based on fossil energy sources. The divestment movement is thus sparking important debates and heightening public awareness about the ecological and economic risks involved in fossil investments. It sends a strong signal, but cannot stem the challenges posed by climate change by itself. Climate policy continues to bear the main burden of responsibility.[66]

1 German Environment Agency, Nährstoffeinträge aus der Landwirtschaft und Stickstoffüberschuss, http://www.umweltbun-desamt.de/daten/land-forstwirtschaft/landwirtschaft/naehrstoffeintraege-aus-der-land-wirtschaft

2 German Environment Agency, Luftqualität 2014, p. 9 et seq. https:// www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/hintergrund_luftqual-itaet_2014.pdf and the accompanying press release no. 5 from 9 February 2015. Air quality 2014: Nitrogen dioxide now ranks as pollutant Nr. 1 https://www.umweltbundesamt.de/en/press/pressinformation/air-quality-2014-nitrogen-dioxide-now-ranks-as

3 German Federal Agency for Nature Conservation, Artenschutz-Report 2015, p. 4, https://www.bfn.de/fileadmin/BfN/presse/2015/Dokumente/Artenschutzre-port_Download.pdf and German Environment Agency, Stickstoff - Zuviel des Guten, p. 13, https://www.umweltbundesamt.de/sites/default/files/ medien/pub-likation/long/4058.pdf

4 German Federal Statistical Office, Umweltökono-mische Gesamtrechnungen, https://www.destatis.de/DE/ZahlenFakten/GesamtwirtschaftUmwelt/Umwelt/Umweltoekonomische-Gesamtrechnungen/MaterialEnergiefluesse/Tabellen/Produktionsfakto-renSchadstoffe.html;jsessionid=46DD4EA89662A01C-89DAE91E2305391A.cae4

5 German Environment Agency, Press Release No. 9 from 17 March 2016: UBA emissions data for 2015 indicate urgent need for consistent implementation of Climate Action Programme 2020, https://www.umweltbundesa-mt.de/en/press/pressinformation/uba-emissions-data-for-2015-indicate-urgent-need

6 http://www.globalcarbonatlas.org/?q=en/emissions

7 https://www.pik-potsdam.de/news/press-releases/four-of-nine-planetary-boundaries-now-crossed?set_lan-guage=en

8 BMUB/UBA (2012): Green Economy, in: Umwelt 6/2012, pp. 58-61.

9 https://www.imf.org/external/pubs/ft/wp/2015/wp15105.pdf

10 https://www.bundesfinanzministerium.de/Content/DE/Standardartikel/Themen/Oeffentliche_Finanzen/Sub-ventionspolitik/2015-08-26-subventionsberi-cht-25-vollstaendig.pdf?blob=publicationFile&v=2

11 Expert commission on the monitoring process, “Energie der Zukunft“, Stellungnahme zum vierten Monitor-ing-Bericht der Bundesregierung für das Berichtsjahr 2014, p. 96, http://www.bmwi.de/BMWi/Redaktion/PDF/M-O/monitoringbericht-energie-der-zukun-ft-stellungnah-me-2014,property=pdf,bereich=bm-wi2012,sprache=-de,rwb=true.pdf

12 Tomasz Kozluk, Christina Timiliotis, Do environmental Policies affect Global Value Chains? A new perspective on the Pollution Haven Hypothesis, OECD Economics Department Working Papers No. 1282, http://www.oecd-ilibrary.org/docserver/download/ 5jm2hh7nf3wd.pdf?expires=1462202060&id=id&ac-cname=guest&-checksum=27636197C06ACC79F-2D7561483E21509

13 Sachverständigenrat für Umweltfragen, Umweltgu-tachten 2016, p. 146, http://www.umweltrat.de/Shared-Docs/ Downloads/DE/01_Umweltgutachten/2016_Um-weltgut-achten_HD.pdf?blob=publicationFile Das Gleiche gilt für die EEG-Umlage sowie für die Privilegi-erung nach § 2 der Konzessionsabgabenverordnung.

14 In its energy concept from September 2010, the Federal Government refers to energy efficiency as a “key ques-tion”.

15 Tilman Rave, Michael Thöne, Umweltbezogenes Sub-ventionscontrolling, Studie im Auftrag des Umweltbun-desamtes, Cologne and Munich 2010, and German Envi-ronment Agency, Environmentally Harmful Subsidies in Germany, Updated Edition 2014, p. 68 et seq. https://www.umweltbundesamt.de/sites/default/files/medi-en/376/publikationen/environmentally_harmful_sub-sidies_in_germany_2014.pdf

16 This is emphasised repeatedly by the IMF in its World Economic Outlook from spring 2016, e.g. p. 53, http://www.imf.org/external/pubs/ft/weo/2016/01/

17 This demand can already be found in the 1992 21 Agenda from the UN Conference for Environment and Development in Rio de Janeiro, p. 73 https://sustaina-bledevelopment.un.org/content/documents/Agenda21.pdf

18 Klaus P. Masuhr, Heimfried Wolff, Jan Keppler (Prog-nos), Identifizierung und Internalisierung externer Kosten der Energieversorgung, Studie im Auftrag des Bundesministeriums für Wirtschaft, Basel 1992.

19 According to former UNEP Executive Diretor Achim Steiner http://www.sueddeutsche.de/wirtschaft/umwelt-schutz-un-attackieren-konzerne-natuerliches-kapi-tal-wird-im-grossen-stil-vernichtet-1.974047

20 Kai Daniel Schmid, Andreas Peichl, Moritz Drech-sel-Grau, Querverteilung und Spitzeneinkommen in Deutschland. Einkommensungleichheit - Quo Vadis?, IMKReport 108, November 2015, http://www.boeckler.de/pdf/p_imk_report_108_2015.pdf

21 https://www.imf.org/external/pubs/ft/wp/2015/wp15105.pdf, S.38

22 Stern Review: The Economics of Climate Change, p. 1, http://mudancasclimaticas.cptec.inpe.br/~rmclima/pdfs/ destaques/sternreview_report_complete.pdf

23 Trucost Plc, Nature Capital at Risk: The Top 100 Externalities of Business, Studie im Auftrag der TEEB for Business Coalition. http://www.longfinance.net/images/PDF/trucost_naturalcapital_2013.pdf See also http:// www.unep.org/Documents.Multilingual/De-fault.asp?Do-cumentID=2713&ArticleID=9468&l=en

24 The Federal Government’s environmental pro-gramme from 1971 http:// dipbt.bundestag.de/doc/btd/06/027/0602710.pdf

25 German Environment Agency, Data on the Environment 2015, p. 102.

26 Cf. in this regard and with regard to the following, German Environment Agency, Methodological Con-vention 2.0 for Estimates of Environmental Costs, Des-sau-Roßlau 2012, p. 40 et seq. as well as attachment B, https://www.umweltbundesamt.de/sites/default/files/medien/376/publikationen/methodological_conven-tion_2_0_for_estimates_of_environmental_costs_an-nex_a.pdf

27 For information about the current state of energy pro-ject funding with export credit guarantees http://dipbt.bundestag.de/ dip21/btd/18/079/1807994.pdf

28 BDH -statistics as well as telephone information provid-ed by the des Industrieverbandes Haus-, Heizungs- und Küchentechnik e. V. about single-room fireplaces.

29 Hans-Joachim Ziesing, Entwicklung der CO2-Emis-sionen in Deutschland im Jahr 2015.

30 German Environment Agency, Luftqualität 2014, p. 12 et seq. https:// www.umweltbundesamt.de/sites/default/files/medi-en/378/publikationen/hintergrund_luftqualitaet_2014. pdf

31 BDEW, as of 1/2016.

32 Data collected by the Bundesverbandes der Deutschen Heizungsindustrie BDH http://www.bdh-koeln.de/de/presse/ pressemitteilungen/artikel/news/dynamische-s-wachs-tum-in-2015-deutsche-heizungsindustrie-zie-ht-jahresbi-lanz.html

33 The 0.5 per cent drop in sales of light heating oil in spite of this was apparently due to consumers covering their excess demand largely with oil stocks and, in spite of the low prices of their tanks, no longer topping them up. See Arbeitsgemeinschaft Energiebilanzen, Energiever-brauch in Deutschland im Jahr 2015, p. 14 http://www.ag-energiebilanzen.de/20-0-Be-richte.html

34 http://www.heizoel24.de/lexikon/Mineralölsteuer

35 An investigation into three cities (Kassel, Bremen, Kiel) shows that passenger car traffic still receives the highest municipal subsidies in spite of this, while bicycle traffic receives the lowest urban subsidy. http://www.uni-kassel.de/fb14bau/fileadmin/ datas/fb14/Institute/IfV/Verkehrsplanung-und-Verkehrs-systeme/Forschung/Projekte/Endbericht_NRVP_VB1211.pdf

36 Verkehr in Zahlen 2015/2016, p. 221 and p. 243.

37 Verkehr in Zahlen 2015/2016, p. 227.

38 See https://www.umweltbundesamt.de/sites/de-fault/files/medien/378/publikationen/texte_59_2014_umweltvertraeglicher_verkehr_2050_0.pdf and https://www.umweltbundesamt.de/sites/default/files/me-di-en/461/publikationen/3773.pdf

39 https://www.destatis.de/DE/PresseService/Presse/Pressemitteilungen/2015/06/PD15_213_85pdf.pdf;j-sessionid=CB358DD1920E49D01A5C76945CF-C44DD.cae3?__blob=publicationFile

40 German Environment Agency, Environmentally Harm-ful Subsidies in Germany, Updated Edition 2014, p.37.

41 Last year, only 34.2 per cent of all new registrations were for private cars. However, official statistics do not differentiate between company cars that are not used privately and staff cars. http://www. kba.de/DE/Presse/Pressemitteilungen/2016/Fahrzeug-zulassungen/pm01_2016_n_12_15_pm_komplett.html?nn=716864

42 https://www.umweltbundesamt.de/publikationen/a-road-toll-for-germany-every-kilometre-counts

43 https://www.umweltbundesamt.de/en/press/pressin-formation/greenhouse-gas-neutral-freight-transport-is

44 http://bookshop.europa.eu/en/multian-nual-fi-nancial-framework-2014-2020-and-eu-budget-2014-pbKV0413055/?CatalogCategoryID=mpgK-AB-stFogAAAEjbIUY4e5K

45 http://www.bundesfinanzministerium.de/Content/DE/ Standardartikel/Themen/Europa/EU_auf_ei-nen_Blick/Politikbereiche_der_EU/EU_Agrarpoli-tik/2012-03-21-ueberblick-gemeinsame-agrarpolitik.html;jsessionid=675D-CAD5F3F13C4055444D147A-3B512A - doc22506body-Text3

46 See on the following German Environment Agency, 30 Jahre SRU Sondergutachten „Umweltprobleme der Landwirtschaft” – eine Bilanz, Dessau-Roßlau 2015, https://www.umwelt-bundesamt.de/sites/default/files/medien/378/publika-tionen/texte_28_2015_umwelt-probleme_der_landwirt-schaft.pdf

47 http://www.lbv-bw.de/Bauernverband-vor-Ort/A-Z/Rottweil/Rechnungshof-kritisiert-zu-teure-Buer-okratie,-QUlEPTQ3OTI1OTImTUlEPTU2MzEz.html und Isermeyer

48 http://www.bmel.de/DE/Landwirtschaft/Agrarpoli-tik/_Texte/GAP-FAQs.html;jsession-id=68356A774D65F-95173CC89FF01E6BC33.2_cid288 - doc4121226body-Text2

49 https://www.umweltbundesamt.de/sites/default/files/medien/376/publikationen/klu_stellungnahme_juli_2013_mehr_guen_in_die_gemeinsame_agrarpoli-tik.pdf

50 https://www.destatis.de/DE/Publikationen/The-matisch/FinanzenSteuern/OeffentlicheHaushalte/AusgabenEinnahmen/KassenergebnisOeffentlicher-Haushalt2140200153244.pdf?__blob=publicationFile, p. 9

51 GWB § 127.

52 § 67 and § 68 of the Procurement Regulation, http://www.bmwi. de/BMWi/Redaktion/PDF/P-R/verord-nung-zur-modernisierung-des-vergaberechts,prop-erty=pdf,bereich=bm-wi2012,sprache=de,rwb=true.pdf

53 § 59 of the Procurement Regulation.

54 Attachment 2 (on § 68 paragraphs 1 and 3) of the pro-curement regulation, for example, specifies EUR 0.03 to 0.04 per kilogramme for carbon dioxide, which is half the maximum recommended by the German Environ-ment Agency.

55 Öko-Institut, Umwelt- und Kostenentlastung durch eine umweltverträgliche Beschaffung, Studie im Auftrag der Senatsverwaltung für Stadtentwicklung und Umwelt, Berlin 2015. The ten product groups are passenger cars, office lights, street lighting, flooring, buildings, multi-functional devices, computers, refrigerators and freezers, photocopying paper and cleaning agents., http://www.oeko.de/oekodoc/2379/2015-541-de.pdf

56 Fraunhofer IFAM, Wirkungen von Förderprogrammen der KFW im Bereich Nichtwohngebäude der Förderjahre 2011 bis 2014, Bremen 2015, p. 9, https://www.kfw.de/PDF/Download-Center/Konzernthemen/Research/PDF-Dokumente-alle-Evaluationen/Evaluation-Nicht-wohngebäude-2011-bis-2014.pdf

57 Udo J. Becker, Grundwissen Verkehrsökologie. Grun-dlagen, Handlungsfelder und Maßnahmen für die Verkehrswende, München 2016, p. 54.

58 Christophe McGlade, Paul Ekins, The geographical distribution of fossil fuels unused when limiting global warming to 2 C, in: Nature, Vol 517 (8.1.2015), p. 187 et seq.

59 Kepler Cheuvreux, Stranded assets, fossilized revenues. USD 28trn of fossil-fuel revenues at risk in a 450-ppm world, Paris 2014, https://www.keplercheuvreux.com/pdf/research/EG_EG_253208.pdf

60 About this issue and on the following, Francis Weyzig, Barbara Kuepper, et. al., The price of doing too little too late. The impact of the carbon bubble on the EU financial system. A report prepared for the Green/EFAA Group - European Parliament, 2014, http://gef.eu/uploads/media/ The_Price_of_Doing_Too_Little_Too_Late_.pdf

61 According to Fossil Free Deutschland on its website http:// was-macht-mein-geld.de/

62 https://350.org/about/media/

63 http://www.pionline.com/article/20151211/ON-LINE/151219959/san-francisco-city-amp-county-to-di-vest-coal-stocks

64 http://www.norges-bank.no/en/Published/Press-re-leases/2016/2016-04-14-Pressrelease/

65 http://www.rffund.org/divestment

66 In fact, the divestment movement is often portrayed as the only glimmer of hope, see e.g. Malte Henk, Wolfgang Uchatius, Morgen vielleicht, in: Die Zeit from. 3.6.2015, http://www.zeit.de/2015/23/klima-wan-del-diskussion-co2-emissionen

67 UNEP, The Financial System We Need, Nairobi 2015, http://web.unep.org/inquiry/publications

68 http://www.fsb.org/2015/12/fsb-to-establish-task-force-on-climate-related-financial-disclosures/

69 TCFD, Phase I Report of the Task Force on Climate-Re-lated Financial Disclosures, March 2016, p. 21, http://www. fsb.org/wp-content/uploads/TCFD-Phase-1-re-port.pdf

Sustainable consumption

The dominant lifestyle choices and consumption patterns of people in industrialised countries are increasingly testing the resilience of the global environment.

How we live, how we get from A to B and what we eat are the main factors that determine our energy and resource requirements and their consequences, which are increasingly having an effect on other corners of the globe.

Uninterrupted increases in the environmental damage caused by consumption demonstrate that Germany is not yet a role model for sustainable development. But there are reasons for hope, as sustainable goods and services have increasingly been establishing themselves as real alternatives in a range of areas of consumption – for instance, in the use of electricity generated from renewable sources, energy-saving household appliances and organic food. A transition to climate-neutral economic and consumption patterns that conserve natural resources still seems possible. However, structural social and market change must be pushed forward consistently if this is to be achieved. Policy needs to identify fields of action and improve framework conditions for sustainable consumption in society. Above all, it comes down to creating a positive environment for innovation, a social shift toward more sustainability and dismantling prejudices and anxieties that result from this process of transformation. The most important thing is to ensure that the transition to sustainable consumption does not put lower-income segments of society at a disadvantage.

Germany: a role model for sustainable development too?

For the largest industrialised nation in the European Union and an economy that continues to rely on the export of goods and services, this will be a real challenge. The “Sustainable Development Goals” (SDGs), adopted by the United Nations in autumn 2015, were not just set in the “classic” developmental areas of health, education and fighting poverty.[1] They also emphasise ecological challenges such as climate change mitigation, the preservation of terrestrial and marine ecosystems and providing access to environmentally friendly energy sources. They explicitly task states with the creation of “sustainable production and consumption patterns”. Industrialised countries, including Germany, are required to take on a leading role.

In comparison with other industrialised countries, Germany performs comparatively well with regard to all 17 SDGs, particularly in light of target dimensions such as economic growth, employment, research and development, and social security. But there is a significant backlog in the area of sustainability. Production and consumption patterns are still far from being sustainable; environmental impacts and problematic burden-shifting strategies are still the norm. A first comparative study by the Bertelsmann Foundation underscored this finding by looking at issues such as waste: on average, each German citizen produces 614 kilograms of waste per year.[2] This is significantly higher than the overall average for industrialised countries of 483 kilograms. The Bertelsmann ranking also sees room for improvement for Germany in the fields of particulate air pollution, soil pollution due to over-fertilisation, the exploitation of water resources and the number of endangered species in Germany. In its most recently published “Integrated Environment Programme 2030”,[3] the BMUB started with the premise that, in spite of successful environmental policy in recent decades, Germany is still exceeding ecological limits. Through our economy, lifestyles and consumption behaviour, we too are responsible for the fact that humanity increasingly has fewer options to keep itself safe.

In a globalised economy, it is becoming increasingly obvious that consumption decisions made by German citizens impact the environment in other countries due to waste exports, emissions, the use of agricultural land and the import of resources. For example, in order to meet our food requirements, we currently need 20.1 million hectares of agricultural acreage – although there are only 14.7 million hectares available in Germany. Industrialised countries like Germany therefore need to do a better job of incorporating the impact of globalisation on the international flow of commodities and on consumption into their environmental strategies and lead the way in implementing measures to reduce these international effects. We can no longer allow healthy, more ecological prosperity in Germany, today and in the future, to come at the detriment of the ecological and social living standards of people in other parts of the world and of future generations. This is the imperative of both fairness and our own foresight.

Definition of sustainable consumption

Sustainable consumption means consuming and producing today in a way that does not endanger the justified needs of current and future generations while respecting the earth’s ecological limits as well as universal human rights. (Progress Report of the Federal Government on the National Sustainability Strategy – draft from 10 May 2016, p. 158.) (Fortschrittsbericht der Bundesregierung zur nationalen Nachhaltigkeitsstrategie – Entwurf vom 10.05.2016, S. 158)

Sustainable consumption: political challenges

Due to the Federal Government’s explicit support of the 2030 Agenda for global sustainable development, the promotion of environmentally friendly and socially just (fair) forms of consumption are playing an increasingly central role in policy making.

In future, the issue of consumption will be a key priority for the Federal Government’s sustainability policy. It supports the willingness of

an increasing number of citizens to take ecological and social aspects into account when making purchasing decisions and choosing goods and services. To this end, the Federal Government adopted a "national programme for sustainable consumption" in February 2016.[4] It contains a multitude of central principles and specific measures to enable more environmental conservation and sustainability in the areas of mobility, nutrition, living and households, work and office, clothing, and tourism and leisure. The programme helps to better coordinate measures implemented by the many different federal ministries in order to strengthen public awareness of sustainable consumption in the long term, as well as to introduce the changes necessary for making consumption more sustainable.

Politically, it is particularly important that sustainable consumption is not just viewed as a matter of individual choice but is instead seen as a mandate for the whole of society. The programme is intended to embrace the multitude of approaches that have been developed in the field of consumption and to motivate as many stakeholders as possible to participate. This is the only way to achieve the transition to more sustainable consumption patterns in our society.

The speed of consumption

Germany is increasingly becoming a society driven by consumption. Up until now, economic and social progress has been closely connected with an increase in general consumption levels and the increasing penetration of goods and services into our everyday lives. Changes in social structures and living conditions, the age structure, forms of employment, incomes and household sizes, coupled with advancing urbanisation, technification and digitalisation, are driving forces for a culture of material consumption that is increasingly accelerating. The result: growth and consumption frequently mitigate the success of environmental policy.

Changing consumption patterns is anything but easy. Consumption and the material prosperity it entails have become central features of our social order and the embodiment of our idea of "good living". We have lost sight of its costs for people and the environment.

The price of prosperity

The environmental effects of consumption are varied. The use of goods and services contributes to climate changes, to the emission of air pollutants, to water and soil pollution, to diminishing biological diversity and to increased resource consumption, among other effects. The three areas of demand – "construction and living", "mobility" and "nutrition" – are decisive factors in the environmental impact made by private households. Together they make up 70 to 80 per cent of consumption's environmental impact. But other sectors, such as "leisure/tourism" and "clothing", also have a relevant environmental impact, for example due to the increasing use of chemicals during textile manufacturing and the associated risks posed to water quality (see also the article on sustainability in the textile industry on page 13). In light of global trade and complex supply chains, the social effects in manufacturing countries are gaining increasing significance.

Flying is the most environmentally harmful mode of transport.

In environmental research, there are different concepts that can be used to identify and measure the environmental impact made by products and household consumption. Whether you call it life cycle assessment, ecological assessment, the ecological footprint, environmental utilisation space or the ecological backpack, what is central to all of these concepts is that they observe all environmental impacts and resource requirements throughout a product's life cycle, from the extraction of raw materials to disposal – from the cradle to the grave. This is the only way to judge the quality of goods and services and to compare the ecological benefit of alternatives.

Within these areas of demand, it is possible to identify “Big Points” (figure 2, p. 58) that significantly determine the environmental consequences:

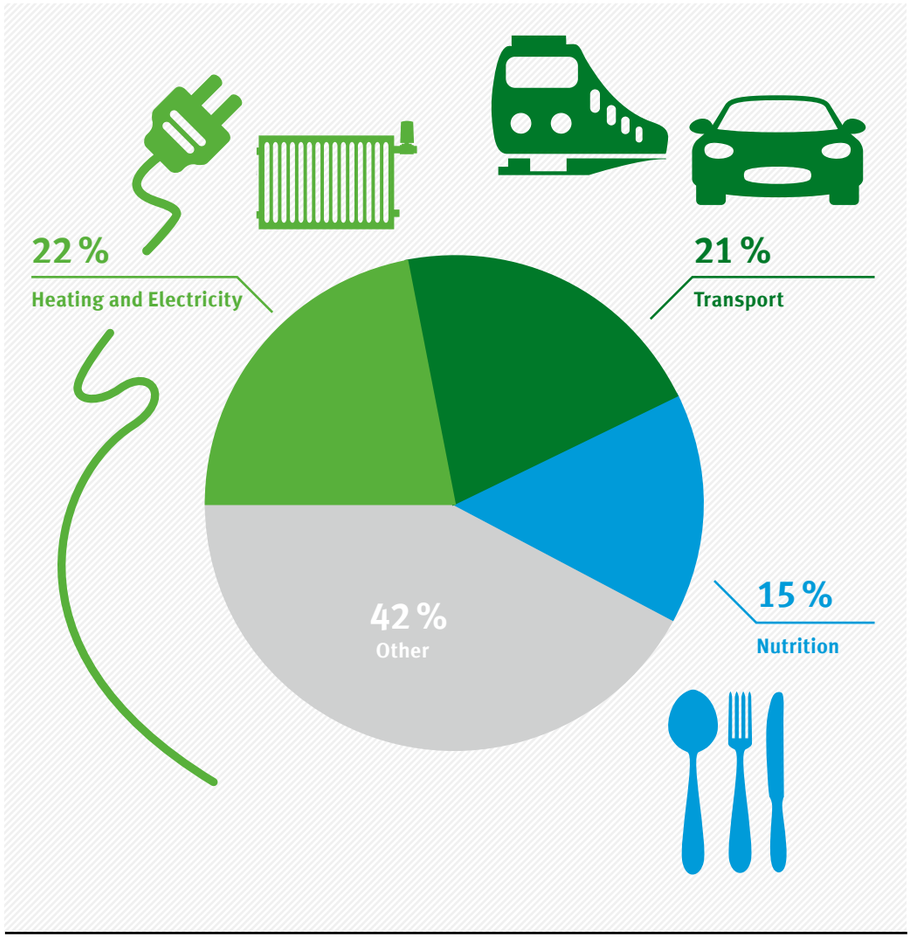
In the area of “construction and living”, these points relate to the size of the residential unit,[5] insulation levels and the building’s selection of supply technology. These factors determine the amount of construction materials, space and heating energy (which requires fuel) required, and thus also greenhouse gas emissions. For example, people who live in a passive house and choose to have 20 per cent less living area than the living area available in an average household reduces their CO_2 emissions by two tonnes (annual overall consumption is 11 tonnes on average).

In the mobility sector, it comes down to which mode of transport we choose, how much fuel a car consumes and how it is driven. The number of long-haul flights a person takes is of particular significance. Alongside the demand for raw materials in the production of cars and other modes of transport, greenhouse gas emissions and air pollution levels – in particular, due to nitrogen oxides and particulate matter – are pertinent factors. With only one additional flight to New York, for example, and one 20-kilometre-long commute, the annual amount of CO_2 produced by one person increases by 5.4 tonnes – i.e. by almost 50 per cent.

The consumption of animal products also has a negative effect on the climate. Per kilo, meat and meat products emit seven to 28 times as much CO_2 as vegetables. The methane emitted by ruminants (above all cows, but also sheep and goats) farmed to produce milk and milk products also makes a considerable contribution to climate change. Added to this is the global cultivation of animal feed – such as soy in South America – which takes up a lot of surface area and is often cleared, either directly or indirectly, by deforesting rain forest. The

Figure 1

Consumption-related greenhouse gas emissions
(per capita by fields of consumption)



Source: UBA/KlimAktiv: UBA-CO_2-Rechner (www.uba.co2-rechner.de)

Consumption indicators for the national sustainability strategy

For the German sustainability strategy, the UBA has suggested two additional indicators for sustainable consumption: indicator 1 states the market share of sustainable products in Germany, while indicator 2 states energy consumption and CO_2 emissions caused by private household consumption. Both focus on the priority areas of need of living, mobility and nutrition.

The first indicator shows how demand for environmentally friendly products is developing and whether the market share is growing over time. The second indicator provides important information about whether market developments are actually having less of an impact on the environment. Building on this, we can investigate whether increases in efficiency are negated by increasing consumption, for example.

Living climate neutrally: a glance at the CO_2 balance

› Link to UBA-CO_2 calculator:
www.uba.co2-rechner.de

2015

11.9 tonnes of CO_2e*
per person / year

Climate change mitigation goals for Germany:

‹ 1 tonne of CO_2e*
per person / year

*CO_2 equivalents

Figure 2

BIG POINTS – what makes a CO_2 footprint so big

Source: UBA

proportion of organic foods purchased is another important aspect. Compared with conventional products, these products not only have the potential (e.g. in poultry and meat production) to reduce the amount of greenhouse gas being emitted, but they are also better when it comes to water conservation, soil fertility and biodiversity.

The extent of the environmental damage caused by each household is very dependent on its available income (see figure 3, p. 60). A well situated university graduate, for example, is responsible for more greenhouse gas emissions on average than somebody receiving social welfare benefits. In simple terms, higher incomes flow into larger residential units, bigger cars and longer journeys, and thus into higher demand for energy and materials. The hope that people who have money will spend it on more expensive products that also conserve resources is only being realised in the area of foodstuffs – in organic products – and among the small group of particularly energy-conscious people.

A lot of knowledge, but not enough action

The importance of environmental and climate change mitigation for securing prosperity, competitiveness and employment, as well as for coping with globalisation, is growing. According to the most recent UBA demographic survey (2014) on the topic of "Environmental Awareness in Germany", this view is being shared by more and more citizens. Almost two-thirds (63 per cent) of those surveyed are convinced that environmental and climate change mitigation form the fundamental basis for mastering these challenges in the future. This indicates a change in public awareness, which is not just boosting environmental policy, but also making positives changes in consumption patterns more likely. People are increasingly realising that there is a connection between their own consumption patterns and global environmental problems. Just a few years ago, in the 2010 environmental awareness study, the majority of those surveyed were of the opinion that environmental conservation needed to be restricted in order to make progress in other areas.

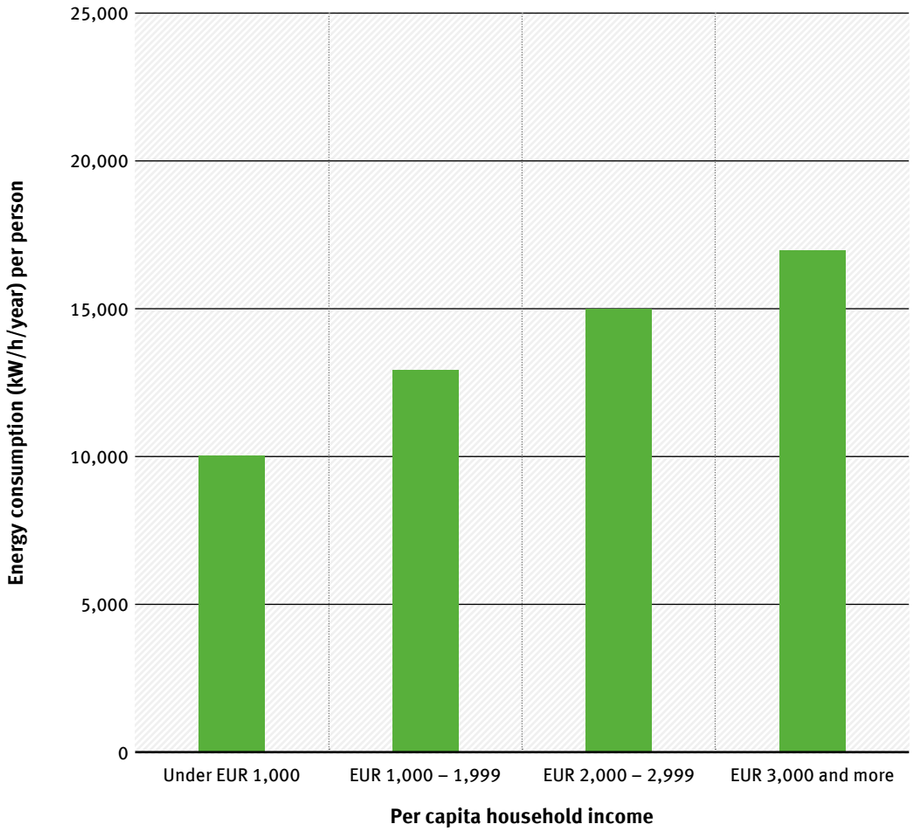
Actual consumption patterns, however, show no real trend reversal. Too few people are reaching out for ecologically beneficial products due to a lack of information, prejudice and, in part, higher prices. But, in principle, there is a desire for change – and it is shared by a large segment of the population. More and more people in Germany are asking themselves whether unbridled consumption – and, with it, the negative consequences and costs it brings for the general public – actually does lead to healthy, sustainable prosperity, both here and worldwide.

Organic farms do not utilise pesticides that harm the environment

Figure 3

People who earn more harm the environment more

Overall energy consumption per capita by income



Source: UBA

67 %

of citizens have more “veggie days” than days when they eat meat.

According to an environmental awareness study by the UBA in 2014, a large majority (82 per cent) of those surveyed share the view that targeted developments that minimise people’s reliance on cars in towns and municipalities will contribute to better living standards. The switch from cars to buses and trains, bikes or (for shorter distances) their own two feet is certainly conceivable for the large majority. Adolescents and young adults are especially sceptical about whether, for example, it is modern or even necessary to own a car in light of roads that are increasingly congested. Many people (75 per cent) were interested in different forms of communal product use (borrowing, swapping) and extending use (passing on, repairing). With regard to the topic of nutrition, there is increasing willingness on the part of many citizens to switch to healthy, sustainable alternatives. For example, over two-thirds of those surveyed (67 per cent) now voluntarily practice more “veggie days” than days when they eat meat and thus show a high willingness to eat less meat in general.
In fact, “green goods” and services have established themselves as real alternatives in a number of consumer areas. Sales of alternative eco-friendly products are increasing continually, even dramatically in some cases. In spite of this, they are still predominantly niche products going by total sales, especially with regard to nutrition and mobility. For example, organic foods only had a market share of 4.3 per cent, A+ cars 7.1 per cent and ecological electricity 16.7 per cent in 2014.[6]

There is a new trend toward consuming more sustainably on the basis of innovative (in particular internet-based) opportunities to share and communally use goods (sharing economy), from swap meets for everyday objects to flat sharing on holiday. However, the environmental effect of these new social practices will only be positive if there is a break with dominant patterns of consumption and they are not established on top of old consumption patterns.

The UBA consumer portal: environmental tips for day-to-day living

It is a huge challenge to live a life of environmental awareness – for us, for our children, for our fellow human beings – and it is not always an easy thing to do in practice. The UBA provides some support: the consumer portal on its homepage has been answering a wide range of questions about environmentally conscious living since 2013.

It does not aim to replace the existing and more specific guidebooks on offer, but rather to act as a gateway that reduces the time spent searching for suitable websites and increases the match rate for relevant environmental information. How do I recognise environmentally friendly products? How can I sensibly save on energy and costs? Which labels can I trust? How can I incorporate environmental conservation into my day-to-day life?

The UBA has been given an important role in the Federal Government’s “National Programme for Sustainable Consumption”. Its objective: in future, it should be easier for consumers to make decisions in favour of environmentally friendly products. The portal, like the programme, is to be further expanded and will function as a “signpost” for consumers.

This is why first steps have now been taken to improve user friendliness. The portal will incorporate significantly more multimedia and will be more intensively incorporated into social networks such as Facebook and Twitter. In addition to this, the portal will be available not only on the UBA website, but also on other websites, for which a widget has been developed. This means that other government departments and the media will also be able to include the central content of the portal on their websites.

The consumer portal currently addresses 58 everyday issues, although it is still missing important topics such as lighting and textiles. Changes are planned in this regard in order to further improve the portal. One important resource is the UBA’s extensive FAQ collection, which will be more strongly incorporated into the consumer portal. Finally, we are currently working on linking the portal with other areas of the UBA website more intensively so that everybody will be able to delve into a topic in detail using the consumer-relevant information and beyond.

› The UBA’s portal is available at: www.uba.de/verbraucherratgeber

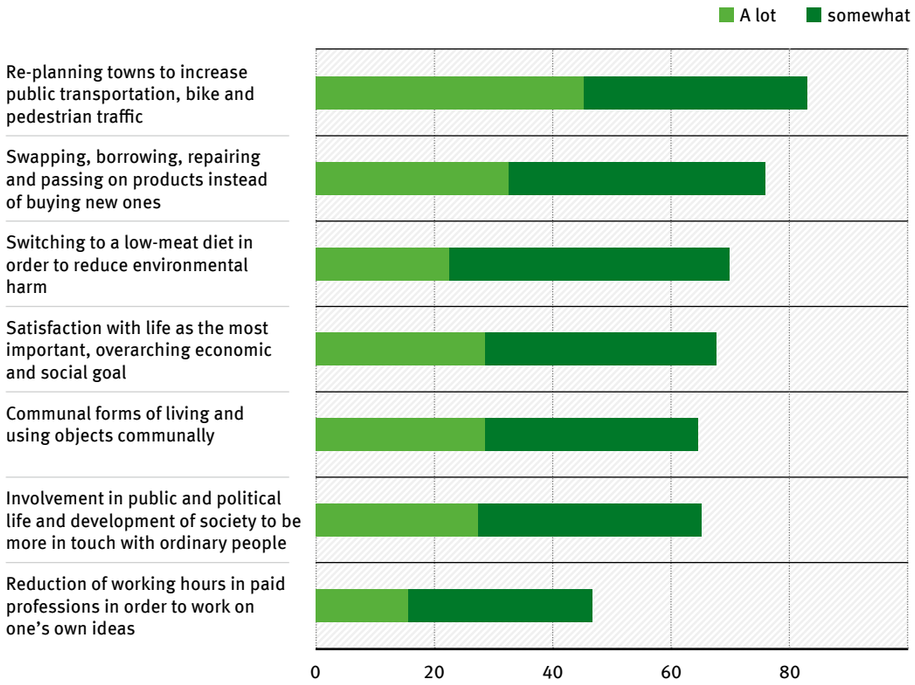
The portal’s categories

More and more people are getting there by bike – cars are no longer the status symbols they once were.

Figure 4

Openness for concepts of socio-ecological change

Question: In the following, you will find a number of ideas and recommendations for the future that could make our lives better. Please indicate in each case whether you personally think that the ideas listed could contribute a lot, somewhat, little or not at all to leading a good life.



Source: UBA

Unfortunately, there are many barriers preventing green market segments from growing in line with the desires expressed by many people in surveys. Alternative practices of consumption are often still far removed from the social mainstream. Eco-friendly alternative products are not universally available and, in particular, there is a lack of transparency about the ecological cost of products – often people only have an eye on the purchase price. If there were a "second price tag" that displayed the full environmental cost, more people could incorporate the costs that are actually being incurred during manufacturing, use and disposal into their purchasing decisions. The way this could work is demonstrated by the information platform developed by the Eco Institute, the "Eco Top Ten", which shows that the market already provides top ecological products in many areas – from cars to organic energy to textiles – that are not more expensive for buyers on average.[7]

The prosperity winners of tomorrow

Although more people are taking environmentally friendly products into account, there are also reverse developments. For instance, sales of the largest, most consumption-intensive, high-performance cars are still booming, while small car sales are falling. Why is this? An important reason is the dangerous distortion of the competition in each market. Car prices are not telling the "ecological truth" either (Ernst Ulrich von Weizsäcker). Drivers are not burdened with the actual social costs of their decisions. But in order to leverage "green goods" and services, all state expenditure and revenue must be measured using ecological criteria. For this reason, we need an ecological financial reform that systematically dismantles environmentally harmful subsidies, for example, and ensures that the environmental costs that have been passed on to society so far are included in the price.

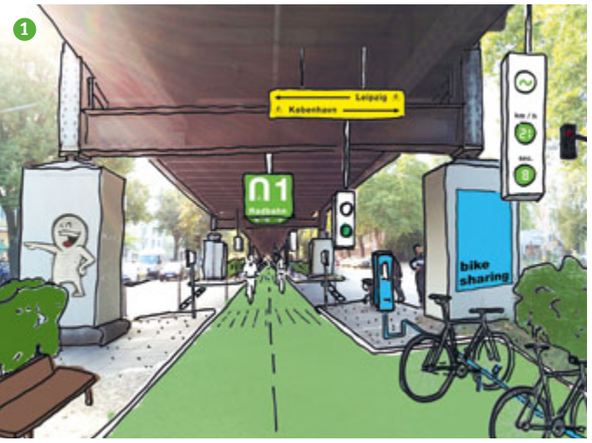
There are other important issues that need to be addressed. Those who want to reduce the environmental consequences of consumption have to begin in the product development phase. A product's design determines up to 80 per cent of its environmental impact. A well-known example: light bulbs vs. LED lights. Their design determines how much electricity the light requires while in use. The LED consumes only a fifth of the energy of a conventional light bulb while giving off the same level of light and having a considerably longer lifespan. Resource and energy requirements can be significantly reduced throughout a product's life cycle in other product groups too. Design that takes into account as many of the cradle-to-cradle principles as possible for products that will at some point be taken out of service makes an even greater contribution to sustainability. The principle: selecting raw materials in a way that creates as little waste as possible – either the materials can be utilised as raw materials for new products after the old ones have been used up, or they can be fed straight back into natural circulation without causing any harm.

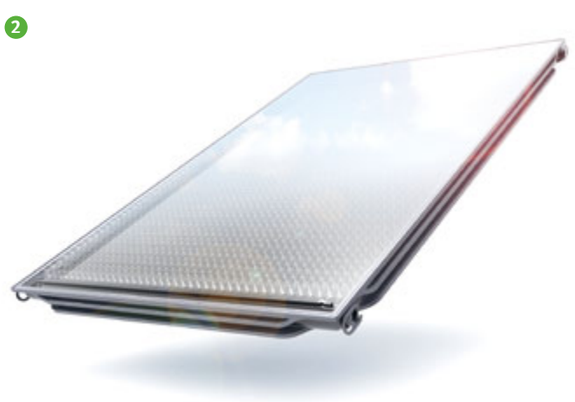
The "Federal Ecodesign Award" demonstrates the wide variety of ecological product design. The BMUB and the UBA have been conferring the award since 2012. Companies, designers and up-and-coming designers can apply with their products, service systems or concepts. Every year there are several hundred entries that present a broad range of design concepts. In 2015, prizes went to a manufacturer of sustainably produced performance clothing, a concept for a covered bike path and a mobile solar collector made from environmentally friendly and affordable materials. Unusual ideas have also been awarded prizes, such as a pilot project for manufacturing foodstuffs out of insects – a "mock hare" made from mealworms. One effective approach to making products

Car sharing – boom and potential

Car sharing is booming. According to the Germany's CarSharing association, there are now roughly 150 car-sharing organisations in Germany and far more than 1.25 million users. On average, there are 45 eligible drivers per fixed-location car-sharing vehicle. For services that are not dependent on stations, this number is as high as 126.[8] According to a UBA study, a coordinated expansion of car-sharing and public transport could reduce CO_2 emissions by more than 6 million tonnes per year. This is the equivalent of roughly 4 per cent of the total CO_2 emitted by traffic in Germany. What is particularly important is that car-sharing offerings have to be more closely connected with public transportation, for example with a higher number of car-sharing parking spaces at traffic hubs. A larger range of mobility offerings with public transport and car-sharing – such as combi-tickets or bus-car-sharing services in rural areas – could create new jobs in the service area alone. The employment gains in traffic and infrastructure operations would be significantly higher in this basic scenario than job losses in areas such as car manufacturing.[9]

Federal Ecodesign Award – winners





1. **Concept category:**
   Radbahn U1, Team Radbahn Berlin
2. **Service category:**
   One World Solar System:
   Sunlumo Technology GmbH
3. **Service category:**
   Coreman Net – ein Service zur Kreislaufwirtschaft, Robert Bosch GmbH / CoremanNet
4. **Up-and-coming category:**
   Falscher Hase – Bugs'Bunny,
   Carolin Schulze
5. **Product category:**
   FREITAG F-ABRIC, FREITAG lab. ag
6. **Product category:**
   Bicycle trailer H tour (Hinterher tour), Hinterher.com bicycle trailer

Ecodesign in design education

Strengthening designers' environmental expertise promotes innovation, environmental conservation and sustainable consumption, and calls upon German universities in particular to do their part. This is why the UBA has developed the "Ecodesign Kit", a "tool box" containing learning materials, tips and practical links about key aspects of ecodesign. It is intended to motivate teachers and students to address the issue of ecodesign and to better understand the environmental impact of their product design. A further goal is to encourage universities and ecodesign to exchange their experiences with one another. In a project funded by the EU, the "Ecodesign Circle", the UBA also wants to strengthen discussion within a broader European context over the course of the coming years. These activities are complemented by an updated edition of the UBA classic "What is Eco-Design?" in the form of an ebook.

more environmentally friendly is to introduce regulatory law – also on a European level. The most important starting point here is the "Ecodesign Directive", which came into effect in 2005. It now sets minimum standards for energy consumption in 25 electronic device product categories, such as vacuum cleaners, computers and washing machines. The Ecodesign Directive thus makes a significant contribution to reaching national and European energy efficiency goals and to climate change mitigation, while consumers profit from lower prices. For example, the amount of energy that vacuum cleaners consume has been limited to 1,600 watts; from September 2017, manufacturers will have to comply with a maximum value of 900 watts. Ecological improvements like these can be implemented without sacrificing convenience, as components that have been technologically optimised ensure the best vacuuming results in spite of reduced energy consumption. Test results from Stiftung Warentest indicate that there were already devices with good suction power available that used significantly less than these 900 watts back in 2014. In spite of initial debate about the sense or nonsense of the efficiency strategy (such as the "light bulb ban"), the guidelines are quite clearly an asset to the EU's environmental policy for green products and sustainable consumption. A new version is now in effect that includes other energy-consuming products, but also products that are "relevant to energy consumption". It also provides a more extensive overview of other resources, such as car tyres with low roll resistance, high-insulation windows or water-saving valves that lower the amount of energy required to heat hot water.

Behind the EU efficiency strategy is the realisation that responsibility for sustainable consumption cannot be assumed by consumers alone. The way that companies that develop and launch products design their products also fundamentally determines the environmental consequences, which means that these companies hold sway over their minimisation.

It is now a matter of course at many German companies to publicly acknowledge ecological and social responsibility. However, it is crucial whether corporate social responsibility (CSR) is actually implemented and communicated credibly at these companies, or if it is just used for marketing purposes. The current VW emissions scandal provides an impressive example of the negative consequences of a strategy that is only geared toward superficial "greenwashing" effects.

The emissions scandal furthermore clearly demonstrates that traditional "end-of-pipe technologies" are reaching their limit in environmental conservation. Manufacturing larger and faster cars with more and more horsepower that produce exhaust gases which take a lot of effort to purify afterwards is the wrong path, both economically and ecologically.

The “Blue Angel” label – now even better

Reliable environmental and social labelling enables customers to make informed decisions about what they consume. The most well-known environmental label in Germany outside of the food industry is the “Blue Angel”. Other examples are EU energy consumption labelling and independently reviewed certificates for wood and wood products such as FSC. Moreover, labels provide manufacturers with incentives to develop sustainable products and services. For this reason, the Federal Government wants to strengthen this area by expanding the Blue Angel to include other product groups. Additional criteria will enable stronger holistic assessments of the whole product manufacturing process, for example by incorporating social factors in the supply chain. “Blue Angel” communication will also become more geared towards target groups and adjusted to accommodate new forms of distribution, such as electronic retail. [10]

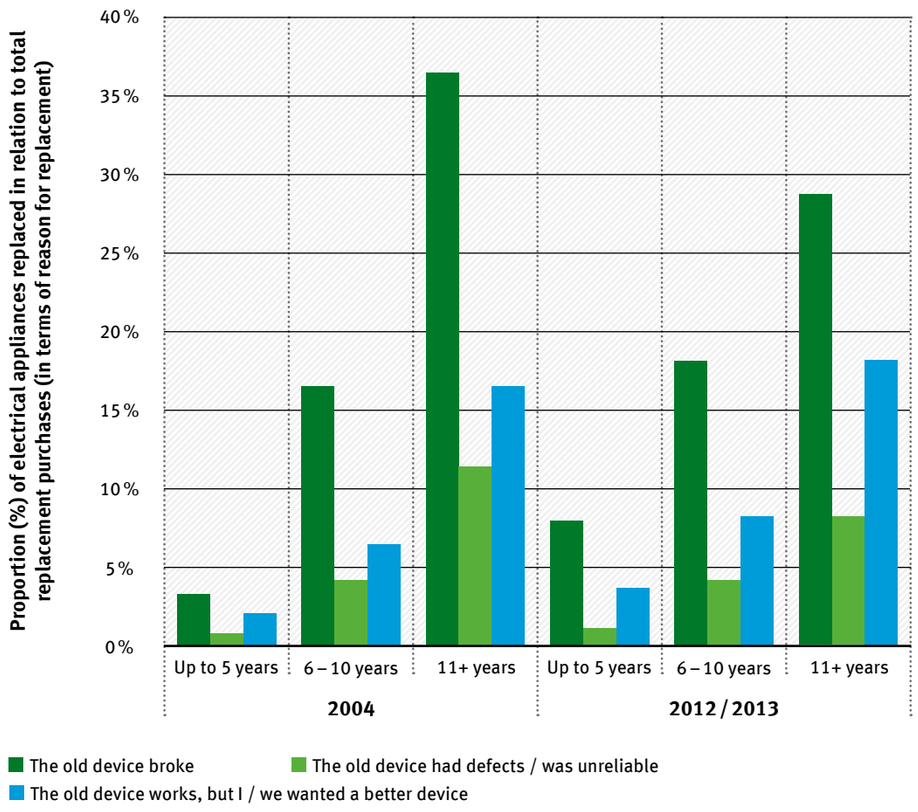
Tendencies in product development that lead to reduced product lifespans are ecologically questionable. A UBA study on the issue of “obsolescence”, i.e. the different factors in wear and tear, shows that electronic and electrical appliances are being used for increasingly shorter periods of time – among other things, because they stop working properly more quickly. The proportion of major household appliances that were replaced within the first five years due to defects increased from 3.5 per cent in 2004 to 8.3 per cent in 2013.[11] But consumers are not entirely without fault either. For example, economic, psychological and social factors play a role in shorter periods of use. On the one hand, repair costs are considered particularly high in comparison to new purchases; on the other hand, there is an increasing trend toward buying products in increasingly short cycles, even if the old ones still work.

In order to establish a circular economy that conserves resources, other strategies need to be chosen. The efficiency of commodities use and utilising low levels of energy in production, lower energy consumption during a product’s use phase and its reuse and recycling at the end of its usage need to take centre stage. In order to support these measures, the Federal Government set up the “German resource efficiency programme” (ProgRess) in 2012. The programme was extended in 2016[12] and takes into account the entire value-added chain. Examples are expanding efficiency consulting for SMEs, supporting environmental management systems, strengthening the procurement of resource-efficient products and services by the public authorities and providing better consumer information.

At the same time, social initiatives that try out new lifestyles, ways of doing business and practices of environmentally oriented consumption, and establish these in their surroundings, are gaining in importance. Initiatives such as transition towns, slow food, urban gardening, community-supported agriculture, eco villages and energy cooperatives often show potential for further propagation. Policies can provide the necessary framework for a strong civil society and community involvement in order to promote approaches like this and spread them out into further consumption fields.

Figure 5

When did you replace a major household appliance and why?



Source: Own portrayal calculated using GfK data (2004: n=2,712; 2012: n=5,664 for major electronic devices in total)

Legal aspects of sustainable consumption

Legal instruments can also contribute to longer product lifespans and to consumers making the conscious decision to purchase long-lasting and environmentally friendly alternative products. A UBA report has identified the following legal possibilities: manufacturing companies should have to notify consumers about their products’ lifespans and the existence of repair services within the scope of guarantee statements and should be liable for those statements. Implementation measures from the Ecodesign Directives could be used to more definitively specify product standards, such as lifespan requirements. Environmental associations could be given more extensive options to take legal action in order to effectively monitor these specifications.[13]

People who buy a dishwasher want to avoid washing by hand for as long as possible.

Sustainable consumption – increasingly a question of justice

Is there an irresolvable tension between environmental protection and social justice, or do the two concerns complement each other? To be successful, environmental policy needs to exploit synergies on social issues and find solutions to conflicts. It should take into account the differences in people's ideas and values, as environmental policy often has an impact on social opportunities and risks. This social conflict is becoming particularly apparent in the rise of electricity prices due to the increase of the EEG levy, while energy-intensive companies enjoy generous exemptions.

If a policy is seen as unjust, acceptance for it disappears – even if the objectives of environmental policy are deemed to make sense. It is particularly problematic whenever certain groups of people are disadvantaged as a result of policy actions. To ensure socially acceptable environmental policy, instruments need to be designed in such a way from the outset that they avoid negative distribution effects to the greatest possible extent.

Above all, it is necessary to illustrate the positive effects more clearly – including for socially disadvantaged persons. Environmental protection often actually amounts to the protection of human health, for example with regard to the establishment of green zones. Such measures specifically target the health of residents.

Environmental protection also results in direct cost savings, such as when household energy consumption goes down due to efficiency gains. The switch to LED lights, more economical TVs and efficient vacuum cleaners help (even as second-hand goods) to save electricity and money. What is more, there are a number of additional eco-social synergies. For example, some subsidies which are considered environmentally unfriendly currently primarily benefit people with higher incomes, such as when it comes to the taxation of company cars and diesel fuel. Dismantling these subsidies would free up billions in financial resources. If these resources were then invested in upgrades on the energy performance of buildings in residential areas with a large percentage of low-income households, the members of those households would stand to benefit from reduced heating costs. In this way, environmental policy can contribute to social equity and help reduce poverty risks.

The way we live today will also affect our children's lives many years from now.

Combining environmental and social policy

To counteract a rising sense of injustice, it is necessary to do a better job of combining environmental and social policy. The aim is to exploit previously untapped potential for synergies between environmental and social policy, as well as healthcare policy – such as when it comes to housing – in a more targeted manner. Attention should therefore be paid to ensuring that social benefits do not have any negative incentive effects from an ecological standpoint, but rather that they deliberately create incentives for environmentally friendly behaviour. Lump-sum allowances for heating or electricity costs, for example, are counterproductive as long as the households receiving support are not allowed to keep any potential savings. At the same time, environmental policy needs to make sure that it is structured in a socially acceptable way. Accompanying measures designed to prevent social hardships should be adopted, such as support programmes for low-income households which provide them with free energy counselling or the opportunity to exchange inefficient household appliances for energy-efficient versions, as the German Advisory Council on the Environment proposed in its current Environmental Report 2016. In a few cases, it may also be appropriate to soften social hardships through social policy and adjust social benefits to increased energy costs, for example.

Outlook: sustainable consumption – prospects for socio-ecological innovation

Germany is facing major challenges. It is obvious to many citizens that the way business is done and everyday consumption patterns have to change – and that such a transformation will require people to reorient how they go about their daily routines. The task now is to unite those efforts that have been made in many areas of society towards achieving greater sustainability and to strengthen them. Germany has the capacity to entrench sustainable consumption in its society.

We need technical progress, innovative products and services, and the establishment of individual practices that are more sustainable. What is more, we need viable and universal cultural patterns of sustainability. However, such patterns will only begin to emerge if, in addition to the many individual activities, we work on a holistic perspective for a sustainable society by putting previously held conceptions of cultural identity and foundations up for public debate. The current debate over the German energy transition vividly reveals what conflicts to expect, but it also demonstrates the kind of innovativeness and creativity that problem-solvers are now employing in their search for new solutions.

Sustainable consumption policy always amounts to social policy, because it has to take into account the values and social circumstances that the lifestyles and consumption patterns of today are based on and – where necessary – help change them. In this sense, public policy acts not only as a guiding force, but also as one that can make things possible, because it already recognises and seizes on the potential for change that society harbours and promotes knowledge sharing between actors.

1 www.un.org/sustainabledevelopment/sustainable-development-goals/
2 www.bertelsmann-stiftung.de/de/publikationen/publikation/did/die-nachhaltigen-entwicklungsziele-der-un-sind-die-industriestaaten-bereit/
3 http://www.bmub.bund.de/fileadmin/Daten_BMU/Pools/Broschueren/integriertes_umweltprogramm_2030_bf.pdf
4 http://www.umweltbundesamt.de/themen/nachhaltigen-konsum-staerken
5 The actual amount of space available in cubic metres – high ceilings require a lot of heating.
6 www.umweltbundesamt.de /daten/private-haushalte-konsum/gruene-produkte-marktzahlen
7 http://www.ecotopten.de
8 http://www.carsharing.de/alles-ueber-carsharing/carsharing-zahlen
9 http://www.umweltbundesamt.de/publikationen/nutzen-statt-besitzen-neue-ansaetze-fuer-eine
10 www.blauer-engel.de
11 http://www.umweltbundesamt.de/publikationen/ einfluss-der-nutzungsdauer-von-produkten-auf-ihre-1
12 http://www.umweltbundesamt.de/themen/ zweites-deutsches-ressourceneffizienzprogramm
13 http://www.umweltbundesamt.de/publikationen/ rechtliche-instrumente-zur-foerderung-des

The UBA

> Plastics research
> Construction projects at the UBA
> Publications
> The UBA in figures

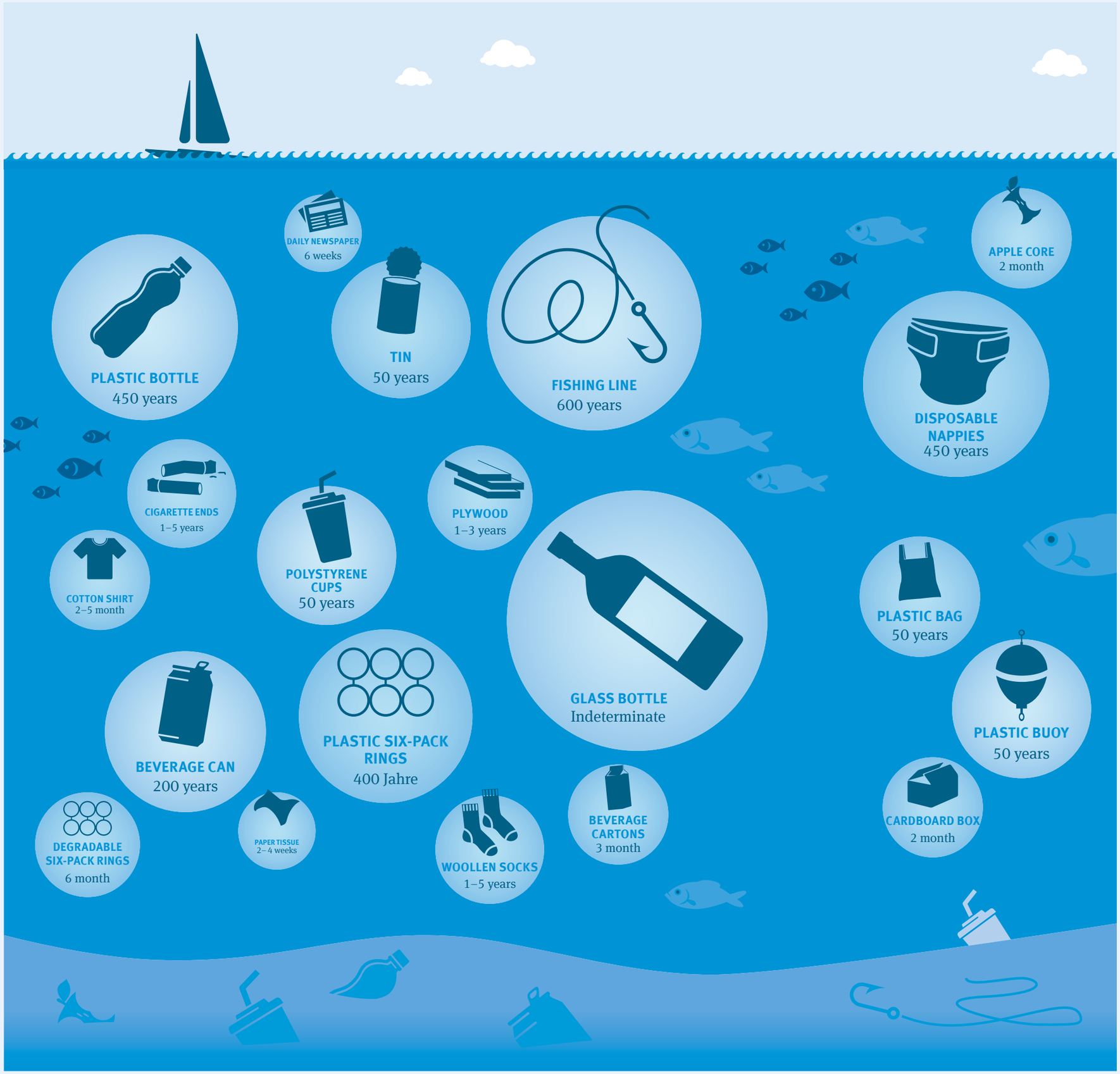
Plastics in the environment – how the UBA is tackling a (not entirely new) topic

In the last two years, the issue of plastics in the environment has gripped not only public debate and media attention, but also the realms of science, business, associations, administration and politics. What initially began above all as a marine protection concern has since become a topic of discussion and action across a wide range of environmental areas.

Plastics and plastic products are an integral part of our lives. They are used at home, in business and in industry. In Germany alone, some 10 million tonnes of plastic are introduced to the market each year in a wide range of different products. Annually, approximately 5 million tonnes of plastic products are recycled or converted into energy; only one per cent of the plastic waste is disposed of. However, despite extensive legislation, efforts to prevent plastics from winding up either directly or indirectly in the environment are currently unsuccessful. This can occur through the careless disposal – or littering – of plastic waste in public spaces, as well as through ageing processes and abrasion of products (e.g. car tyres), through losses during production, and through the introduction of synthetic polymers when using certain fertilisers. Plastics break down in the environment at only a very slow rate. Depending on the properties of the materials and additives, they can remain in ecosystems sometimes for hundreds of years. As the world's largest basins, the oceans are particularly affected by plastic pollution.

Figure 1

How long does rubbish remain in the ocean?



How did it start??

The UBA has been dealing with the topic of marine litter since the early 1990s. Research projects were initiated back then that focused on recording and collecting litter at selected sections of beach on Germany's North Sea coast. Litter in the beaches' wash margin– the area of shore where material is deposited (washed up) – was the subject of study. With this research work, it was possible to establish wash margin monitoring activities at Germany's North Sea coast. They have long since been part of a joint wash margin monitoring series on the coasts of states bordering the North-East Atlantic, including the North Sea, which are coordinated by the Oslo-Paris Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR). In addition, efforts were established within the scope of OSPAR to monitor the level of plastic particles that northern fulmars had ingested from the sea surface after confusing them with food by looking at the stomach contents of these birds found dead on the beach. The UBA finances and coordinates northern fulmar monitoring in Germany.

How did it proceed?

Marine litter really gained media attention when the Great Pacific Garbage Patch became so large that it was said to be visible to the naked eye from outer space. This prompted the launch of research activities worldwide, and the attention that authorities in charge paid to marine litter increased.

When the EU's Marine Strategy Framework Directive (MSFD) entered into force in 2008, the issue of marine litter received even stronger focus on the European level. It stipulates that the amount of marine litter must be surveyed and assessed. Furthermore, if negative impacts on marine life and habitats are observed, then steps need to be taken to combat marine litter.

In autumn 2010, the UBA organised an in-house "Plastics Day". With the assistance of external moderators, it generated widespread UBA interest. The event featured a World Café format and included the participation of Werner Boote, the director of the film "Plastic Planet" (www.plastic-planet.de). This marked the beginning of broad-based engagement at the agency with the issue of plastics in the environment. The event made it clear that this is a topic which concerns many units within the UBA. Expertise on plastics and the environment can be found in 30 sections, eight departments and four divisions.

In 2010, marine litter was incorporated into the OSPAR North-East Atlantic Environment Strategy for the years 2010 – 2020.

With this strategy, signatories have committed to substantially reducing marine litter to prevent negative environmental impacts on coastal and marine ecosystems. In keeping with this, OSPAR pledged at the 2010 Ministerial Conference in Bergen to develop programmes and measures for reducing or stopping litter from sources on land and at sea from entering the Convention Area. This provided the basis of the Regional Action Plan for Prevention and Management of Marine Litter , which was adopted in 2014. HELCOM, which is the intergovernmental Baltic Marine Environment Protection Commission, addressed the issue of marine litter in depth in the 2013 Ministerial Declaration. Like OSPAR, HELCOM agreed that it wished to prevent and reduce litter from land- and sea-based sources. A regional action plan was developed for this purpose and adopted by the signatory states in 2015.

Another milestone with regard to greater interest by the media and experts in Germany and Europe was the International Conference on Prevention and Management of Marine Litter in European Seas, which was held in Berlin in 2013. The conference was organised and hosted by the UBA on behalf of the BMUB and in cooperation with the EU Commission. The conference was a great success: it provided the basis for the development and enactment of regional action plans to combat litter in European seas.

The regional action plans from HELCOM and OSPAR were developed in both instances under Germany's lead. The UBA was in charge of the technical work and is lending significant support to the plans' implementation, which is already under way. The action plans address land- and sea-based sources of litter, and they support an environmentally sound approach to removing litter from the ocean, as well as efforts to raise awareness.

Discarded plastic disperses easily in the environment.

98 per cent of the nests in the gannet colony on Heligoland contain plastics, primarily leftover netting in which the birds are often strangulated

What action is currently being taken on marine litter?

In addition to the existing beach litterand northern fulmar monitoring activities, the UBA has also established a coherent pilot programme for marine litter monitoring pursuant to the provisions of the MSFD. It examines the occurrence of litter on the seabed and the sea surface, and its relevant impact, such as the ingestion of pieces of litter in the meso range (smaller than 2.5 cm) and the micro range (smaller than 5 mm) by other indicator species (e.g. benthic and demersal fish), or the entanglement of sea birds in litter that they have brought into their nesting colonies.

Under German presidency, the participants of the G7 summit in Elmau in June 2015 adopted an action plan against marine litter. This plan is found in the Annex to the Elmau Declaration and lists measures that specify the commitment of G7 states to reducing marine litter. It addresses measures for combating sources of litter on land and at sea, removal actions and measures geared towards education, research and public relations.

On 31 March 2016, Germany punctually reported its national programme of measures as part of the EU's MSFD to the European Commission. Among others, it contains proposals for reducing the amount of litter in German maritime areas and is closely linked to HELCOM, OSPAR and G7 action plans.

On 18 March 2016, Federal Environment Minister Barbara Hendricks, State Environment Minister for Lower Saxony Stefan Wenzel and UBA President Maria Krautzberger founded the Marine Litter Round Table. Under their sponsorship, the objective is to further develop the national measures that have been proposed for reducing marine litter until they are ready for implementation. The focus within the next two years will initially be on the measures from the MSFD programme of measures. Apart from federal and coastal state authorities, relevant stakeholders from industry, shipping and fishing, as well as non-governmental organisations, are represented.

Conference on inland waters in June 2016

At the invitation of the BMUB, the UBA and the Federal Institute of Hydrology (BfG), the first European Conference on Plastics in Freshwater Environments was held in Berlin from 21–22 June 2016. Apart from public authorities, stakeholders from industry, water resources management, waste management and scientific research from a total of 22 countries attended the conference. The programme covered a wide range of issues, from the entry, impact and evaluation of plastic in the environment, to socio-economic concerns and potential measures that can be taken. It became apparent from the discussions that plastic in inland waters still raises many questions, and that we need to look well beyond riverbanks and lakeshores to find the right answers for protecting the environment. We must follow the example of marine conservationists, expand on approaches they have developed and press ahead with additional European approaches.

The European Commission has announced a strategy on plastics for 2017. One focus will be on marine litter. The strategy provides for related measures to considerably reduce rubbish in the sea. Other focal points will include recyclability, biodegradability and the presence of SVHCs in plastics.

Action at the UBA

In the course of the discussions on microplastics in 2013, the UBA's executive board established a cross-divisional group tasked with pooling information and expertise across the boundaries of the relevant divisions. One of the first fruits of this group's efforts was an extensive report on microplastics. The report

addressed the presence of microplastics in – and their impact on – the environment, test methods and research aspects, and was used to inform the BMUB.

Following the UBA's in-house "Plastics Day" in 2010, a second agency workshop was held in spring 2014. It featured discussions about the UBA's various activities and views on unresolved issues. It became apparent during the experts' discussion – including in relation to media coverage – that an assessment of the entry routes and quantities of primary microplastic from products (e.g. cosmetic products) with respect to their environmental impact cannot be conclusively performed based on the available data. Restricting the issue to microplastic also did not seem appropriate. The experts determined that an assessment of the environmental problem's relevance compared to other forms of pollution is only possible to date where marine protection is concerned. So far, there is a lack of necessary findings on the environmental media soil, inland waters and air.

Links to institutions outside of the agency

Apart from the extensive expertise within the agency, a wide range of institutions outside of the UBA are also dealing with the issue – particularly within the interministerial research group. Together with the Federal Institute for Risk Assessment (BfR), the BfG and the Federal Institute for Materials Research and Testing (BAM), a workshop dedicated to microplastics was held with the relevant inter-ministerial research institutes in 2014. Eleven inter-ministerial research institutes from five ministries, as well as the BMBF project management agencies Karlsruhe (PTKA-WTE) and Jülich (PTJ), participated in the event. The objective of the experts' discussion was to inform each other of activities related to microplastics; to reach an initial agreement on definitions, classification, methods, relevance, sources and sinks; to assess risks; and to talk about unresolved issues and the need for research on them. They determined that the relevance of this topic is undeniable. At the same time, the workshop made it clear that it is necessary to specify the areas affected (the environment, food [e.g. marine animals], cosmetic products, textiles, detergents, blasting abrasives, medicines, etc.).

Commitment on the European level

Networking by the UBA is especially important on the European level. The reason behind this also pertains to the implementation of the proposed measures as part of the Marine Strategy Framework Directive, as it concerns not only those countries bordering the sea, but also those located inland. After a 2015 European workshop on microplastic organised by Austria, the idea arose to establish a working group within the EPA Network which focuses on plastics in the environment. The UBA assumed responsibility for chairing and managing this group. The work will focus on proposals for implementing relevant directives, as well as initiatives within the realm of a circular economy, which is currently a priority for the EU Commission.

Support in developing technical rules and standards

Technical standards are a key instrument in protecting the environment. They also include standardised examination and test methods. The DIN Standards Committee Plastics (FNK) represents Germany's standardisation interests on the European Committee for Standardisation (CEN) and the International Organisation for Standardisation (ISO). The UBA therefore decided in 2015 to financially support the technically competent committee in order to draw up an ISO/TC 61 Plastics progress report as a means of preparing for foreseeable standardisation projects on methods for examining plastics in the environment. A working group was established for this purpose. The group's spokesperson is a representative of the UBA.

Research by and at the UBA

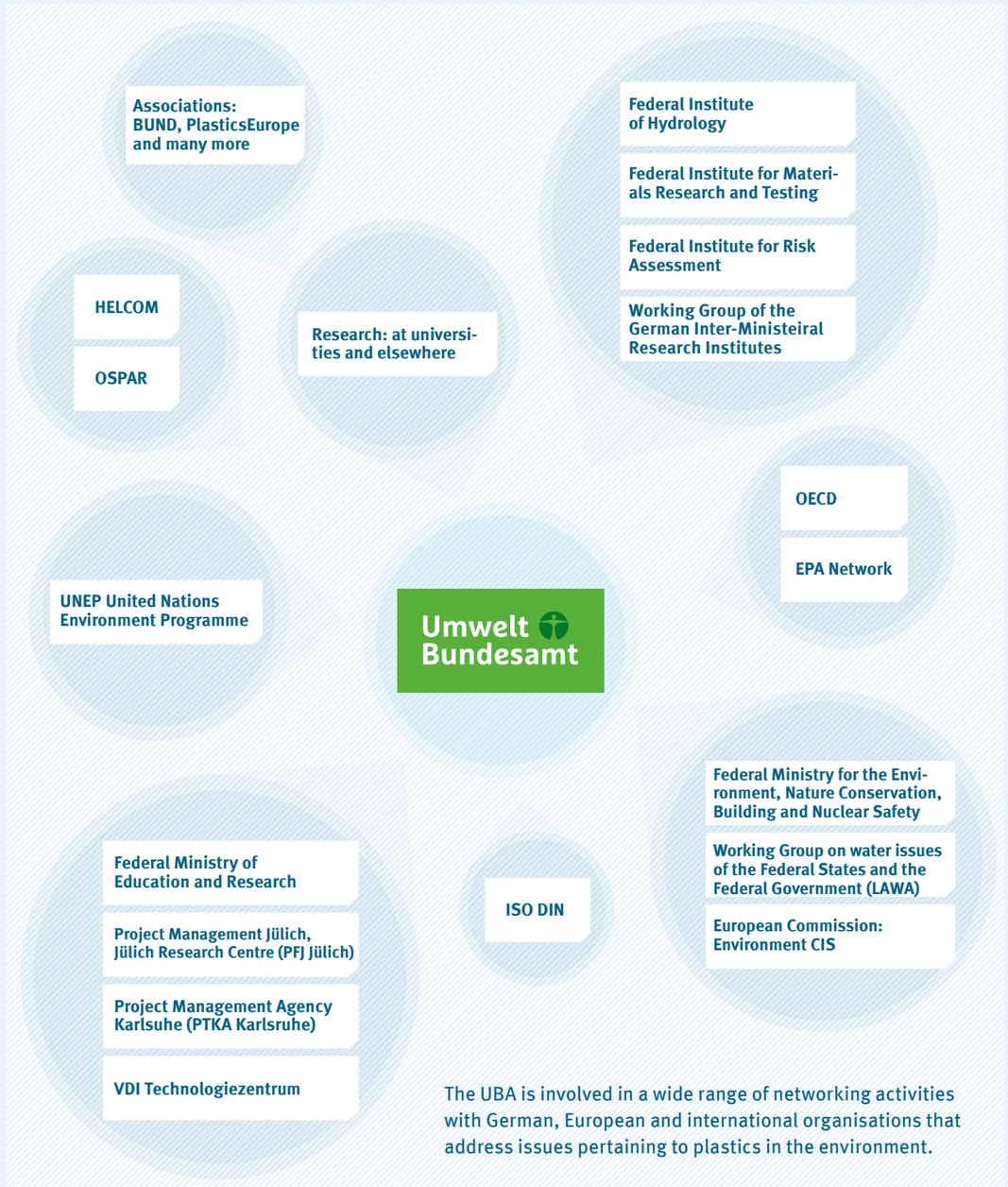
The UBA commissions research projetcs through the inter-ministerial research plan of the BMUB (formerly UFOPLAN), for example. Experimental in-house research and research funded by third parties are also conducted at the UBA. All available instruments are currently being used for the thematic cluster of plastics and the environment.

As part of the (inter-)ministerial research plan, the UBA has commissioned work on the following aspects regarding marine litter:

- Development and preparation of long-term marine litter monitoring activities
- Evaluation of pathways of litter to the marine environmen
- Impact of marine litter on marine organisms

Figure 2

Networking by the UBA on the issue of plastics in the environment



The UBA is involved in a wide range of networking activities with German, European and international organisations that address issues pertaining to plastics in the environment.

Source: UBA

In-house research on the topic is also conducted at the UBA.

There is an average of 236 pieces of litter for every 100 metres of coastline on the beaches of the southern North Sea.

Based on the findings from these analyses, the aim is to design a coherent monitoring programme for the German North Sea and Baltic Sea regions concerning marine litter. This will also take the pathways of litter through rivers and streams into account.

Due to the shortcomings on this topic found at both the UBA and in the inter-ministerial experts' discussion – especially with regard to analytics – the BAM was commissioned with a project in 2015 on "Microplastic screening tests for various media". One particular emphasis of the UBA's in-house research is the development of methods for taking and preparing samples of various media before the plastics detection process. Another focus is on the socio-economic effects of litter on selected German beaches at the North and Baltic Seas. On the basis of partnerships with the Technical University of Berlin, the Free University of Berlin, Trier University and the University of Applied Sciences Bingen, students are completing, or have already completed, bachelor and master theses on the topic.

Further scientific research into the topic is being conducted as part of two cooperative projects of the Federal Ministry of Education and Research (BMBF). The project "Microplastic in the Water Cycle – Sampling, Sample Treatment, Analytics, Presence, Removal and Evaluation" within the BMBF funding measure known as "Risk Management of Emerging Pollutants and Pathogens in the Water Cycle" is developing a set of methods for the chemical and ecotoxicological characterisation of plastics in water.

In addition, the UBA is also involved in the project "Optimised Materials and Methods for Removing Microplastic from the Water Cycle" project as part of the BMBF's funding measure designated "Materials for Sustainable Water Management". This project is primarily concerned with the development of new materials and process technologies for improving the retention of various microplastic particles.

Ausblick

Das UBA hat sich des Themas „Kunststoffe in der Umwelt" angenommen und sich hausintern auf die vielfältigen Herausforderungen inhaltlicher sowie struktureller Art ausgerichtet. Die internationale Dimension macht es notwendig, nicht nur auf nationaler, sondern auch auf europäischer Ebene und im internationalen Kontext zu agieren. Die Übernahme des Sekretariats der „IG Plastic" innerhalb des EPA-Netzwerkes ist dazu ein weiterer Schritt und flankiert das große bestehende Engagement, insbesondere innerhalb von HELCOM und OSPAR.

Construction projects at the UBA

When the UBA makes plans for construction projects, it aims to visibly present the scientifically developed positions in the individual specialised divisions to the outside world and demonstrate what it recommends to others. The UBA thus leads by example and goes far beyond the average standard.

In general, the objective is to attain silver certification within the Assessment System for Sustainable Building (BNB) for German federal buildings. The UBA, however, defines at least one standard for user needs which meets gold certification requirements, and goes beyond that in the area of ecology. As a result, a plus-energy building is being erected with the extension in Dessau. It will use 100 per cent renewable energy sources and environmentally friendly building materials.

The UBA is planning to make many investments in its buildings in the years ahead to ensure that they are usable over the long-term future. At present, the UBA is spread across six locations in Germany. Four are laboratory sites, and two are office locations. Once all of the construction projects are finished, the UBA will carry out its work from four locations: Dessau, Berlin Bismarckplatz, Berlin Marienfelde and Bad Elster. The latter two serve as laboratory sites.

Manager and client for the UBA's construction projects is the Institute for Federal Real Estate (BImA). Planning and execution are being handled by the respective building authorities in charge, while the planning and construction costs are being refinanced through the UBA's rental payments to the BImA.

Extension in Dessau

The UBA is expanding at its headquarters in Dessau-Roßlau. Apart from the agency's main building completed in 2005, a second office building is going up. It will feature 106 workspaces, which employees who have so far been working in offices outside of the main building will move into. Approximately 970 people in total will then work at the Dessau location in 2018. The new building will once again serve as a model of green construction. It will supply itself entirely through renewable energy – namely solar power and a heat pump. In addition, environmentally compatible building materials are being installed, such as recycled concrete and hemp insulation for interior insulation. The extension is setting innovative standards in sustainable building, something that the main building also achieved ten years ago. The construction of a plus-energy building means that despite around 100 new workspaces and a large conference area being added to the premises, the amount of energy consumed on site will not be any higher than it was before.

The outward appearance of the building planned by the Berlin firm Anderhalten Architekten is characterised by its amorphous shape and the facade's structure. An intelligent folding technique increases the surface, which integrates alternating photovoltaic elements and window areas. The photovoltaic elements are positioned at a 75-degree angle, which means they are able to exploit sunlight better than if they had been mounted vertically.

The power for operating the building is provided entirely by a photovoltaic system nearly 730 m^2 in size mounted on the facade and roof, as well as by a heat pump connected with approximately 30 down-hole heat exchangers. In the course of the year, the balance between the amount of energy consumed and the amount generated should equate to surplus energy production. Monitoring activities to accompany operation during the initial phase of use will provide support in reaching the high targets that have been set. The potential surplus of electricity will be routed to the main UBA building. There is another special feature as well: the entire construction site boasts environmentally friendly operations thanks to certified hydropower. With the construction of an office building designed to be a model of sustainability, the Federal Government is setting both a standard and an example in the building sector for how to leave behind an intact framework for future generations from an environmental, social and economic perspective.

Project

Dessau extension / Wörlitzer Platz 1, 06844 Dessau

Expected move in	2017
Objective	› Expansion at the current location › Plus-energy building (energy balance offset over one year, plus energy gain), the first federal building › Gold standard according to the Assessment System for Sustainable Building (BNB) › 100 per cent renewable energy sources › Around 60 per cent lower than the levels stipulated by the 2009 Energy Saving Ordinance › Use of environmentally compatible building materials › Building serves as a model for federal buildings
Structural features	› Constructed with reinforced concrete using recycled concrete › All energy requirements for heating, cooling (only the conference rooms), ventilation, lighting and operating current are met through technical systems installed on and in the building › Heating/cooling: A geothermal heat pump (50 kW) ensures geothermal heat from 31 down-hole heat exchangers for heating needs. The same principle is used in the summer to cool the conference rooms › Electricity: Photovoltaic elements on the facade and the roof generate approximately 70,000 kWh of electricity annually across approximately 730 m^2 › Extensive roof greening under the PV installation
Facts and figures	› Usable area: approx. 2,200 m^2 › Gross floor area: approx. 4,600 m^2 › Four floors: ground floor and three upper floors, partial basement (2/3 of the footprint)

Renovation of the Berlin office at Bismarckplatz

Plans call for the renovation, remodelling and expansion of the listed UBA building at Bismarckplatz in Berlin. Originally designed in the 1930s to serve as an administrative building, it currently features laboratory facilities in addition to office space. The renovation project aims to create a strictly administrative building once again. The laboratories will be concentrated at the site in Berlin Marienfelde.

The UBA's current presence within the urban space does not match how the agency sees and understands itself. Cultivating a stronger public image as a citizen-oriented agency while safeguarding the interests of UBA employees and the structure's status as a historic listed building are therefore key elements of the design. An opening onto the side street behind the building (Königsallee) and one for the courtyard will also serve to enhance the public's interaction with the building. Public spaces, such as the library, cafeteria, exhibition areas and parts of the conference rooms, will be pooled on the ground floor of the north-west wing. They will face the courtyard with windows that extend down to the floor and feature terraces in front. This simple gesture will position the building so that it is in dialogue with the exterior space.

The renovation of the Bismarckplatz location focuses in particular on serving as a model of sustainable building within the stock of listed structures. The aim is to attain the highest possible BNB certification level: gold.

Project

Renovation of the Bismarckplatz location / Bismarckplatz 1, 14193 Berlin

Expected move in	2021/2022
Objective	› Attainment of gold certification from the Assessment System for Sustainable Building (BNB) within the stock of listed buildings › Renovation of the office in line with listed building specifications › Enhancement of the UBA's public image and perception at the Berlin Bismarckplatz location › Achieving energy efficiency that goes beyond the levels stipulated by the Energy Saving Ordinance (EnEV) › Use of renewable energy sources › Use of environmentally compatible building materials
Structural features	› Renovation of an existing building from the 1930s › Expansions that do not match the historical facade will be dismantled, and the historical lobby will be reconstructed with its original design. These careful alterations to the listed structure will remain recognisable in their contemporary idiom and can be modified or reversed with regard to any future changes in use
Facts and figures	› Usable area (space allocation plan): 9,388 m^2 › Usable area (entire building): 14,100 m^2 › Gross floor area: 27,400 m^2, 1,100 m^2 for newly constructed part › Five floors: ground floor and three upper floors, basement level

Development of the laboratory site in Berlin Marienfelde

The UBA conducts experimental in-house research, primarily in the fields of natural science, environmental medicine and environmental technology. It assesses the environmental status of water, drinking water, waste water, soil and air. Activities include developing and testing methods for capturing the concentrations and effect of chemicals and pathogens in the environment. Method- and topic-based laboratory clusters that span divisional boundaries are formed at the Marienfelde laboratory site, which is set for restructuring. The volume of the existing building will approximately double. Efforts are being made to ascertain whether the laboratory building known as “Haus 23” located at the so-called Dahlem Triangle can be housed at the Marienfelde site in an economical way.

As the Federal Government’s first campus project, plans call for erecting this site in such a way that its operations are greenhouse-gas neutral. It remains to be seen in the forthcoming planning phase whether it will be possible to achieve this objective and how it might be accomplished. Renewable energy will of course be used to meet the building’s energy needs to the greatest possible extent.

Project

Marienfelde laboratory site / Schichauweg 58, 12307 Berlin

Expected move in	2025/26
Objective	› Construction of new office and laboratory buildings › Integration of the new buildings into the existing property › Assessment System for Sustainable Building (BNB), gold certification › Use of renewable energy sources › Use of environmentally compatible building materials › Greenhouse-gas-neutral operation of the property
Facts and figures	› Usable area: 4,422 m² › Existing buildings: 7,609 m²

Renovation and expansion of the Bad Elster site

The UBA needs new laboratories at its Bad Elster site. The expansion of the investigative scope as part of the transfer of duties by the Federal Ministry of Health calls for the UBA to perform research to shed light on the presence of infectious organisms in samples of waters used for swimming in particular, which fall under protection level 3 classification pursuant to the Biological Agents Ordinance. Protozoa, such as Naegleria fowlerii, can appear in swimming pools, swimming ponds and other waters used for swimming, and cause severe brain infections. Verifying and distinguishing between such organisms are just as much a part of the UBA’s duties as the development and assessment of new methods for verifying these pathogens. Dealing with these organisms requires laboratories that meet protection level 3 specifications. The UBA has no such laboratories at any of its locations yet.

The existing buildings are also in poor condition in terms of their technical and energy performance. They are in need of renovation, while laboratory building 4 and the garages must be torn down. The construction of a completely new building in the Bad Elster area is also being examined as an alternative to renovation. If this option is chosen, the most economic and expedient version will be erected for meeting the entire range of user needs.

Project

Bad Elster laboratory site / Heinrich-Heine-Str. 12, 08645 Bad Elster

Expected move in	2025/26
Objective	› Technical and energy-related refurbishment with a newly constructed section or entirely new building › Integration of the new section into the existing property › Assessment System for Sustainable Building (BNB), gold certification › Use of renewable energy sources › Use of environmentally compatible building materials › Greenhouse-gas-neutral operation of the property
Facts and figures	› Usable area: 2,759 m² › New section: 384 m² for laboratories and office area

Construction project at Schauinsland measuring station

The UBA observes and monitors air quality at the Schauinsland measuring station as part of national and international air pollution conventions. One key task is to record long-term developments. Europe's longest measurement series for carbon dioxide – from 1972 through today – can be found at Schauinsland.

Plans originally provided for the renovation of the Schauinsland measuring station to enhance its energy performance. However, preliminary inspections revealed a large number of structural defects in the old building. As a result, erecting a new building proved to be a more appropriate course of action from an economic and environmental perspective. Plans now call for a new measuring station to go up in the immediate vicinity of the current site. The existing building will be taken down only after the move into the new station has been completed to avoid costly provisional accommodation.

Project

Schauinsland measuring station / Schauinslandweg 2, 79254 Oberried / Hofsgrund

Move in	2021
Objective	› Construction of a new air measuring station › Assessment System for Sustainable Building (BNB), silver certification › Use of renewable energy sources › Use of environmentally compatible building materials
Facts and figures	› Usable area: 303 m²

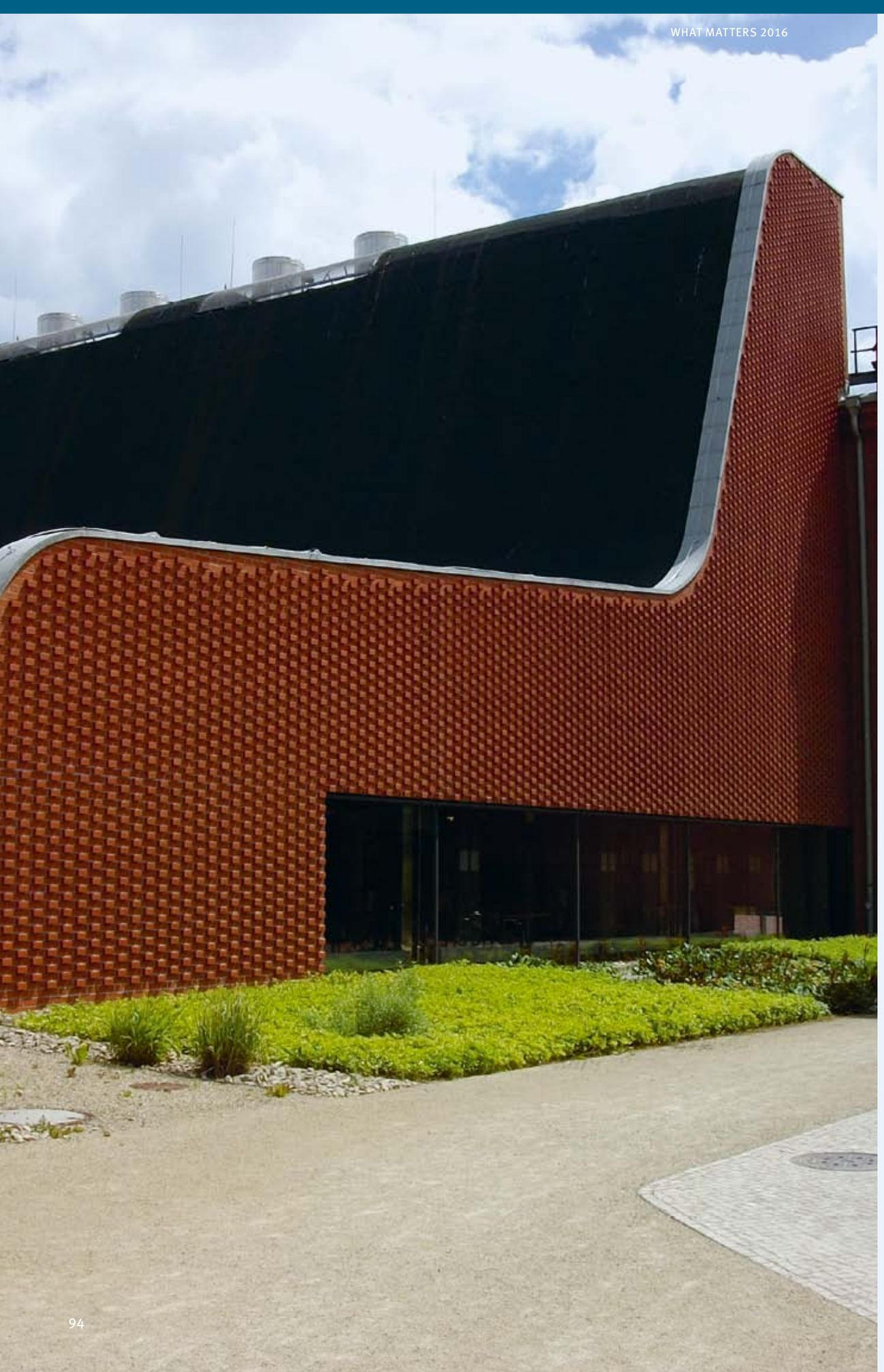
"Haus 2019"

An accessible zero-energy building with 31 office workspaces and three conference rooms was constructed in Berlin-Marienfelde between 2011 and 2013. The building received the working name "Haus 2019", as it already meets the requirement of the European Energy Performance of Buildings Directive that new public buildings from 2019 on must be zero-energy when calculated across an entire year. "Haus 2019" is not only a model of sustainable building, it also serves as an example of how zero-energy buildings can be planned and constructed in future. The building entirely meets its own energy needs by using a photovoltaic system on the roof and a ground-source heat pump. As a rule, the set-up also generates surplus energy on an annual basis. Gold certification from the Assessment System for Sustainable Building officially attests to the building's excellent qualities. Assessments of the building while in operation have even revealed that it exceeds energy generation requirements, making it a plus-energy building with a significant surplus.

Project

Haus 2019 / Schichauweg 58, 12307 Berlin (Marienfelde)

Move in	09/2013
Objective	› Zero-energy building (energy balance offset over one year), the first federal building (besides the EffizienzhausPlus) › 100 per cent renewable energy sources › Around 40 per cent lower than the levels stipulated by the 2009 Energy
Facts and figures	› Usable area: approx. 730 m² › Gross floor area: approx. 1,200 m²



Publications by UBA employees

A large number of UBA employees publish the findings of their research and technical work as articles in scientific journals and individual publications, or they turn them into talks and conference presentations.

These publications are collected in a central location at the agency's **Fachbibliothek Umwelt** (Environmental Library). They are kept on long-term file using the electronic library catalogue (OPAC) at http://doku.uba.de and are available to all interested parties.

Each year, the library creates a **list of UBA employee publications** based on reported contributions. The list is not necessarily exhaustive. It features only those publications reported to the library for the respective year in question.

A total of 394 UBA employee publications were reported for 2015 – 44 more than in the previous year.

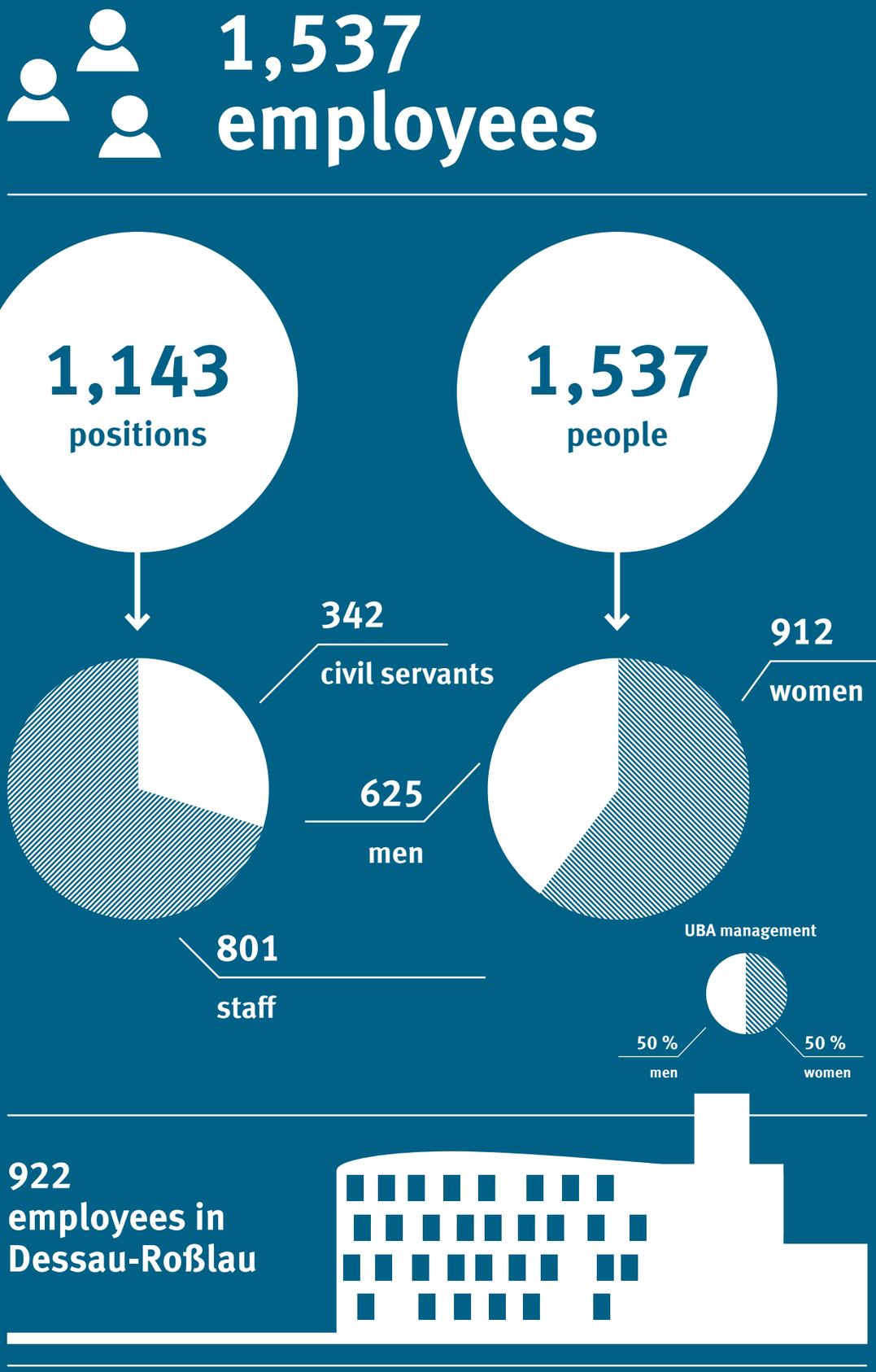
The **current list** can be found:

> on the pages of the agency's website: www.uba.de

> among the information from the library

> as a direct link at www.uba.de/mitarbeiterveroeffentlichungen

Lists from the previous years are also available here: http://www.umweltbundesamt.de/das-uba/fachbibliothek-umwelt



The UBA in figures

UBA budget

	2014 target in EUR thousand	2015 target in EUR thousand
1.1 Total expenditure	**116,198**	**123,349**
Personnel expenditure	72,185	77,973
Investment expenditure	3,494	3.660
Administrative expenditure, including	40,489	41,686
› Scientific publications and documentation	409	409
› Information and documentation system (UMPLIS)	6,257	5,282
› IT	5,429	6,946
1.2 Orders for federal agencies and third parties	**2.738**	**3.997**
2. For administration of funds assigned from other sectors, including for		
Investments towards pollution abatement	38	3
Awarding and management of research projects (Departmental research plan, “environment” section	28,400	33,400
Awarding and management of research projects (Departmental research plan, “nature conservation” section)	192	376
Environmental Specimen Bank	4,031	4,214
Subsidies for associations, federations, other organisations	7,954	8,219
› Institutional support	1,354	1,410
› Support for projects	6,600	6,809
Educational measures	839	838
Consultation for environmental protection in the countries of Central and Eastern Europe, and in the New Independent States (NIS)	2,532	2,490
International cooperation	954	867
Sum total of the funds assigned for administration from other sectors	**391,338**	**253,775**

Projects funded by third parties 2015

BMG – Bundesministerium für Gesundheit *Federal Ministry of Health*		**EUR 615,957.00**
FG II 3.3	Chromium in raw water – Treatment of raw water contaminated with chromium for the public supply of drinking water	2015 – 2017
FG II 3.4	Migration of plastic additives	2015 – 2017
FG II 3.5	Legionella in the drinking water installation – Analysis of drinking water tests and epidemiological case-control study	2015 – 2019
FG III 3.1	BMG WHO – Collaborating Centre for Research on Drinking Water Hygiene	Annual

BMBF – Bundesministerium für Bildung und Forschung *Federal Ministry of Education and Research*		**EUR 301,431-80**
FG II 1.2	GeUmGe – Gender, environment and health	2015 – 2016
FG II 1.4	River hygiene – Hygienically relevant microorganisms and pathogens in multifunctional waters and water cycle	2015 – 2018
FG II 1.6	UKAGEP – Analysis and evaluation of social and economic connections/investigation of connections between environmental factors and health parameters	2015 – 2020
FG II 3.3	INIS/KURAS – Urban rain-water management concepts for sewage systems, sub-project [11]	2013 – 2015
FG II 3.3	Pathotrack – Pilot project with new viral substitutes for assessing the removal of pathogenic substances during water filtration in porous media	2015 – 2017
FG II 3.6	CYAQUATA – Recording and evaluation of the toxicological risk potential of cyanotoxins in reservoirs in Saxon	2015 – 2018
FG IV 2.2	DENANA – Design criteria for sustainable nanomaterials	2014 – 2017
FG IV 2.2/2.4	nanoGRAVUR – Nanostructured materials – Grouping in terms of occupational safety, consumer protection, environmental protection and risk mitigation	2015 – 2018

BMVI – Bundesministerium für Verkehr und digitale Infrastruktur *Federal Ministry of Transport and Digital Infrastructure*		**EUR 512,516.00**
FG I 1.5	COPUBA – Support for the technical coordination of Copernicus land services at the national level and rooting Copernicus within the UBA	2015 – 2018
FG I 3.1	NRVP2020 – Provision of technical, scientific and administrative assistance with the funding process, as well as project support for implementing NRVP 2020 based on the new funding guidelines	2013 – 2016

KOM –Europäische Kommission *European Commission*		**EUR 991,804.64**
FG I 1.2	Twinning Israel 2 – Support for the Israeli Ministry of Environment Protection in improving and modernising environmental, regulatory and management tools for the Israeli industry – Regulatory tools for SMEs, resource efficiency, eco-management and audit scheme	2015 – 2017
FG I 3.5	INSPIRATION – Integrated spatial planning, land use and soil management research action	2015 – 2018
FG II 1.2	Bridge Health – Effect of pollution on the development of diseases – Human biomonitoring for recording pollution in the EU	2015 – 2017
FG II 2.4	ENV51 MeTra – Traceability for mercury measurements	2014 – 2017
FG II 2.5	ENV08 – Development of the metrological basis for comparable measurement results in monitoring priority substances according to the EC Water Framework Directive	2011 – 2015
FG II 4.4	ENV55 MetNH3 – Metrology for ammonia in ambient air	2014 – 2017
FG II 4.4	MacPoll – Improvement in the accuracy and comparability of measurements of harmful gases in outside air	2011 – 2015
FG III 2 ATF	PowerStep – Full-scale demonstration of energy-positive sewage treatment plant concepts towards market penetration	2015 – 2018
FG IV 2.2	iPiE – Intelligence-led Assessment of Pharmaceuticals in the Environment	2015 – 2019
FG IV 2.2	Prosafe – Promoting the Implementation of Safe by Design	2015 – 2016

BMWI – Bundesministerium für Wirtschaft und Energie *Federal Ministry for Economic Affairs and Energy*		**EUR 152,339.00**
FG II 3.3	MOL – Efficacy study of a catalytic method for biofilm disinfection of drinking water and drinking water conservation	2015 – 2016
FG IV 1.4	ATRAP – Automated optical detection and classification of vectors	2015 – 2017

Bundesländer und Bund *Federal States and Federal Government*		**EUR 346,458.00**
FG II 2.2	Pollutant Release and Transfer Registers – PRTR	Ab 2007
FG III 2.1	BREF – Translations of BREF and BAT reference sheets	Ab 2003
FG III 2.1	IPPC office – Financing of a German expert at the European IPPC office by the Federal State	Ab 2011

Vereine und Sonstiges *Associations and other*		**EUR 574,886.00**
Bavarian State Ministry of the Environment and Consumer Protection		
FG II 4.4	VAO II – Trends regarding greenhouse gases and aerosols	2014 – 2017
BfR – Federal Institute for Risk Assessment		
FG IV 2.3	ReachApp – Development of a smartphone app for consumer enquiries regarding REACH	2014 – 2016
BMI – Federal Ministry of the Interior		
FG II 2.2	P23R – Operational environmental data reporting according to the P23R principle	2012 – 2016
Bundesländer – Federal States		
FG II 2.2	Calculation tools – Development of a precise tool for calculating the entry of pollutants from municipal sewage systems into water for the targeted planning and implementation of environmental measures (first phase)	2012 – 2015
DFG – German Research Foundation		
FG II 3.3	INTERNANO II – Mobility, aging and functioning of engineered inorganic nanoparticles at the aquatic-terrestrial interface	2015 – 2018
DIN – Deutsches Institut für Normung		
FG II 4.5	Validation of a CEN method – Comparative field measurements for the validation of the CEN method for determining carbon species in particulate matter	2014 – 2017
DVGW – German Technical and Scientific Association for Gas and Water		
FG II 3.4	DVGW odour – Plastic pipe testing as part of the DVGW research project “Evaluation of plastic pipes in the drinking water installation” regarding compliance with hygienic requirements	2015 – 2016
EEA – European Environment Agency		
FG II 2.4	ETC ICM – Framework Partnership Agreement concerning the European Topic Centre on Inland, Coastal and Marine Waters 2014-2018	2014 – 2019
EU Environment and Sustainable Development Advisory Councils		
SRU	SRU-EEAC – Coordination and support for the EEAC network	2014 – 2016
RIVM – National Institute for Public Health and the Environment		
FG III 3.1	WSP Ethiopia – Workshops on Water Safety Plans (WSP) in Ethiopia	2013 – 2015
VRH – Verein Rohrleitungssysteme in der Haustechnik		
FG II 3.6	Migration waters – Biotest-based strategies for recording risk potential in migration water	2015 – 2016
WHO – World Health Organization		
FG III 3.1	Kyrgyzstan II – Workshops on Water Safety Plans (WSP) and small drinking water systems in Kyrgyzstan and Ukrain	2015

BMBF – Bundesministerium für Bildung und Forschung *Federal Ministry of Education and Research*		**EUR 155,130.00**
FG II 3.6	HyReKA – The biological and medical hygienic relevance, as well as monitoring, of antibiotic-resistant pathogens in hospital, agricultural and municipal waste water and their significance in raw water	2016 – 2018
FG II 3.6	MiWa – Impact of microplastic on drinking water from a toxicological perspective with respect to humans	2016 – 2018
FG III 2.6	MiWa – Sampling and sample treatment of plastics in environmental media for thermoanalytical detection, as well as proposals for adopting the method in regulations	2016 – 2019
FG III 2.6	OEMP – Optimised materials and methods for removing microplastic from the water cycle – Sample treatment and assessment	2016 – 2018

KOM – Europäische Kommission *European Commission*		**EUR 364,729.08**
FG I 1.2	Twinning Croatia – Improvement of Croatian Environment Pollutant Register (Croatian EPR) and its Integration Environmental Information System (CEIS)	2016 – 2018
FG I 1.6	SystemRisk – A Large-Scale Systems Approach to Flood Risk Assessment and Management	2016 – 2019
FG II 1.2	EHBMI – European Human Biomonitoring Initiative	2016 – 2021
FG III 1.1	EcoDesign Circle – European ecodesign initiative for promoting green product design as a driver of innovation in countries bordering the Baltic Sea	2016 – 2018
FG III 1.4	SuperSmart – Expertise hub for a market uptake of energy-efficient supermarkets by awareness raising, knowledge transfer and pre-preparation of an EU ecolabel	2016 – 2019
FG III 2.1	HAZBREF – Indentification of hazardous chemicals in the IED BREFs	2016

Vereine und Sonstiges *Associations and other*		**EUR 67,500.00**
BMI – Federal Ministry of the Interior		
FG II 2.2	Z6-D MRN – Metropolitan Rhine-Neckar region as a testing area for the large-scale introduction of the P23R principle	2016 – 2018
BMVI – Federal Ministry of Transport and Digital Infrastructure		
FG II 4.2	Copernicus_Luft – Satellite-based services and mobile applications for air qualit	2016 – 2017

Publication details

Publisher:
Umweltbundesamt (Federal Environment Agency)
Postfach 14 06
06844 Dessau-Roßlau
Germany
Phone: +49 340 2103-0
Email: info@umweltbundesamt.de
Website: www.umweltbundesamt.de

/umweltbundesamt.de
/umweltbundesamt

Editorial team:
Martin Ittershagen,
Felix Poetschke

Design:
Studio GOOD, Berlin
www.studio-good.de

Illustration:
Lisa Schmidt
www.schmisalidt.de

Print:
bonitasprint gmbh
www.bonitasprint.de

Printed on 100% recycled paper

Ordering brochures:
Umweltbundesamt
c/o GVP
Postfach 30 03 61 | 53183 Bonn
Germany
Service phone: +49 340 2103-6688
Service fax: +49 340 2104-6688
Email: uba@broschuerenversand.de
Website: www.umweltbundesamt.de

Publication as a PDF:
http://www.umweltbundesamt.de/publikationen/what-matters-2016

As at October 2016

Photo credits/Copyright

Cover: www.shutterstock.com/hxdbzxy
Page 2: © PhotostudioD29
Page 6: Shutterstock.com
Page 7: © Tupungato | Shutterstock.com
Pages 9, 15, 17, 19, 21: Shutterstock.com
Page 22: © KarimPhoto | Shutterstock.com
Page 23: Shutterstock.com
Page 24: © IDZ | Wunderwerk
Page 25: Shutterstock.com
Page 27: © IDZ | PYUA
Page 31, 33: Shutterstock.com
Page 34: © testing | Shutterstock.com
Pages 35, 38: Shutterstock.com
Pages 39: Regionalverband Ruhr | © orange edge, 2014
Pages 41, 42, 43: Shutterstock.com
Page 44: Photocase.de | © view7
Pages 54, 55, 59, 62: Shutterstock.com
Pages 64/65: © IDZ | Radbahn U1 (1), © IDZ | Sunlumo Technology GmbH (2), © IDZ | Carolin Schulze (3), © IDZ | Robert Bosch GmbH/
CoremanNet (4), © IDZ | FREITAG lab. ag (5), © IDZ | Hinterher.com Fahrradanhänger (6)
Pages 66, 67: Ecodesign-Handbuch: Agim Meta, ecosense. Screenshot: UBA
Pages 66, 67, 69, 70: Shutterstock.com
Pages 72, 73: UBA | © Susanne Kambor
Page 74: Shutterstock.com
Page 78: © Clara K.B.
Page 79: © Peter Quint
Page 81: © Ina Steffens
Pages 82, 83: Shutterstock.com
Page 84: UBA
Page 87: © Anderhalten Architekten
Pages 88, 89: © Architekten von Gerkan, Marg und Partner
Page 90: UBA
Page 91: UBA | © Dr. Peter Renner
Pagess 92, 93: UBA
Page 94: UBA