Data on the Environment

Environmental Monitor 2020

German Environment Agency

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Data on the Environment

Environmental Monitor 2020

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Preface

Dear Readers,

With the Environmental Monitor 2020, for the first time, the German Environment Agency is publishing a condensed picture of the state of the environment and progress in achieving long-term environmental goals, such as climate protection, air pollution control or water protection. The Environmental Monitor addresses ten central topics and focuses on the links between the state of the environment and the fields of policy action.

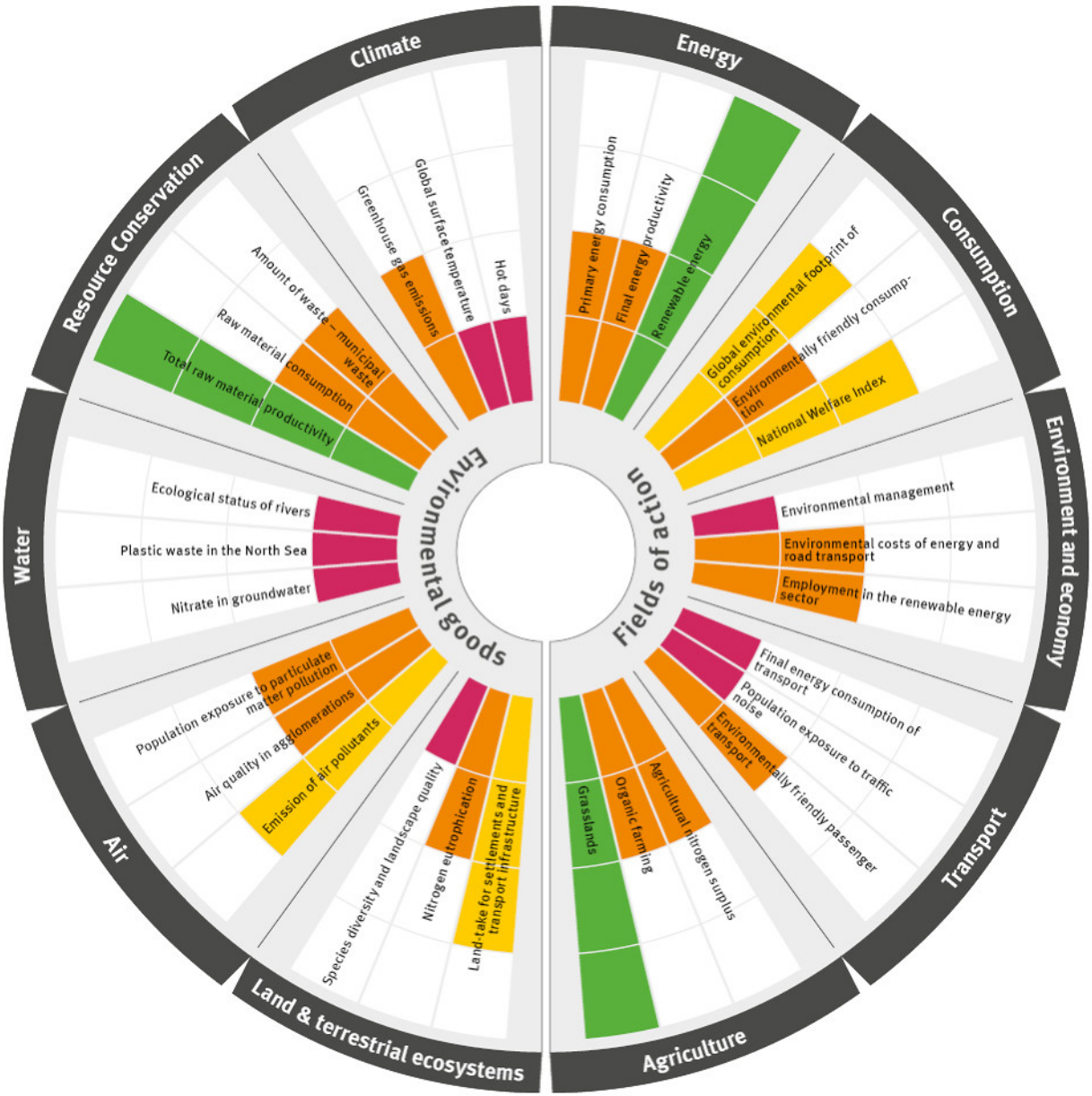
There has been progress in climate protection. Emissions have fallen and, according to 2020 carbon balance estimates, the 2020 reduction target has been met just so. However, this short-term success is of no use if the increase in the concentration of greenhouse gases in the atmosphere cannot be stopped in the long term.

In order to achieve the goal of greenhouse gas neutrality by 2050, further efforts are needed. A sustainable reduction of energy consumption in transport, an increase in energy productivity in the economy and a further increase in the share of renewable energies are important levers.

The year 2020 with the Covid-19 pandemic will be remembered and shaped by all of us. The crisis and the extensive measures to deal with it present an opportunity to initiate new directional developments more quickly. A key need, as I see it, is to link post-Corona reconstruction with the fight against climate change and the other environmental crises. Through economic stimulus packages and public structural investments, the economy damaged by the Corona crisis must be reactivated in such a way that employment is stabilised and, at the same time, that environmental protection, climate protection and resource conservation, as well as equality and fairness, are being advanced.

Dirk Messner
President of the German Environment Agency

Environmental monitor – At a glance



Source: German Environment Agency, March 2021
Design: Studio GOOD

Environmental Monitor – Are we achieving our environmental goals?

The **Environmental Monitor 2020** provides an overview on the state of the environment and the progress made in key environmental policy fields of action. Are we achieving the climate targets, what is the status of the expansion of renewable energies, how much is health affected by particulate matter, how polluted are our waters? – are only some examples. The Environmental Monitor covers a total of 10 topics with 30 environmental indicators. Four colour categories (green, yellow, orange, red) provide information on the extent to which the environmental goals set are likely to be achieved. As is the case with the German government's Sustainability Strategy, these are usually targets for the year 2030. In the visualisation of the Environmental Monitor, the length of the bars additionally illustrates the degree of target achievement in four increments.

Indicators that are anchored in strategies (e.g. Sustainable Development Strategy), guidelines (e.g. Water Framework Directive), laws (e.g. Climate Protection Act) or concepts of the federal government (e.g. Energy Concept) were selected with priority for the Environmental Monitor. Another criterion – in line with the sustainability indicators – is the existence of an explicit target, such as reducing greenhouse gas emissions by at least 55 % compared to 1990 levels by 2030.

Rating	Explanatary note
	If the trend continues, or according to expert assessment, green indicates that at least 95 % of the target will be achieved for quantitative indicators. For indicators that are expected to continue in a certain direction, green indicates that this development has taken place both in the long term and in recent years.
	If the trend continues or according to expert assessment, the target will be moderately missed (target achievement 80 % - 95 %). In the case of indicators that are supposed to move in a certain direction, yellow indicates that the development has not taken place as desired over a longer period of time, but has been moving in the desired direction in recent years.
	If the trend continues or according to expert assessment, the target will be missed by a wide margin (target achievement 30 % - 80 %). In the case of indicators that are supposed to move in a certain direction, orange indicates that although the development has been as desired over a longer period of time, it has no longer been moving in the desired direction in recent years.
	If the trend continues or according to expert assessment, the target cannot be achieved, and the distance to the target may even increase (target achievement lower than 30 %). In the case of indicators that are supposed to move in a certain direction, red indicates that the indicator shows a contrary development both in the long term and in recent years.

Climate

We have made progress on climate protection – things are moving forward. Greenhouse gas emissions have fallen by over 35 % from 1990 to 2019. Preliminary data showed a 40.8% decrease in 2020 compared to 1990. However, intensive efforts are still required to achieve the emission reduction targets for 2030 (at least minus 55 %) and 2050 (complete greenhouse gas neutrality). The German government has introduced measures to this end with the "Climate Action Programme 2020" and the "Climate Protection Programme 2030".
Drought with negative effects on ecosystems, an increase in hot days with negative effects on health, as well as more extreme weather events with heavy rain and storms are omnipresent. After 2018, 2020 was the second warmest year in Germany since weather records first started.

Energy

Saving energy, switching to more environmentally friendly electricity and heat generation and increasing efficiency are important starting points for sustainable energy use. The expansion of renewable energies has made good progress in recent years, and the target for the share of renewable energies in gross electricity consumption in 2020 has been achieved, based on preliminary data. However, it is well known that we cannot afford to rest on our past successes: for the future, we need additional efforts in the use of renewable energies in the building and transport sectors. Before 2050, all electricity generated and consumed in Germany should be greenhouse gas neutral (EEG amendment 2021).

Transport

The transport sector remains problematic with high energy consumption, hardly decreasing CO_2 emissions and high noise pollution for parts of the population. There is an urgent need to promote environmentally friendly passenger transport such as buses, trains, walking and cycling more strongly. Although cycling has increased slightly, development here has stagnated in recent decades. The federal government's goals for reducing the energy consumption of transport will not be achieved in the foreseeable future.

Water

The ecological status of water bodies, nitrate pollution of groundwater and the increase of plastics in the oceans are central aspects in the assessment of the environmental status. The assessment is consistently poor. Only 7 % of the rivers achieve a good ecological status. Large quantities of plastic waste are still being discharged into the oceans. For years, nitrate pollution of water bodies has been above the limit value at about every sixth measuring point. The main reason for this is the still excessive nutrient load in the waters. This is mainly caused by agriculture. The central element for implementing the Nitrates Directive is the Fertiliser Ordinance. The Fertiliser Ordinance defines "good professional practice in fertilisation" and specifies how the risks associated with fertilisation are to be minimised. In 2020, the Fertiliser Ordinance was revised again. However, the effects cannot be mapped at this point in time.

Agriculture

The expansion of organic farming, as a more environmentally, climate and nature-friendly form of cultivation, also has been making slow progress. According to data from the Federal Statistical Office, the share of organically farmed land in agricultural land was 7.8 % in 2019. If the trend continues as in previous years, it will still take several decades before the target value of 20 % is reached. It is encouraging from the point of view of environmental protection that the area of grassland has recently slightly increased again. Permanent grassland is important for soil and water protection and, as a carbon sink, makes an important contribution to climate protection.

Air/Health

Overall, air quality in Germany has improved in recent years. In 2019, for the first time, there were no exceedances of the currently applicable limit value in the measured concentrations of particulate matter. However, what initially appears to be a success is not yet sufficient from a health perspective. The limit values, which are now more than 20 years old, no longer correspond to the latest scientific findings. The EU Commission has also stated in the European Green Deal that a revision of the limit value is necessary. The German Environment Agency therefore bases the population's exposure to particulate matter on the guideline values of the World Health Organisation. Although the number of people affected by exceedance of the guideline value is declining, that number is still too high.

Consumption/Economy

The claim on the environment in the economic cycle - e.g. the use of raw materials, energy consumption or the development of waste volume - shows a stable correlation: the decoupling of economic growth and environmental consumption is successful. This means: for every unit of gross domestic product generated (in €), the consumption of raw materials, energy and the volume of municipal waste has fallen. However, these so-called efficiency gains are always being used up. After a long period of increase, the amounts of municipal waste are only decreasing hesitantly, the consumption of raw materials per capita has recently increased again slightly and primary energy consumption also hardly decreases.

The consumption behaviour of private households has a significant influence on environmental consumption. Thermal insulation of buildings, installation of more efficient heating systems and overall more environmentally friendly mobility can contribute to reducing environmental consumption. However, the goal of the Sustainability Strategy to continuously reduce energy consumption, raw material consumption and CO_2 emissions from consumption is currently only being achieved to some extent.

Assessment of the Monitor Indicators

In the table you will find information on the development and evaluation of the indicators of the Environmental Monitor. The four color categories of the Environmental Monitor also provide a quick overview of the extent to which the set environmental targets are likely to be achieved. Detailed information on the indicators can be read starting on page 20. Information on the evaluation methodology can be found starting on page 100.

Land, soil, terrestrial ecosystems

Land-take for settlements and transport infrastructure

The Integrated Environmental Programme 2030 formulates the goal of limiting the increase in settlement and transport areas to 20 hectares per day by 2030. From 2015 to 2018, an average of 58 hectares per day were added for settlement and transport areas. If the trend of recent years continues, the target will be reached by 2030. However, land take has increased in the last year. Achieving a limit of 20 ha/day is very ambitious and requires further measures.

Nitrogen eutrophication

In 2015, 68 % of Germany's area of sensitive ecosystems was threatened by excessive nitrogen inputs. The aim is to reduce the share of the area of sensitive terrestrial ecosystems exceeding eutrophication thresholds by 35 % by 2030 compared to 2005 levels. This goal can only be achieved if efforts to reduce emissions of air pollutants are increased. Above all, ammonia emissions must be reduced significantly.

Species diversity and landscape quality

A wide variety of animal and plant species is an essential prerequisite for a productive natural balance and is an important basis for human life. The indicator for species diversity and landscape quality has deteriorated in the last 10 years. The slight increase in the last year is not a sufficient indication of a trend reversal. Therefore, the target is still being missed significantly. The target of the Sustainability Strategy calls for an index value of 100 in 2030. If the development remains unchanged, this target will not be met.

Air

Emission of air pollutants

By 2030 Germany has to reduce the five air pollutants sulphur dioxide (SO_2), nitrogen oxides (NO_x), methane (NH_3), volatile organic compounds (NMVOC) and particulate matter (PM2.5) by an average of 45 % compared to 2005. This goal is set out in the European "National Emission Ceiling Directive" (NEC) and the German Sustainability Strategy. With the measures taken so far, the target will be missed to a moderate degree. Therefore, further air pollution control measures are necessary.

Air quality in agglomerations

The background levels in German agglomerations still exceed the recommendations of the World Health Organisation (WHO) for two important air pollutants (particulate matter, ozone). If the trend for particulate matter continues, it will possible to undercut the WHO recommendations for the average of all urban background monitoring stations. A trend assessment for ozone is not possible due to its strong weather dependency.

Population exposure to particulate matter pollution

The population's exposure to particulate matter was significantly lower in 2018 than in 2010. The UBA proposes as a target that the exposure of the entire population should be below the World Health Organization's guideline value for particulate matter (PM2.5) of 10 µg/m³ as an annual average by 2030. This is an ambitious target. Impetus for a reduction in particulate matter pollution is expected above all from the implementation of measures under the national Clean Air Programme, which was adopted by the German government in 2019.

Water

Nitrate in groundwater

The European Nitrate Directive obliges Germany to prevent the limit value for nitrate of 50 milligrams per liter from being exceeded. Since 2008, the limit value has been exceeded every year at about every sixt measuring point. The target is therefore still not met. The European Court of Justice has found Germany guilty of violating the EU Nitrate Directive. The effects of measures taken (e.g. amendment of the Fertiliser Ordinance) will only become apparent in a few years' time.

Plastic waste in the North Sea

Large quantities of plastic waste continue to enter the oceans, where they are only very slowly degraded and cause massive damage to ecosystems. Plastic pieces are mistaken for food by animals and after consumption can damage and clog their digestive organs, which can lead to the death of the animals. In about 60 % of the fulmars found in German North Sea areas, there are more than 0.1 grams of plastic pieces in the stomach. According to a quality target set by the OSPAR Convention (2008), this should occur in a maximum of 10 % of the birds.

Ecological status of rivers

The target set in the Water Framework Directive of achieving at least good ecological status in all rivers and streams is clearly missed. Only about 7 % of German rivers and streams met this target margin. It is now necessary to use the remaining management cycle under the Water Framework Directive in order to achieve the ambitious targets by 2027 at the latest.

Conservation of resources: raw materials and waste

Total raw material productivity

The extraction and consumption of primary raw materials is in part associated with massive negative environmental impacts. One of the goals of the German government in its Sustainability Strategy is therefore to use raw materials as sparingly and efficiently as possible and to increase their productivity by 1.6 % per year up to 2030. The development of the indicator currently shows a corresponding trend. However, this is mainly due to an increase in gross domestic product and imports, while the use of primary raw materials, which is much more significant from an environmental protection perspective, has even increased slightly since 2000. In UBA's assessment, the target for increasing productivity in the Sustainability Strategy is too low overall. On the basis of known and foreseeable developments, total raw material productivity should be increased by at least 2 % per year in order to also promote the necessary economical use of primary raw materials. A more ambitious target and the addition of a target for reducing the absolute consumption of raw materials is therefore even more important.

Raw material consumption

The production, extraction and processing of primary raw materials have a high environmental impact. If the worldwide per capita demand for raw materials were as high as in Germany, this would place a very heavy burden on global ecosystems. This is why the Federal Government is aiming to reduce the consumption of raw materials. From 2000 to 2009 there was a decline. Since then, development has stagnated; there is no discernible clear trend.

Amount of waste - municipal waste

While municipal waste shows no clear trend in the long term, it has fallen slightly to most recently 50.3 million metric tons in 2016. In its 2013 Waste Prevention Programme, the German government set itself the goal of decoupling economic growth from waste generation, i.e. the volume of waste should grow at most as fast as the economy. This has been achieved. However, the goal of reducing waste volumes at all stages of the value chain is being missed.

Climate

Greenhouse gas emissions

Germany's greenhouse gas emissions are to be reduced by at least 40 % by 2020 and by at least 55 % by 2030 compared to 1990 emissions, according to the Climate Protection Act. Complete greenhouse gas neutrality is to be achieved by 2050. By 2019, there had been a decrease of around 35 %. Without massive and rapid additional efforts, the 2030 target will not be achieved.

Global surface temperature

To prevent a dangerous disruption of the climate system, the global increase in air temperature is to be limited to well below 2 °C, if possible to 1.5 °C compared with pre-industrial times (United Nations Paris Climate Agreement). This can only be achieved if global greenhouse gas emissions are reduced quickly and drastically. The last six years have been the warmest globally since 1850, with a recent temperature increase of 1.2 °C compared with the same period from 1850 to 1900.

Hot days

Rising temperatures can have a detrimental effect on health. The number of hot days (area average) above 30 °C increased in trend until 2020, but with strong annual fluctuations. 2003, 2015 and 2018 were the years with the most hot days in Germany. Due to climate change, more hot days can be expected in the coming decades.

Energy

Primary energy consumption

By 2020, primary energy consumption was supposed to drop by 20 % compared to 2008 – according to current preliminary estimates for 2020, this target will be narrowly missed despite the effects of the Corona pandemic. The German government has also set itself the target of reducing primary energy consumption by 30 % by 2030 and by 50 % by 2050. To achieve this target, primary energy consumption would have to fall by an average of 1.5 % per year over the next few years. Before the 2020 crisis year, the average decline was 1.1 % per year.

Final energy productivity

Energy productivity needs to be increased worldwide to prevent global energy consumption from increasing unchecked and to avoid drastic consequences for the environment. The German government is aiming for an annual increase in final energy productivity of 2.1 %. Between 2008 and 2019, the average increase of 1.3 % per year was significantly below this figure. The target will therefore be missed by a wide margin if the trend continues.

Renewable energy

According to the Energy Concept from 2010, the German government committed to achieving a share of renewable energies in gross final energy consumption of 18 % in 2020. In addition, the Renewable Energy Sources Act (EEG 2017) set the target of increasing the share of electricity generated from renewable energies in gross electricity consumption to 40 to 45 % by 2025. This subtarget was already exceeded in 2020, with 45.4 % of gross electricity consumption coming from renewables. Before 2050, all electricity generated and consumed in Germany is to be greenhouse gas neutral (EEG amendment 2021).

Due to the very positive development in the electricity sector and according to preliminary data, the 18 percent target for gross final energy consumption covering all sectors also has been achieved in 2020 – despite significantly less progress in the use of renewable energies in the buildings and transport sectors. According to preliminary estimates, the share of renewable energies in gross final energy consumption will be 19.6 % in 2020 based on calculations based on the German government's Energy Concept.

Private households and consumption

Global environment footprint of consumption

Through their consumption activities, private households significantly contribute to the environmental impact caused by the German economy as a whole. In its Sustainability Strategy, the German government has therefore set the goal of continuously reducing the global environmental impact of private household consumption in the areas of direct and indirect energy consumption, direct and indirect CO_2 emissions and raw material use. While the use of raw materials is developing in the desired direction overall, further efforts are needed in terms of energy consumption and CO_2 emissions to achieve the German government's target.

Environmentally friendly consumption

In its Sustainability Strategy, the German government has set the goal for environmentally friendly products to have a market share of 34 % by 2030. The share of sales accounted for by products with state eco-labels declined for the second time in succession following previous continuous growth and stood at 7.5 % in 2018. If the trend continues, the target will not be met. Further measures are necessary.

National Welfare Index

Gross domestic product is a measure of the economic performance of an economy. However, it does not reflect social welfare. Based on consumer spending, the National Welfare Index (NWI) takes into account a total of 20 welfare-creating and welfare-reducing activities. The NWI reached its highest value in 1999 and declined thereafter until 2005. An upward trend has been observed since 2013.

Environment and economy

Environmental management

The number of organisations, sites and employees registered under the 'Eco-Management and Audit Scheme' (EMAS) is a measure of the distribution of sustainable production patterns in the economy. In its Sustainability Strategy, the German government has set itself the goal of having 5,000 sites registered under EMAS by 2030. In December 2020, 2184 sites were registered. If the trend from the past continues, the target will be missed by a long way in 2030.

Environmental costs of energy and transport

Power generation, heat production and transport activities pollute the environment among other things by emitting greenhouse gases and air pollutants. This results in high follow-up costs for society, for example through environmentally-related illness, damage to ecosystems or to buildings. For Germany, the amount of these environmental costs is estimated at about 225 billion euros in 2017, which is an increase of 4 % compared to 2014. For heat generation and transport activities, the environmental costs have increased, for power generation the environmental costs decreased in this period.

Employment in environmental protection

The increase in the use of renewable energies not only benefits climate protection, but also creates jobs in Germany. After a strong increase since 2000, employment there has been declining since 2012. Initially, major job losses in solar energy were responsible for this. Since 2017, production in wind energy has also declined sharply. The main drivers are losses in foreign trade and unfavourable framework conditions in Germany.

Transport

Final energy consumption in transport

Harmful greenhouse gas emissions are closely linked to energy consumption in the transport sector. For this reason, energy consumption in passenger and freight transport is to be reduced by 15-20 % by 2030 (Sustainability Strategy). However, the final energy consumption of transport is stagnating at a high level with a rising trend in recent years. According to the current trend, this means that the target will not be met. In order to reduce the energy consumption of transport, more energy-efficient alternatives must be promoted, the demand for transport must slow down or decrease, and transport must shift to more environmentally friendly means of transport.

Population exposure to traffic noise

Traffic noise affects the lives of many people in Germany and can have far-reaching effects on health. In 2017, around 13 % of the population was affected by traffic noise levels at night, which can cause cardiovascular diseases. During the day, it was 19 %. Compared to 2012, the situation has only marginally improved. The federal government's goal of a significant reduction in noise pollution thus is missed.

Environmentally friendly passenger transport

Bus, the railway, walking and cycling make up environmentally friendly passenger transport. The share of total passenger transport has stagnated around 20 % for years, but increased slightly in the last two years. In order to keep the environmental impact and energy consumption of passenger transport down as envisaged in the energy concept, this share must be increased. Further measures are needed.

Agriculture and forestry

Agricultural nitrogen surplus

The 5-year average of the nitrogen surplus in the overall balance per hectare of agricultural land has declined by 20 % since 1992. The federal government's goal is to reduce the nitrogen surplus of the overall balance to 70 kilograms per hectare of agricultural land per year on average from 2028 to 2032. If the current trend continues, the target will be missed. In order to still achieve this target, efforts must be significantly increased. However, the effects of the fertiliser legislation, revised once again in 2020, cannot yet be mapped. Whether further adjustments will be necessary also depends on the design of the Material Flow Balance Ordinance.

Organic farming

The share of agricultural land managed according to the rules of organic farming has grown slowly but steadily in the period 1999 to 2018. In 2019, the share of organically farmed land in agricultural area was 7.8 % and is supposed to increase to 20 % by 2030 (Sustainability Strategy). Even if the positive trend of recent years were to continue, however, it would still take several decades to reach the target value. It is therefore important to identify obstacles to growth and to remove them through efficient measures and continuous promotion.

Grasslands

Grassland is of great value for environmental protection and nature conservation. The goal that the area of grassland should not shrink any further from 2012 onwards can be derived from the last reform of the European agricultural policy and its national implementation. After decades of decline in the grassland areas, the development has recently reversed: Compared to the starting year 2012, the area has slightly increased again. This means that the target can currently be considered achieved. It is important that the current status remains in place in the future. For this, the next reform of the European agricultural policy must provide support mechanisms to protect and promote grassland.

01
Land, soil, terrestrial ecosystems

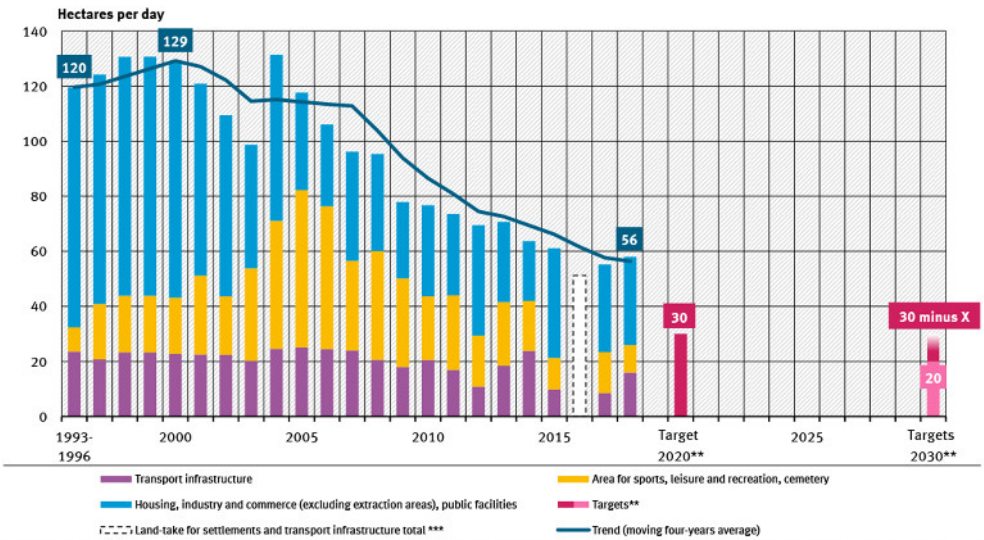
Land-take for settlements and transport structure

Nitrogen eutrophication

Species diversity and landscape quality

Land-take for settlements and transport infrastructure

Land-take for settlements and transport infrastructure*



* Land use survey is based on the evaluation of the states' (Länder) land registry. Data on increase in land-take for settlement and transport infrastructure have been distorted from 2004 due to a change-over in land registries (recoding land use types in course of digitalisation).
** Target 2020: Climate Action Plan 2050; Targets 2030: '30 minus X' hectares per day: German Sustainable Development Strategy, revised 2016; 20 hectares per day: Integrated Environmental Programme 2030
*** Since 2016, the distinction between "buildings and adjacent open areas" and "operating area excluding extraction areas" has become obsolete due to the switch from the automated property book (ALB) to the automated real estate cadastre information system (ALKIS). This means that time comparison is currently impaired and the calculation of changes is made more difficult. The settlement and traffic area determined after the changes contain largely the same types of use as before. Further information is available at www.bmu.de/WS2220#c10929.

Quelle: Values from Federal Statistical Office 2018, Fachserie 3 Reihe 5.1.2018. Bodenfläche nach Art der tatsächlichen Nutzung from 15.11.2019 supplemented at May 7 2020 (in German only)

At a glance

- Between 2015 and 2018, 56 hectares of land per day were newly dedicated to settlements and transport infrastructure.
- Originally, the increase was to fall to 30 hectares per day by 2020. According to the goals of the Sustainability Strategy, the daily increase now should be less than 30 hectares per day by 2030.
- The Integrated Environmental Programme of the Federal Environment Ministry specifies a reduction in the daily increase to 20 hectares per day by 2030.
- Additional actions are necessary in order to achieve these targets.

Indicator online (latest data, data download): http://www.uba.de/57125
Last updated: 13.07.2020

Environmental importance

The conversion of agricultural land, forests or grassland to settlements and transport infrastructure has significant environmental impacts. Much of the land is covered with buildings and other facilities or sealed to expand transport networks. This destroys the natural fertility of soils, thereby impeding future (re-)use for agriculture and forestry. Sealed surfaces (i.e. asphalted or paved) lose their ability to regulate the microclimate and are unable to mitigate the overheating of towns and cities in summer. In addition, the loss of these areas has an adverse effect on species diversity as the new settlements and transport infrastructure increase fragmentation of landscapes and reduce the size of habitats.

Furthermore, newly developed settlements and transport infrastructure generate additional traffic which in turn creates noise and pollution. Material consumption also increases for the construction of buildings and transport routes. New buildings and infrastructures have to be operated, thereby energy consumption increases as well.

Assessing the development

The EU's 'Roadmap for a Resource Efficient Europe' aims to reduce land use in such a way that by 2050 no more land is consumed in net terms (COM/2011/0571). The objectives of the Sustainability Strategy (BReg 2016) and the climate action programme 2030 (BReg 2019a) specify that by 2030 less than 30 hectares per day should be newly designated as land for settlement and transport purposes. The 'Integrated Environmental Programme 2030' of the Federal Environment Ministry mentions a more ambitious target of 20 hectares per day for the year 2030 (BMUB 2016a), as this figure should be achieved if a linear progress towards the net zero target for 2050 is made - as also intended in the 'Climate Action Plan 2050' (BMUB 2016b).

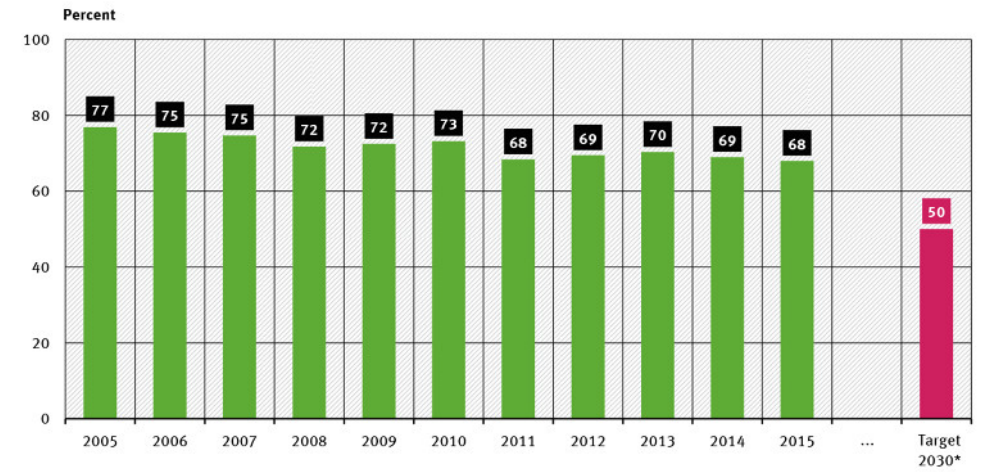
In the 2015 – 2018 period, the settlement and transport area increased by an average of 56 hectares per day. Since the year 2000, the daily increase in settlement and transport area has been roughly halved. The reasons for this were stricter regulations in building and planning law, greater efforts in the federal states and municipalities, subdued economic development and demographic change. If the trend of the last five years continues, the target of the Integrated Environmental Programme of 20 hectares per day by 2030 can be achieved. However, maintaining the trend is challenging. This is evident from the steadily increasing values of the last three years.

Methodology

The indicator shows the average increase in settlement and transport area in hectares per day. Settlement and transport areas include buildings and open spaces, operational areas (excluding mining land), recreational areas, cemeteries and traffic areas. The indicator is calculated annually by the Federal Statistical Office on the basis of the land use data reported by the Länder. In many cases these are subject to special effects and must be partially corrected by the Federal Statistical Office. Methodological notes on this can be found in the publication ‘Bodenfläche nach Art der tatsächlichen Nutzung’ (Destatis 2019a).

Nitrogen eutrophication

Proportion of vulnerable ecosystems where critical loads for eutrophication are exceeded



* Federal Government's Strategy for Sustainable Development: The proportion of land affected by excess nitrogen deposition should fall by 35 % between 2005 and 2030. Based on a value of 77 % in 2005, this gives a target value of 50 % for 2030.

Source: Schaap et al. 2018. PINETI-3, Modellierung und Kartierung atmosphärischer Stoffeinträge von 2000 bis 2015 zur Bewertung der ökosystem-spezifischen Gefährdung von Biodiversität in Deutschland

At a glance

- 68 % of vulnerable ecosystems in Germany are threatened by excess nitrogen deposition.
- With the revised German Sustainable Development Strategy 2016, the Federal Government aims to reduce the proportion of these areas by 35 % until 2030. According to the current calculation basis, this results in a target value of 50 % by 2030.
- This target is feasible only if efforts to reduce air pollution are maintained.

Indicator online (latest data, data download): http://www.uba.de/57128
Detailed information: http://www.uba.de/11626
Last updated: 12.11.2018

Environmental importance

The maximum amount of pollutants that ecosystems can tolerate without being damaged is known as the 'critical load'. It is a measure of an ecosystem's sensitivity to pollution. Air pollution levels above these critical loads can permanently damage ecosystem structures and functions.

Excess deposition of airborne nitrogen compounds in terrestrial ecosystems can cause nutrient imbalances which may modify the species composition. Organisms that prefer low-nitrogen conditions will be displaced in favour of species that thrive in nitrogen-rich habitats.

Almost half of ferns and flowering plants on Germany's Red List are threatened by nutrient deposition. Moreover, many plants become more susceptible to frost, drought and pests due to changes in nutrient availability. The indicator focuses on natural ecosystems, especially forests, inland marshes, peat bogs, heathlands and nutrient-poor grasslands.

Assessing the development

Despite declining nitrogen deposition, in 2015 critical loads were still exceeded in 68 % of the area comprising vulnerable ecosystems. In 2005, this figure was as high as 77 %. High ammonia emissions associated with livestock farming and fertilisation are particularly problematic. These have fallen only marginally and are not expected to decline steeply in the near term.

The Federal Government has set a new target in the revised German Sustainable Development Strategy: The proportion of land affected by excess nitrogen deposition should fall by 35 % between 2005 and 2030 (BReg 2016). With the current calculation basis, this results in a target value of 50 % in 2030.

To reach this target, the reduction commitments for ammonia and nitrogen oxides specified in the EU Directive 2016/2284 on the reduction of national emissions of certain atmospheric pollutants" have to be met. These commitments provide for a reduction by 29 % (NH_3) and 65 % (NO_x) compared to the reference year 2005. The measures that are suitable to reduce these emissions are portrayed in the National Air Pollution Control Programme, according to the directive.

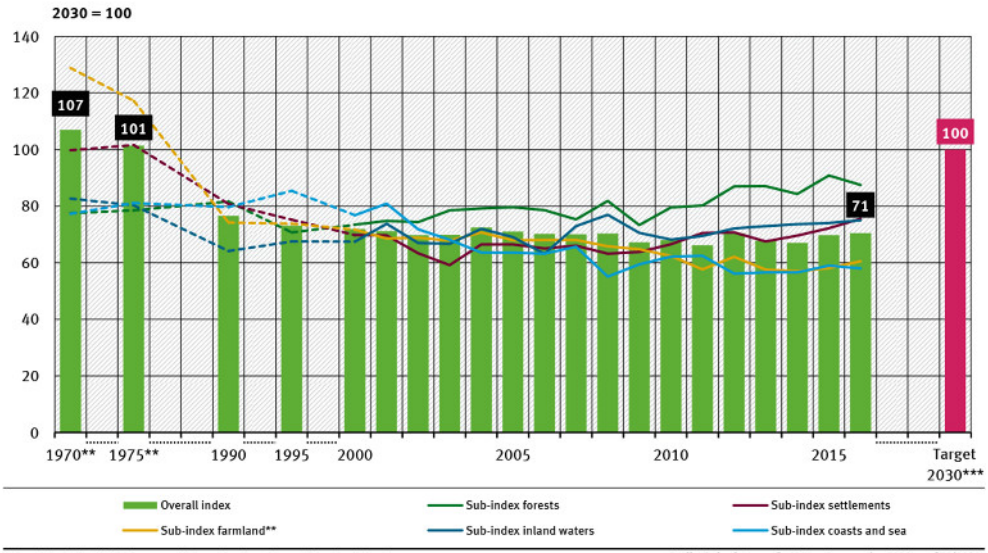
The German Environment Agency proposes measures aimed at solving the problem of nitrogen eutrophication in its publication 'Reactive nitrogen in Germany' (UBA 2015a).

Methodology

The first stage is to calculate critical loads for vulnerable ecosystem types: How much nitrogen can be deposited without damaging the ecosystem in the long term? The critical loads are compared with substance depositions in the ecosystems which are calculated in the framework of national deposition modelling. Further information can be found in the reports of the European Environment Agency and the Federal Environment Agency (EEA 2014, UBA 2014). As part of the reporting on the National Biodiversity Strategy, a related indicator is published (BMUB 2015a). Due to different methods, this indicator comes to different values.

Species diversity and landscape quality

Population of representative bird species in different landscape and habitat types*



* The sub-index for the Alps has currently been abandoned across the entire data series.
** The values for 1970 and 1975 are based on a reconstruction; value of agricultural land 1970: 128.8
*** Target of the German Sustainable Development Strategy

Quelle: Federal Agency for Nature Conservation 2020, as of 05/2020;
Data: Dachverband Deutscher Avifaunisten 2020

At a glance

- In 2016 the indicator was at 70.5 and remains far from the target value.
- The sub-indicators for farmland and coasts and sea have fared particularly badly.
- In the German Sustainable Development Strategy, the Federal Government envisages that the indicator should rise to 100 by 2030.

Indicator online (latest data, data download): http://www.uba.de/57129
Last updated: 20.08.2020

Environmental importance

A rich diversity of plant and animal species is essential to the balance of nature and provides an important natural resource for humans. Species diversity is closely linked to the diversity of habitats and landscapes. Sustainable forms of land use across the landscape and a responsible treatment of the natural environment are required to maintain biodiversity.

The indicator presented here was developed to assess the state of nature and landscape in Germany. It shows changes in the population of selected bird species which are representative of Germany's most important landscape and habitat types. Highly structured landscapes with intact, sustainably used habitats do not only provide habitats for birds. The indicator thus indirectly reflects trends in many other species living in the landscape and in the sustainability of land-use.

Assessing the development

In 1990, the indicator value was already significantly below the values that had been reconstructed for 1970 and 1975. The indicator continued to show a negative trend in the last 10 years of the data series, but recently rose again slightly. It was as low as 71 % of the target value in 2016. The main causes for this development are intensive agricultural use, landscape fragmentation and urban sprawl, sealing the ground and large-scale input of substances (e.g. nutrients, pesticides or acidifiers). The report 'Vögel in Deutschland 2014' (Wahl et al. 2015) illustrates this trend in detail.

In 2002, the indicator was developed as a key indicator for sustainable land use as part of the Strategy for Sustainable Development and incorporated in the National Strategy on Biological Diversity (BMU 2007). Initially, the target value of 100 was to be achieved by 2015. According to a progress report on Germany's Sustainable Development Strategy, this deadline has been extended to 2030 by the government (BReg 2016). The 'Naturschutz-Offensive 2020' (BMUB 2015b) sets out key measures to achieve a positive trend.

Methodology

The indicator reflects the trend in populations of selected bird species for five landscape and habitat types. For each bird species, an expert committee has defined a population target for 2015 which can be achieved if nature conservation regulations and guidelines for sustainable development are implemented rapidly. The target values have been standardised to give a target of 100 for the overall indicator. Initially set for 2015, this target has been carried forward to 2030. Currently, the target values are being examined within a research project. A detailed description of the method can be found in Achtziger et al. 2004.

02
Air

Emission of air polluants

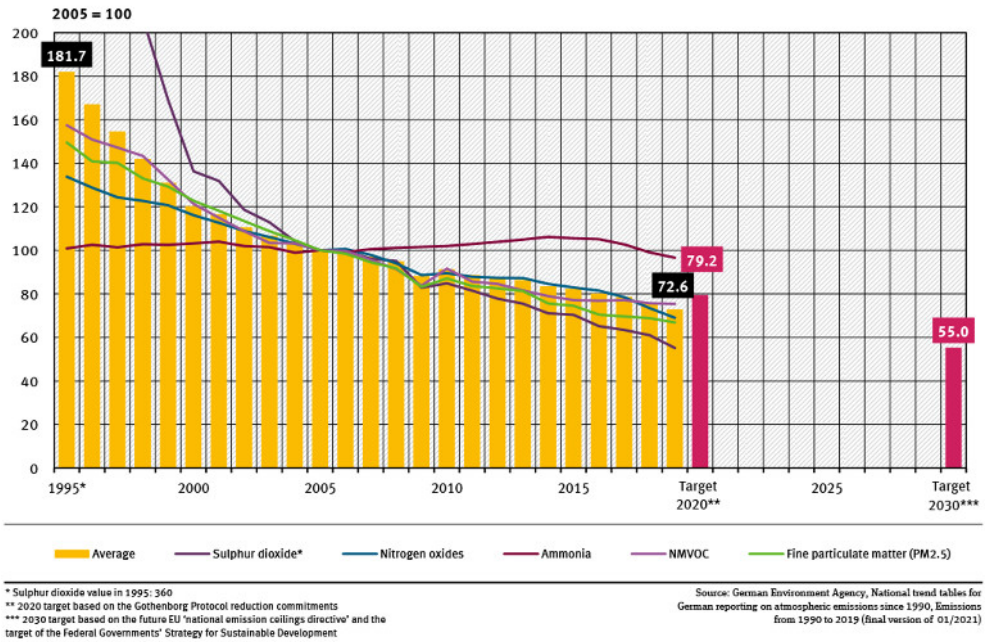
Air quality in agglomerations

Population exposure to particulate matter pollution

Emission of air pollutants

Index of air pollutant emissions

Trend of different air pollutant emissions relative to 2005 emissions (in mean percentage)



* Sulphur dioxide value in 1995: 360
** 2020 target based on the Gothenborg Protocol reduction commitments
*** 2030 target based on the future EU 'national emission ceilings directive' and the target of the Federal Governments' Strategy for Sustainable Development

Source: German Environment Agency, National trend tables for German reporting on atmospheric emissions since 1990, Emissions from 1990 to 2019 (final version of 01/2021)

At a glance

- The mean index of five air pollutants shows an average yearly reduction of almost 5 % between 1995 and 2019.
- The commitments of the Gothenburg Protocol for 2020 are expected to be met.
- Meeting the commitments of the European NEC Directive for 2030, is a major challenge for the German environmental policy.
- Ammonia emissions must be reduced significantly to achieve this.

Indicator online (latest data, data download): http://www.uba.de/57122
Last updated: 16.02.2021

Environmental importance

The indicator is based on the trend of five different pollutants (index) from different sources. Ammonia (NH_3) mainly comes from agriculture through livestock farming and fertilisation. Nitrogen oxides (NO_x) and sulphur dioxide (SO_2) are mainly produced by combustion processes in power stations and engines. Non-methane volatile organic compounds (NMVOCs) mainly arise from the use of solvents in industrial processes. Fine particulate matter with a particle size of less than 2.5 micrometres (PM2.5) is derived from combustion processes in households, road transport and agriculture.

Their impacts on the environment vary. Sulphur dioxide contributes to the acidification of ecosystems by causing 'acid rain'. Ammonia and nitrogen oxides lead to excessive nutrient enrichment (eutrophication). NMVOCs increase the amount of harmful ozone pollution. Among other things, PM2.5 causes respiratory diseases in humans.

Assessing the development

The value of the index has fallen sharply since 1995: Since 1995 it has fallen by 60 %. However, the progress made with the different pollutants varies significantly. Emissions of sulphur dioxide have declined by almost 85 % since 1995. Emissions of ammonia, have declined only by 4 % since then.

Germany has committed to reducing emissions of the five main air pollutants in accordance with the 2012 amendment to the Gothenburg Protocol of the Geneva Convention on Long-Range Transboundary Air (UNECE 2012). Germany must reduce emissions by an average of 21 % by 2020 compared to 2005. This target can be achieved. For the five air pollutants, further reduction obligations have also been set in the new European NEC Directive of December 2016. Accordingly, Germany must reduce emissions of the five air pollutants by an average of 45 % between 2005 and 2030. The Federal Government has included this reduction target in the German Sustainable Development Strategy (BReg 2016).

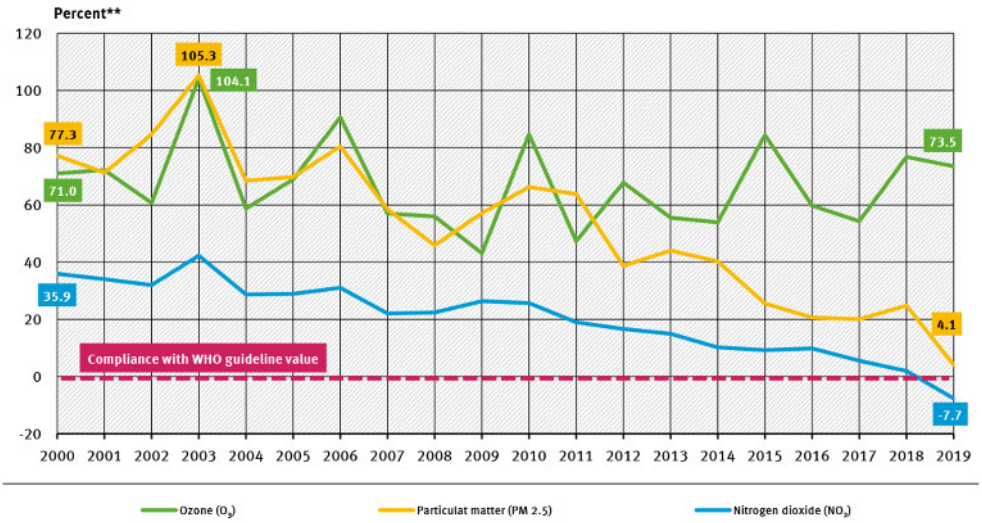
Achieving these targets is a major challenge for German environmental policy. Additional measures are needed, especially to reduce ammonia emissions from agriculture. Significant progress must also be made in the areas of e-mobility and the expansion of public transport, in building modernization, and in particulate matter emissions from small combustion plants (stoves and fireplaces) in order to ensure that the 2030 target values are safely achieved.

Methodology

The indicator is based on the relative trend of the emissions of five pollutants since 2005. Emissions of that year were set at 100 (indexed). The indicator is calculated from the annual average for the five pollutants. The calculation is based on data from the respective air pollutant inventories calculated by the German Environment Agency. These calculations are described in detail in the UBA's 'German Informative Inventory Report' (UBA 2020a).

Air quality in agglomerations

Discrepancy between average pollutant concentrations and WHO recommendations* in urban background locations in German agglomerations



* WHO guideline values: O_3: 100 µg/m³ as max. daily 8-hour mean; PM2.5: 10 µg/m³ in annual mean (WHO Air quality guidelines - global update 2005); recommendation for NO_2: 20 µg/m³ in annual mean (HRAPIE Project, WHO 2013)
** The y-axis was extended into the negative value range. Negative values correspond to a desirable undercutting of the WHO recommendations.

Source: German Environment Agency 2020

At a glance

- The background levels of two main air pollutants (PM2.5, ozone) in German agglomerations still exceed World Health Organisation (WHO) guideline values.
- Close to sources, pollutant levels can even be significantly higher.
- The situation regarding nitrogen dioxide and particulate matter has greatly improved since 2000.
- Ozone and particulate matter pollution is very dependent on the weather. Levels thus fluctuate significantly.

Indicator online (latest data, data download): http://www.uba.de/57123
Last updated: 23.07.2020

Environmental importance

Nitrogen dioxide (NO_2), particulate matter (PM2.5) and ozone (O_3) are of particular concern to human health. All three pollutants affect the respiratory organs. Many premature deaths are also attributed to particulates. Ecosystems are also damaged by ozone.

The World Health Organisation WHO has defined air quality guideline values for particulates and ozone (WHO 2006). A new recommendation for NO_2 has been proposed in a research paper (WHO 2013). Above these levels, health risks increase significantly. These values are stricter than the limits defined in the EU Air Quality Directive.

Air quality is particularly precarious in agglomerations, where one third of the German population lives. Here, industry, traffic and residential areas exist in close proximity. The indicator incorporates data from monitoring stations which measure background urban pollution levels. At busy locations in cities pollution levels may be significantly higher. The indicator represents the average discrepancy of all monitoring stations of urban background from WHO guideline values, respectively. Even with negative indicator values, individual monitoring stations can still be above the target value.

Assessing the development

Levels of nitrogen dioxide and particulate matter have fallen considerably. 2019 is the first year in which nitrogen dioxide falls below the newly considered WHO recommendation in agglomerations. If this trend continues for particulate matter (PM2.5), concentrations may fall also below the WHO recommendations in the foreseeable future.

However, ozone concentrations fluctuate widely. This is largely due to the influence of the weather. In hot summers such as 2003 or 2015, ozone concentrations rise sharply. Thus it is impossible to make a meaningful statement about the trend in recent years.

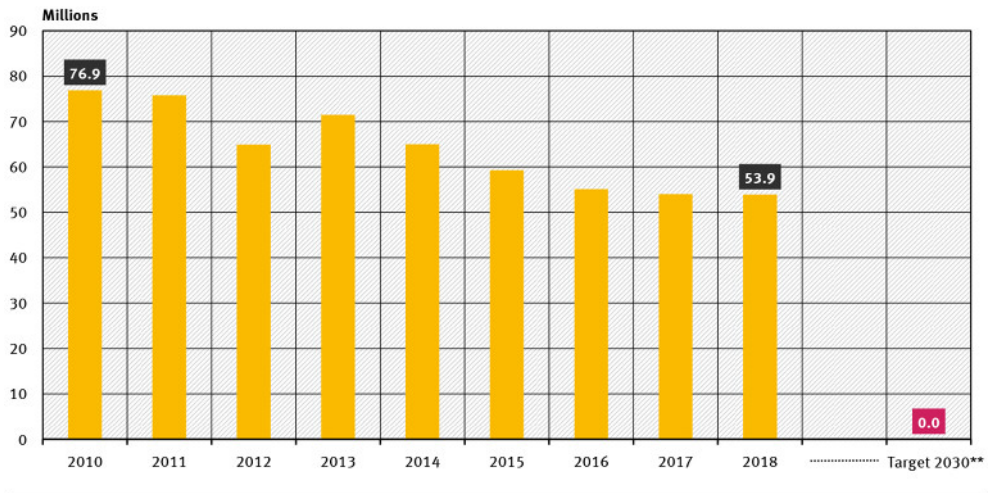
In 2008 the EU set out its air quality objectives in the Air Quality Directive (EU Directive – 2008/50/EC). The German Environment Agency believes that, in the long term, the limit values defined in the directive should be reduced to the WHO recommendations. Even then, large parts of Germany would still fail to meet the less ambitious targets of the EU directive (UBA 2019a). There is still a long way to go until the air in agglomerations is sufficiently 'clean'.

Methodology

The indicator is based on measurement data from the network of German air quality monitoring stations. All monitoring sites within an agglomeration were included in the measurement of urban and suburban background pollution levels. Measurements of these monitoring sites are used to calculate the extent to which the three pollutants NO2, PM2.5 and O_3 exceed or fall short of WHO recommendations. The average discrepancy between the values recorded at all monitoring stations and the WHO recommendation is calculated for each agglomeration. The average discrepancies are then averaged across all agglomerations and expressed in a standardised form with the WHO recommendation.

Population exposure to particulate matter pollution

Population exposed to PM2.5-concentrations exceeding the WHO annual mean guideline value*



* Guideline value: 10 µg/m³; The calculations are based on present population density results (population census 2011).
** Target set by UBA compared to the German Sustainable Development Strategy (PM10)

Source: German Environment Agency 2020

At a glance

- The exposure of the population to particulate matter (excluding traffic-related measuring points) was significantly lower in 2018 than in 2010.
- Particulate matter concentrations in ambient air are considerably affected by weather conditions which may vary substantially within the year and from one year to another.
- The German Environment Agency (UBA) proposes a target of keeping the exposure of the entire population below the World Health Organisation's (WHO) guideline value for particulate matter (PM2.5) of 10 µg/m³ as an annual average by 2030.

Indicator online (latest data, data download): http://www.uba.de/57183
Last updated: 05.03.2020

Environmental importance

Particulate matter in ambient air is harmful to human health. The particles enter the human body through the respiratory system. Depending on the size of the particles, they can penetrate deeply into the respiratory system. Particularly small particles can enter the blood stream when penetrating the pulmonary tissue. There is clear evidence that particulate matter can trigger various diseases (see 'Particulate matter').

Particulate matter is mainly the result of human activities (e.g. combustion processes), but is also released by mechanical processes (e.g. the abrasion of tires and brakes). Part of the particulate matter is produced in the atmosphere by chemical reactions of other pollutants (such as nitrogen oxides and ammonia) and is therefore referred to as "secondary" particulate matter.

The indicator focuses on the particulate matter exposure levels from rural and urban background areas, but does not take into account areas with increased particulate matter concentrations such as roads with high traffic volumes or areas that are close to large industrial plants. It can therefore be assumed that the approach used here underestimates the overall exposure level of the German population.

Assessing the development

At almost 54 million in 2018, the number of people in Germany exposed to concentrations of particulate matter (PM2.5 – particles with a diameter up to 2.5 µm) above the WHO guideline is significantly lower than at the beginning of the time series. This is mainly due to the fact that measures to reduce emissions are proving successful, especially in the transport sector. Furthermore, weather conditions have a direct influence on the particulate matter concentrations in ambient air.

The EU Air Quality Directive defines a mean annual limit value of 25 µg/m³ for PM2.5 in ambient air to protect human health (EU DIR 2008/50/EC). In Germany, this annual limit value has not been exceeded in recent years. However, the UBA proposes that by 2030 the exposure of the population should be below the WHO guideline value for particulate matter (PM2.5) of 10 µg/m³ as an annual average.

Impulses for a reduction in particulate matter pollution can be expected above all from the measures of the national air pollution control programme (BReg 2019b). These measures (in particular the phasing out of coal combustion and the reduction of ammonia emissions from agriculture) will significantly reduce emissions of particulate matter and its precursor gases by 2030.

Methodology

The indicator is calculated by combining modelled data from the REM-CALGRID chemical transport model, PM10 measurement data provided by the Federal States of Germany and the UBA and additional spatial interpolation procedures. The PM10 data are converted to PM2.5 data using a constant conversion factor of 0.7 and are then combined with population density maps to introduce a population weighting scheme. Only those measuring stations that are not directly exposed to particulate matter emissions, for example from traffic, are considered for the indicator. For more methodical details, see Kallweit et al. 2013.

03
Water

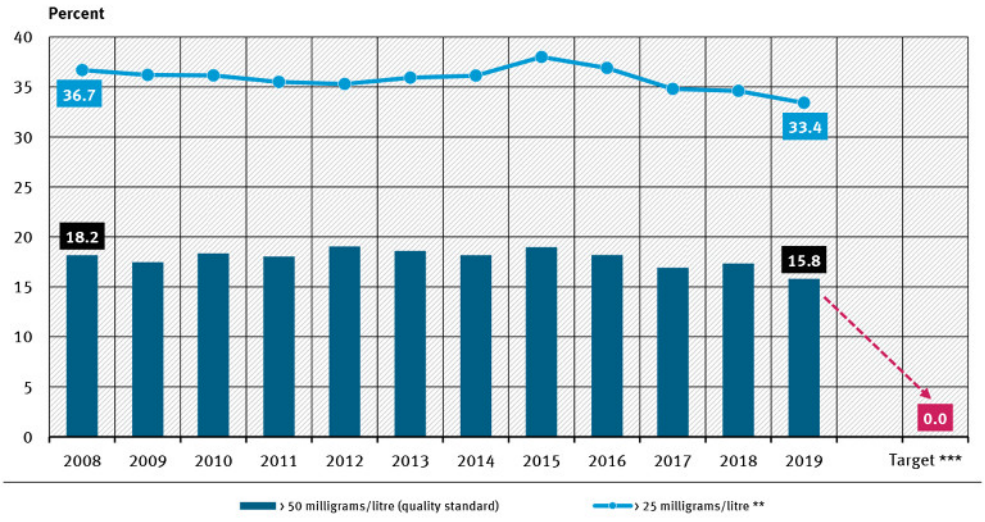
Nitrate in groundwater

Plastic waste in the North Sea

Ecological status of rivers

Nitrate in groundwater

Proportion of monitoring sites which exceed the quality standard for nitrate in groundwater*



* Basis: EEA monitoring network quality standard: 50 milligrams per litre annual mean value
** The value includes the percentage of sampling sites with › 50 mg/l.
*** Target set by the Nitrates Directive and the German Sustainable Development Strategy

Source: German Environment Agency and the Länder Initiative on Core Indicators (LIKI) 2020 based on data from the German Working Group on water issues of the Federal States and the Federal Government

At a glance

- The European Nitrates Directive places Germany under the obligation to prevent exceedances of the quality standard of 50 milligrams nitrate per litre.
- Since 2008, the quality standard has been exceeded every year at almost one in six measuring points.
- On June 21, 2018, the European Court of Justice found Germany guilty of violating the EU Nitrates Directive.
- Agriculture is the most important source of high nitrate concentrations in groundwater.

Indicator online (latest data, data download): http://www.uba.de/57158
Last updated: 12.01.2021

Environmental importance

In agriculture crops are given the necessary nitrogen via fertiliser. However, the fertiliser is often not applied correctly for the specific site and use. If the amount of fertiliser is too high the plants do not absorb it completely. Excessive nitrogen is leached out and ends up as nitrate in the groundwater and other water bodies. This leads to eutrophication in rivers and lakes (cf. 'Ecological status of rivers' and 'Ecological status of lakes' indicators), and to nitrogen enrichment and exceedance of the nitrogen threshold in groundwater.

Nitrate can be converted to nitrosamines in the human body. This can result in disruption to the oxygen transport in infants (methemoglobinemia). The National Drinking Water Ordinance therefore stipulates a quality standard for nitrate of 50 milligrams per litre (TrinkwV 2001).

The value is very rarely exceeded in drinking water. It is complex and expensive to remove nitrate from pipe water in water treatment plants.

Assessing the development

The aim of the European Nitrates Directive (EU Directive 91/676/EWG) is to prevent pollution of groundwater by agricultural nitrate inputs. Governments are obliged to develop action plans to prevent nitrate concentrations above 50 mg/l. On 21 June 2018, the European Court of Justice found Germany guilty of violating the EU Nitrates Directive (case C-543/16). The reason therefore was that the directive had not been implemented adequately and the measures taken so far were not sufficient to achieve a significant reduction in nitrate pollution. Since 2008, the proportion of monitoring sites which exceed the quality standard lies between 16 and 19 %. The proportion of monitoring sites with a nitrate concentration above 25 mg/l has also stagnated since 2008 at 33–38 %. Since 2016, compliance with the nitrate quality standard has also been a target of the German Sustainable Development Strategy (BReg 2016).

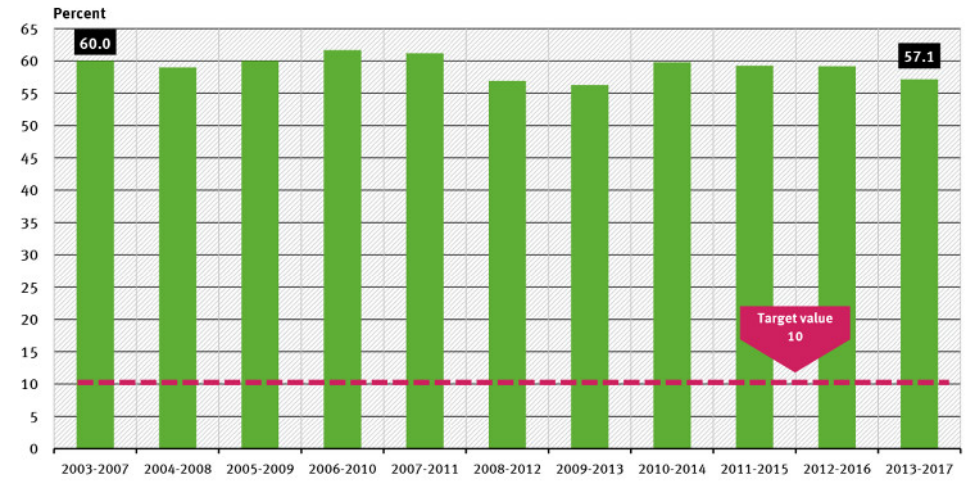
The central legal instrument for implementing the Nitrates Directive is the German Fertiliser Application Ordinance. The Fertilisation Ordinance defines "good professional practice in fertilisation" and specifies how the risks associated with fertilisation are to be minimised. It is an essential component of the national action programme for implementing the EU Nitrate Directive. In 2017, the federal government adopted a new fertilisation ordinance with stricter rules. However, this was not sufficient for the EU Commission and therefore demanded improvements. In February 2020, the federal government then presented a new draft that had been agreed with the EU and which was approved by the Bundesrat on 27 March 2020 and has been legally effective since 1 May 2020.

Methodology

Germany has to send data on the condition of the groundwater to the European Environment Agency (EEA) on a regular basis. The Federal States therefore selected representative monitoring sites to add to the EEA groundwater network. These are reported to the EEA through the German Environment Agency. The indicator compares the monitoring sites where the quality standard is exceeded with the total number of monitoring sites.

Plastic waste in the North Sea

Percentage of beached fulmars on the North Sea coasts of Germany with over 0.1 g of plastic in their stomachs (5 year average)



Source Data until 2017: Research and Technology Centre West Coast (2019), OSPAR Fulmar Litter EcoQO - Mass of plastic waste parts in the stomachs of fulmars.
Source data 2017: Communication from the West Coast Research and Technology Centre of 23.06.2020

At a glance

- Since studies began, the stomachs of 93 % to 97 % beached fulmars have been found to contain plastics.
- Around 60 % of beached fulmars on the North Sea coasts have more than 0.1 grammes of plastic in their stomachs.
- The target set by the OSPAR convention is to reduce this to a maximum of 10 %. However, it may take a long time to reach this target.
- Large quantities of plastic waste still end up in the oceans, where plastic degrades very slowly.

Indicator online (latest data, data download): http://www.uba.de/57157
Last updated: 14.07.2020

Environmental importance

Every year between 4.8 and 12.7 million tonnes of plastic waste end up in the oceans (Jambeck et al. 2015). Plastic parts are considered food by animals and, after consumption, can injure and clog their digestive organs, which can lead to their death. Around 1,200 marine species are known to be negatively affected by contact with marine litter. The most obvious effects are ingestion of and entanglement in marine litter. The entanglement of marine life in litter items causes visible injuries which can be fatal, the effects of swallowing litter are often invisible.

For monitoring purposes, the fulmar has been established as an indicator species in the North Sea. This seabird has a wide distribution and feeds exclusively at the open sea. There, he confuses floating plastic parts with food particles and accumulates them in his stomach for several weeks. So far no species has been identified for the Baltic Sea which can be used for similar studies. Therefore no comparable information for the Baltic Sea is available for the time being.

Assessing the development

The majority of the fulmars (currently 97 %) found dead on the beaches of the German North Sea coast have plastic waste in their stomachs. While the average quantity of plastic swallowed in recent years has declined slightly, the proportion of animals with more than 0.1 g of plastic in their stomach remains at a high level. It fluctuates between 56 % and 62 % during the study period without a clear statistical trend.

Germany has signed the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR). In 2008 the Contracting Parties to OSPAR decided as one of its so-called Ecological Quality Objective (Eco-QO) that the percentage of beached fulmars having more than 0.1 g of plastic in their stomachs should be 10 % at the maximum. This value was derived from fulmars in the relatively unpolluted Canadian Arctic.

Large quantities of plastic waste are still entering the seas and plastics take a very long time to break down. Therefore it can be expected, that the OSPAR target can only be achieved in the long term. An important instrument for reducing further inputs and existing quantities of marine litter in the Northeast Atlantic is the OSPAR Regional Action Plan on Marine Litter adopted in 2014 (OSPAR Commission 2014). It addresses a series of measures related to the relevant sea- and land-based sources and on opportunities for the removal of marine litter and awareness raising.

Methodology

The indicator is based on studies of beached (dead) fulmars on the North Sea coasts of Germany (south-east North Sea). In the laboratory, various parameters are then determined regarding the state of health and the possible cause of death. The stomach contents are then examined. Then the percentage of fulmars that have more than 0.1 grammes of plastic in their stomach is calculated. As the values sometimes greatly deal between years, the indicator is calculated as the average of the last five years (Guse et al. 2012). In the other countries bordering the North Sea, the plastic contamination of fulmars is also determined using the same standardised method in order to be able to compare the development between the regions.

Ecological status of rivers

Percentage of running waters in at least good status or with at least good potential

* The year refers to the year of reporting to the EU. For the 2010 reporting year, data were collected until 2008. The reporting year 2015 uses data collected between 2009 and 2014.

Source: German Environment Agency, report portal WasserBLicK; German Federal Institute of Hydrology 2015, management plans for the period 2016 to 2021

At a glance

- In 2015 only around 7 % of German streams and rivers were in at least a good ecological status or had at least a good ecological potential.
- According to the European Water Framework Directive, by 2015 with a time extension to 2027 all rivers must have achieved at least a good ecological status or potential.
- The time up to 2027 must be used to reach these demanding targets.
- The measures taken to date require more time to take effect. Other measures are also required.

Indicator online (latest data, data download): http://www.uba.de/57159
Last updated: 20.10.2017

Environmental importance

Streams and rivers are an important part of the environment. The landscapes away from the coastsare mainly shaped by rivers. Their status has deteriorated seriously in the past. Due to water engineering works over the last few centuries, around half of all streams and rivers are now considerably modified or artificial. Rivers are also polluted by contaminants and nutrients from industry, private households and agriculture.

Water pollution causes changes in the original species composition. The indicator primarily reflects the degree to which the current species composition in the rivers corresponds to the original composition. The closer the species diversity to the original status, the better the ecological status and therefore the more resilient the ecosystem. The ecological potential, on the other hand, is specified in significantly modified or artificial water bodies, because a comparison with the natural species composition is not possible in such cases.

Assessing the development

The share of streams and rivers in at least good ecological status or with at least good ecological potential remained almost constant between 2010 and 2015. This share was just under 7 % when last measured. The most important reason for this is that species communities which have been disturbed on the long term require time to recover. This was initially underestimated. However, the share of running waters in a bad or poor status declined between 2010 and 2015. At the same time the proportion of running waters in a moderate ecological status increased significantly.

The European Water Framework Directive (WFD, EU Directive 2000/60/EC) was agreed in 2000. This set a target for all water bodies in Europe of a good or very good status by 2015. The Federal States drew up management plans defining measures for improving water quality. Germany was not the only country that missed the 2015 target for most streams and rivers by a large margin. The next management cycle according to the WFD must now be used to achieve the ambitious targets by 2027 at the latest.

Methodology

The ecological status of a stream or a river is primarily defined on the basis of the presence of different species and their abundances. This is compared with the species composition which would naturally be present in this type of water body. Five status classes are defined, depending on the degree of divergence, from ‘very good’ to ‘bad’. An ecological potential is assessed for artificial and heavily modified water bodies. The highest potential is present when all measures to improve the environmental quality have been taken which do not have a significant negative effect on use. The classification is laid down in the Surface Waters Ordinance (cf. water protection policy in Germany).

04
Conservation of resources: raw materials and waste

Total raw material productivity

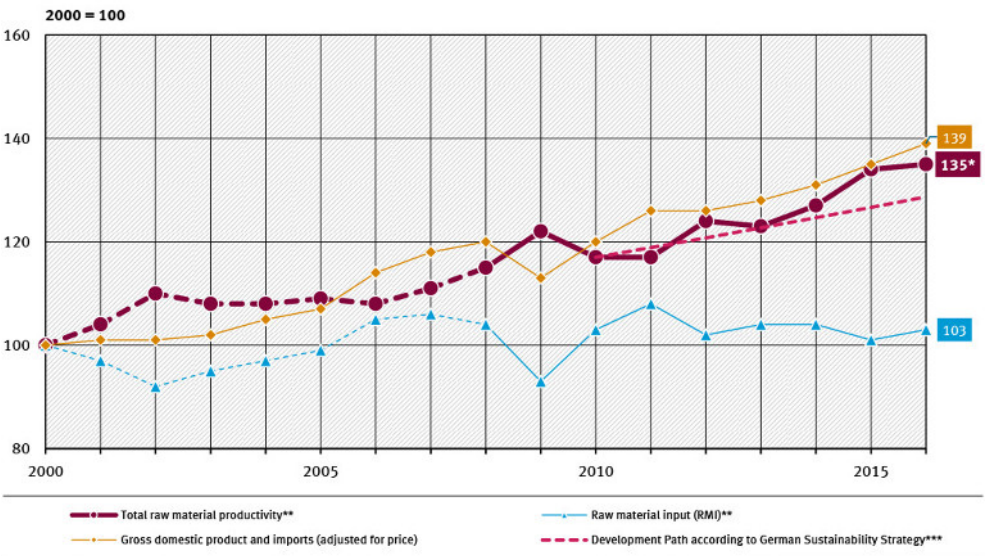
Raw material consumption

Amount of waste – municipal waste

Total raw material productivity

Total raw material productivity

Sum of gross domestic product and imports in relation to primary raw material input (RMI)



* 2016 preliminary value
** RMI = Raw Material Input; there are no values available for the indicator from 2001 to 2007; the graph shown is based on an estimate of the missing values
*** Target according to "German Sustainability Strategy. Revision 2016": annual total raw material productivity growth rate of 1.6 percent between 2010 and 2030

Source: Federal Statistical Office 2020, Table "Gesamtrohstoffproduktivität und ihre Komponenten, Index 2000=100", destatis.de (02.06.2020)

At a glance

- The total raw material productivity grew by 35 % between 2000 and 2016.
- According to the German government, an average growth of 1.6 % of total raw material productivity must be achieved between 2010 and 2030.
- Since 2010, the average annual growth rate of 2.4 % has exceeded this target.
- The indicator also includes raw materials needed for the production of imported goods.

Indicator online (latest data, data download): http://www.uba.de/57185
Detailed information: http://www.uba.de/15102
Last updated: 18.12.2020

Environmental importance

Primary raw materials are obtained mainly from mining but also in forestry and agriculture. Some of these economic activities have huge environmental impacts. An aim of environmental policy is therefore to ensure that the national economy uses raw materials as efficiently as possible. In order to measure this development, the indicator 'Total raw material productivity' relates economic activity to the utilisation of raw materials.

However, Germany imports and exports mainly processed goods and finished products. The indicator 'Primary raw material inputs' reflects the extent to which primary raw materials are actually used. It is based on raw material equivalents. It therefore includes the total weight of primary raw materials which were required to produce the goods made in Germany or imported to Germany. To calculate the total raw material productivity, the use of primary raw materials is related to the total value added created with these raw materials, i.e. the sum of the gross domestic product (GDP) and the value of imports.

Assessing the development

Total raw material productivity in Germany increased by 35 % between 2000 and 2016. The main reason for this was the significant growth in gross domestic product (GDP) and import values. At the same time the use of primary raw materials largely stagnated. Even though the decoupling of these factors is positive, the use of raw materials for domestic consumption and investments is still too high (cf. indicator 'Raw material consumption').

In the new edition of the German Sustainability Strategy of 2016, the German Government has set a new goal for the further growth of raw material productivity: Between 2010 and 2030, the value is expected to increase by an average of roughly 1.6 % per year, which was the average annual increase between 2000 and 2010 (BReg 2016). Between 2010 and 2016 there was an increase by about 15 %. The average annual increase during that period was about 2.4 %.

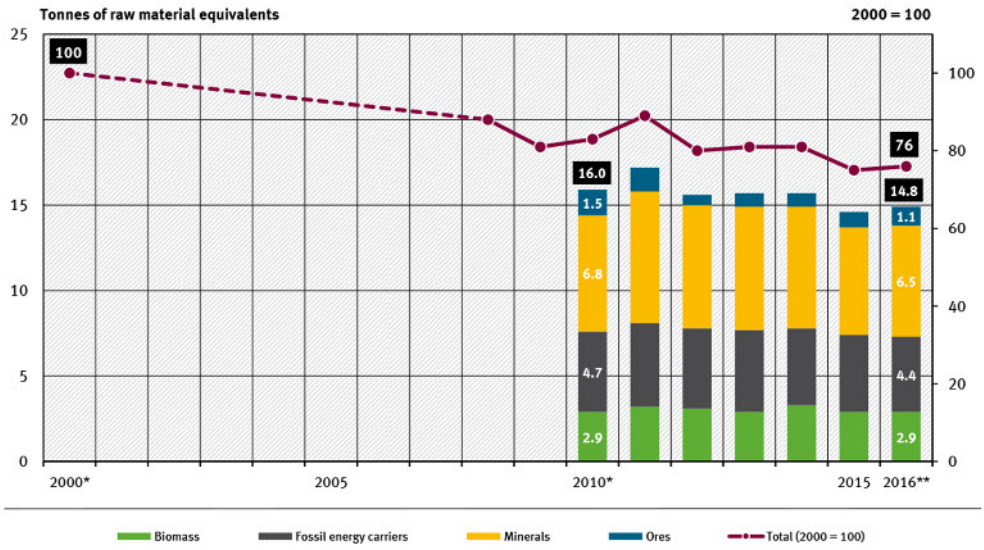
In the German Resource Efficiency Programme III (ProgRess III) records a large number of measures for the years from 2020 onwards to increase the productivity of raw materials (BMU 2020). As new topics, resource-efficient mobility and the potentials and risks of digitalization for resource efficiency are now being considered in ProgRess III.

Methodology

The total raw material productivity results from the ratio of two variables: The numerator is formed from the sum of gross domestic product and the monetary value of German imports. This figure is prepared by the national accounts of the Federal Statistical Office of Germany. The denominator contains the information on the primary raw material input in Germany from production and imports in tonnes. The process for determining the indirect imports ('raw material equivalents') is described in a research report (UBA 2016).

Raw material consumption

Raw material use for domestic consumption and investments (RMC) per capita*



* Due to methodological reasons, absolute figures for raw material use can only be displayed for years 2010 and later. A presentation of figures starting in 2000 is possible only by means of an indexed value (2000 = 100).
RMC = Raw Material Consumption
** 2014: preliminary data

Source: Federal Statistical Office 2020, Umweltökonomische Gesamtrechnung. Aufkommen und Verwendung in Rohstoffäquivalenten. Berichtszeitraum 2000 bis 2016 (in German only)

At a glance

- Per capita raw material consumption fell by 24 % between 2000 and 2016. No trend could be detected for the recent time period since 2009.
- These figures include raw materials which were required for the production of consumed goods at home and abroad.
- German raw material consumption is too high by international comparison and has to be reduced further.

Indicator online (latest data, data download): http://www.uba.de/57186
Last updated: 22.06.2020

Environmental importance

The production of goods and the provision of services requires raw materials. The German economy is strongly integrated internationally. Germany imports and exports large quantities of semi-finished and finished products. The weight of raw materials used for this manufacture is taken into account in the calculation of the raw material equivalents. These include all raw materials used in the production of these goods both at home and abroad. The indicator shown here includes the total weight of all goods used in Germany for home consumption – including the 'raw material equivalents'. In order to make the issue understandable and comparable, 'raw material consumption' is referred to the number of inhabitants in Germany.

The mining or cultivation of these raw materials and their subsequent processing are accompanied by large environmental impacts. If the global per capita raw material consumption were as high as in Germany, this would put a heavy burden on global ecosystems. Germany is therefore responsible for reducing the use of primary raw materials.

Assessing the development

Raw material consumption per capita fell by roughly 24 % between 2000 and 2016. This is mainly due to reduced expenses for investments and construction. While the consumption of households, non-profit institutions serving households (NPISH) and general government in 2016 declined by 5 % compared to 2000, primary raw material expenditure on fixed assets investment fell by around 28 % over the same period. This development can be explained above all by the decline in construction investments between 2000 and 2010. After 2010 construction investments increased again, leading to higher consumption of mineral based raw materials. Also, waste recycling is relevant: Recycling reduces the demand in raw materials, which would else have to be extracted from the environment. Overall the raw material consumption hasn't shown a clear trend since 2010.

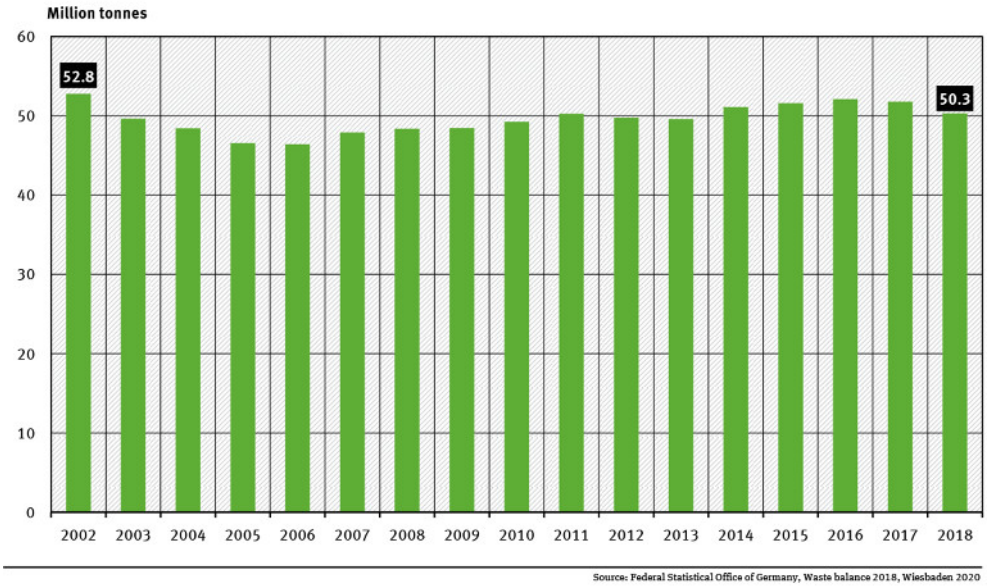
So far German and European policies have not set any target for raw material consumption. However, experts and the German Environment Agency believe that consumption of raw materials needs to be reduced considerably. Political strategies such as the German Resource Efficiency Programme III (BMU 2020) head in the right direction, but require further ambitious development in the long term.

Methodology

The indicator 'Raw material consumption' is composed of domestic raw material extraction and imports minus exports. In order to calculate indirect imports (raw material equivalents) use is made of input-output and linkage tables plus data on imports and exports in the German economy. The method was developed in research projects for the German Environment Agency and is described in a research report (UBA 2016).

Amount of waste – municipal waste

Waste generation in municipal waste category



Source: Federal Statistical Office of Germany, Waste balance 2018, Wiesbaden 2020

At a glance

- The volume of municipal waste fluctuates only slightly over time. In 2018 it stood at 50.3 million tonnes.
- The target of environmental policy is to decouple the amount of waste from economic growth.
- This target has been achieved. However, to reduce resource consumption, municipal waste has to decline further.

Indicator online (latest data, data download): http://www.uba.de/57187
Detailed information: http://www.uba.de/12535
Last updated: 18.08.2020

Environmental importance

Government is pursuing a variety of strategies to reduce the economy's demand for raw materials. One approach is the prevention of waste. Paragraph 6 of the German Circular Economy Act defines a waste hierarchy (KrWG 2012). It assigns the highest priority to the prevention of waste. Waste that is not generated does not cause any environmental impacts, which would otherwise be caused by its collection, sorting and further recycling or dumping.

The total amount of waste generated in Germany is dominated by building waste which makes up around 55 %. The total amount of waste therefore primarily reflects the economic situation in the building industry.

The indicator used here is the development of municipal waste which formed almost 12 % of the total waste generated in 2018. Municipal wastes mainly cover the types of waste collected by municipal waste management companies. The main ‘waste producers’ are households, administration and commercial companies. The amount of municipal waste therefore reflects the behaviour of a wide spectrum of waste producers.

Assessing the development

The amount of municipal waste has fallen slightly between 2002 and 2006: While in 2002 it was still 52.8 million tonnes, the lowest level occurred in 2006 with 46.4 million tonnes. Since 2013, however, there has been a slight increase to values above 50 million tonnes.

With the aim of strengthening waste prevention, the Federal Government adopted a Waste Prevention Programme in in accordance with § 33 of the Closed Substance Cycle Waste Management Act (KrWG), with the participation of the Länder (BMU 2013). Economic growth and the amount of waste should be decoupled and the amount of waste should grow at most as fast as the economy. This target has been achieved in terms of municipal waste. While the German economy grew by 24 % and the number of households by 7 % between 2002 and 2018, the amount of municipal waste fell in this period. Nevertheless, further efforts are needed to effectively reduce waste volumes at all stages of the value chain.

Methodology

The amount of waste is published annually in the waste balance of the Federal Statistical Office of Germany (Destatis 2020a). The waste statistics are based on a series of different surveys which are collated into a waste balance. Further information on the waste statistics can be found in the relevant quality reports. In 2002 the European waste register was established, leading to major differences in the definition of waste categories. Due to these significant methodological changes the indicator displays only values from 2002 onwards.

05
Climate

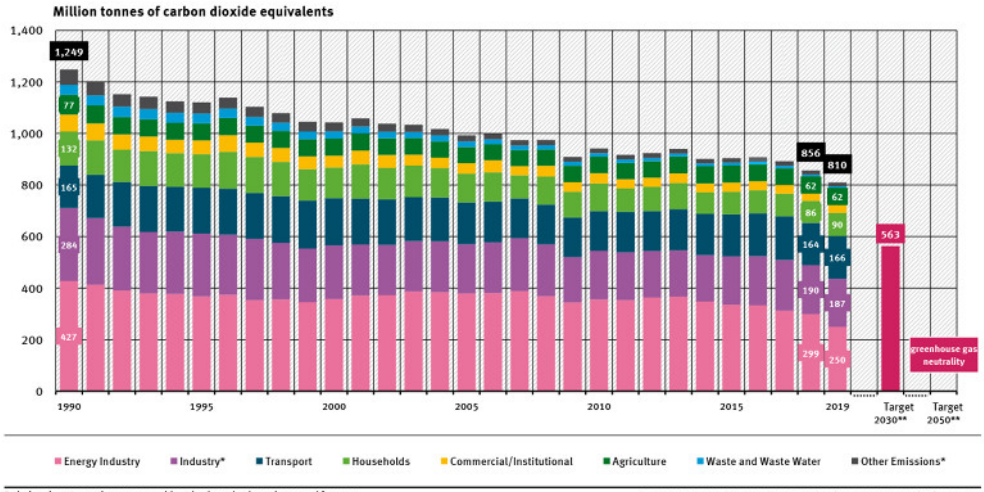
Greenhouse gas emissions

Global surface temperaturer

Hot days

Greenhouse gas emissions

Emission of greenhouse gases covered by the UN Framework Convention on Climate



Emissions by UN reporting category, without land use, land use change and forestry
* Industry: Energy and process-related emissions from industry (1.A.2 & 2).
Other Emissions: Other combustion (rest of CRF 1.A.4, 1.A.5 military) & fugitive emissions from fuels (1.B)
** Targets 2030 and 2050: Federal Climate Protection Act (KSG), Bundesgesetzblatt 2019 Part 1, No. 48 of 17.12.2019

Source: German Environment Agency, National Inventory Reports for the German Greenhouse Gas Inventory 1990 to 2019 (as of 12/2020)

At a glance

- Greenhouse gas emissions in Germany declined by more than 35 % between 1990 and 2019.
- Germany aims to reduce greenhouse gas emissions by 40 % by 2020 and by at least 55 % by 2030 compared to 1990 emission levels. Complete greenhouse gas neutrality is to be achieved by 2050.
- Without massive and rapid efforts the set targets will not be achieved.
- The Federal Government intends to reach the climate protection targets with the help of the ‘Climate Change Act’, the ‘Climate Action Programme 2020’ and the ‘Climate Action Plan 2050’.

Indicator online (latest data, data download): http://www.uba.de/49509
Last updated: 18.01.2021

Environmental importance

Greenhouse gases are released mainly through the use of fossil fuels such as coal and petroleum. Industrial processes and livestock farming are also relevant emission sources. Rising levels of greenhouse gases warm the earth's atmosphere, leading to climate change. Global warming has diverse negative impacts such as rising sea levels, increased risks of flooding, drought and other extreme weather events.

Thus at the 2015 Climate Summit in Paris the international community agreed to limit the temperature increase to 1.5 °C when possible and to keep it below 2 °C. This can only be achieved if global greenhouse gas emissions are rapidly reduced.

Assessing the development

Greenhouse gas emissions in Germany have fallen since 1990: from 1,249 million tonnes of CO_2 equivalents in 1990 to 810 million tonnes in 2019 – the lowest level since 1990. This amounts to a decline of more than 35 %. Excluding the low value in the crisis year 2009, the indicator follows a long-term downward trend. After a period of stagnation, emissions have fallen significantly in 2018 and 2019, mainly due to increased emissions trading certificate prices, low gas prices and the expansion of renewable energies.

At the end of 2015, a successor agreement to the Kyoto Protocol was agreed with the Paris Convention. The development to date makes it clear that intensive efforts in climate protection are necessary to achieve the targets. The German government has therefore initiated measures in the form of the 'Climate Action Programme 2020' (BMUB 2014) and the 'Climate Action Programme 2030' (BReg 2019a). With the 'Climate Change Act' in 2019, binding annual emission quantities for 2019 as well as a monitoring and sharpening mechanism for the individual sectors were agreed upon in order to ensure the greenhouse gas reduction target of "at least 55 %" by 2030.

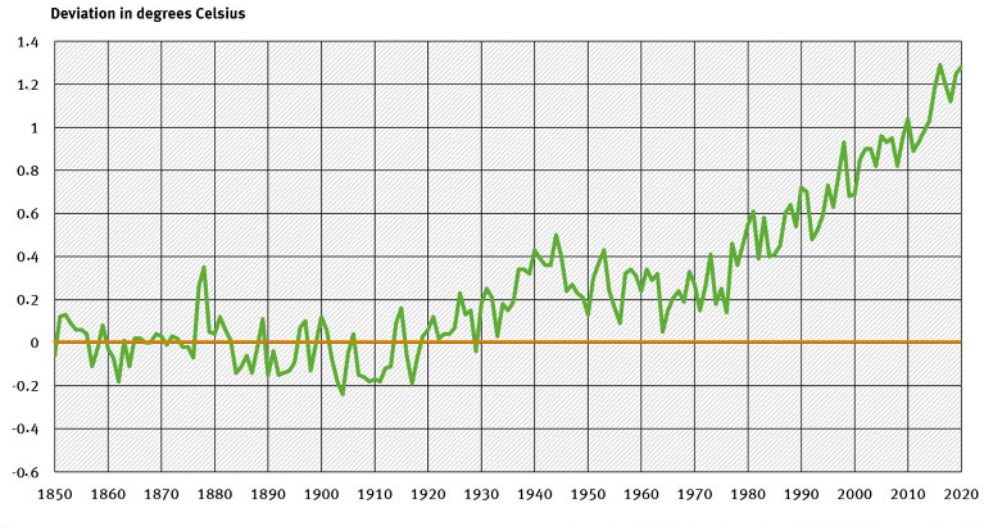
A current analysis of the Climate Action Programme 2030 shows that the gap to the 55 % target will be reduced by its measures, but not completely closed. According to the projection, a GHG reduction of 51 % will be achieved by 2030. A gap of about 70 million tons of CO_2 equivalents remains.

Methodology

The indicator is based on the National Greenhouse Gas Inventory 1990-2019. The calculation method is described in the latest inventory report (UBA 2021, yet unpublished). Emissions of all greenhouse gases governed by the Kyoto Protocol (e.g. carbon dioxide, methane) are compiled in a standardised format. Since the different gases have different impacts on the climate, their effect is expressed in terms of the effect of carbon dioxide (CO_2 equivalents).

Global surface temperature

Deviation from global mean surface temperature 1850 to 1900*



* The zero line corresponds to the global average surface temperature from 1850 to 1900.

Source: Met Office Hadley Centre, Climate Research Unit; HadCRUT.5.0.1.0 model; median of 200 calculated time series

At a glance

- 2020 was the second warmest year worldwide since records began, with a very slight distance to the warmest year to date, 2016.
- The last six years have been the warmest years worldwide since 1850.
- The Paris Climate Agreement stipulates that the increase in global temperature should be limited to well below 2 °C above pre-industrial levels, and even to 1.5 °C. Due to historical data availability, the comparative period used by WMO for this purpose is 1850 to 1900.

Indicator online (latest data, data download): http://www.uba.de/57080
Last updated: 03.02.2021

Environmental importance

Climate change manifests itself as an increase in the global average surface temperature. But we are also seeing increases in climate variability and risks of extreme weather events such as heavy precipitation, heat waves and droughts. Germany as well has growing warmer over the years, and more so than the global average. Consequently, the number of hot days are increasing (cf. 'Hot days' indicator). The increase in average temperatures is also changing the duration of individual seasons. As of yet we have only a rudimentary understanding of the complex effects of these seasonal shifts on plants and animals.

The global average temperature for one year alone is not very significant. We obtain more information from a given year's global mean deviation from the average for a longer period in the past. This shows whether one year was warmer or cooler than the climatological average. Usually a comparison is made with the period 1850 to 1900, which is also used by the WMO.

The 'German Strategy for Adaptation to Climate Change' envisages climate impact monitoring (BReg 2008). Climate change impacts and adaptation in different areas are published in a monitoring report which is updated every four years (UBA 2019b).

Assessing the development

To prevent dangerous interference to the climate system, the aim is to limit the temperature increase to well below 2 degrees Celsius (°C) above pre-industrial levels, and even to 1.5 °C. This is the agreement adopted by the global community at the 2015 Climate Conference in Paris (UNFCCC 2015). To achieve this target, global greenhouse gas emissions must be reduced rapidly and substantially (cf. 'Greenhouse gas emissions' indicator).

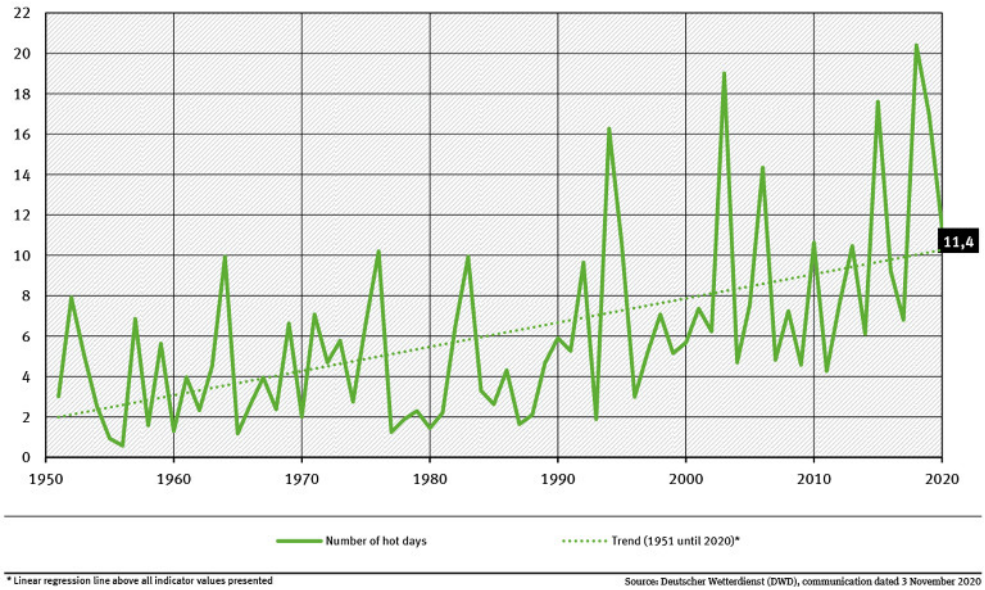
In 2020, the global mean of ground-level air temperature was about 1.2 °C above the mean from 1850 to 1900, according to WMO calculations. This made 2020 the second warmest year ever recorded, with a very small gap to the previously warmest year, 2016. The last six years were the warmest years worldwide since 1850.

Methodology

The Hadley Centre's temperature data form part of an internationally recognised body of temperature datasets. As with other available datasets, the global average surface temperature is based on measurement data from meteorological stations. The global average surface temperature is calculated from worldwide measurements using a combination of calculation rules and interpolations with the HadCRUT5 model (Morice et al. 2021). In addition to the HadCRUT5 data shown here, the WMO also uses time series from other institutes, including ECMWF, NASA, NOAA, and JMA, resulting in a slightly lower mean warming of well +1.2 °C instead of the +1.28 °C shown here.

Hot days

Number of days when maximum air temperature exceeds 30 degrees Celsius (areal mean)



* Linear regression line above all indicator values presented

Source: Deutscher Wetterdienst (DWD), communication dated 3 November 2020

At a glance

- The highest number of hot days averaged across Germany were recorded in 2003, 2015 and 2018.
- Despite considerable fluctuations between individual years, the overall trend is rising significantly.
- More hot days are expected during summer months in the coming decades due to climate change.

Indicator online (latest data, data download): http://www.uba.de/57109
Detailed information: http://www.uba.de/57569
Last updated: 11.11.2020

Environmental importance

Rising temperatures can adversely affect human health. Germany's National Meterological Service, the Deutscher Wetterdienst (DWD), defines the 'hot day' as any day on which the maximum temperature exceeds 30 degrees Celsius (°C).

High air temperatures have a direct impact on the human body, as the heat can cause circulatory problems. Indirectly, hot weather can raise pollutant levels in the air we breathe, leading to an increase in respiratory and circulatory diseases. High air temperatures combined with intense sunlight encourage the formation of ground-level ozone. Ozone irritates the eyes and airways and can exacerbate existing respiratory diseases. It can also trigger allergic reactions.

Assessing the development

In 2020 Germany recorded about 11 'hot days', when temperatures exceeded 30 °C.

The strain on heat was particularly high in 2003, 2015 and 2018: in these years there were between 18 to 20 'hot days' on a nationwide average. Nine of the ten hottest years based on the number of hot days have been recorded since 1994. Although the annual figures for this indicator vary greatly, the overall trend has increased significantly since records began.

Climate models show that in the future Germany can expect an increase in the number of hot days in summer and more prolonged heat waves

Methodology

The indicator is based on temperature measurements taken at Deutscher Wetterdienst (DWD) monitoring stations. Temperature readings and indicator values must be calculated for those areas not covered by monitoring stations. The results can be presented in a grid (1×1 km) which shows the distribution. An annual total of hot days is calculated for each grid point. The indicator is the mean of the annual values for all grid points (areal mean). For more information about the calculation method refer to a report by the DWD (Müller-Westermeier 1995).

06
Energy

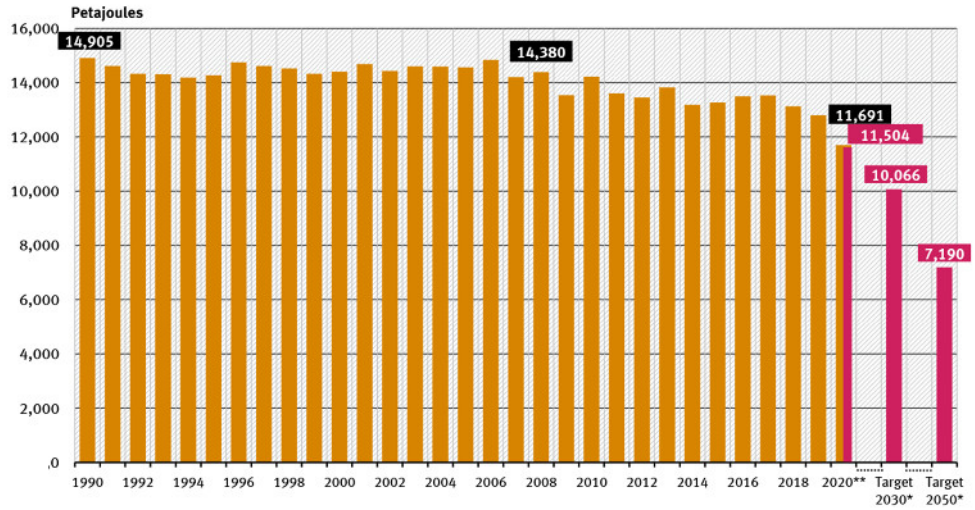
Primary energy consumption

Final energy productivity

Renewable energy

Primary energy consumption

Development of primary energy consumption



* Targets of the Energy Concept and the German Energy Efficieny Strategy: Reduction of the primary energy consumption by 20 % until 2020, by 30 % until 2030 and by 50 % until 2050 (base year 2008)
** 2020 preliminary data and target year

Source: German Environment Agency on basis of the Working Group on Energy Balances (AGEB), Evaluation Tables on the Energy Balance for Germany 1990 to 2019, as of 09/2020; for 2019, 2020 AGEB, primary energy consumption, as of 12/2020

At a glance

- Overall, primary energy consumption in Germany has been decreasing. Between 1990 and 2020 it fell by 33 %.
- The German government has set the target of reducing consumption by 20 % by 2020 compared with 2008, by 30 % by 2030 and by 50 % by 2050. Since 2008, energy consumption has fallen by an average of 1.7 % per year.
- The 2020 target is expected to be narrowly missed. According to preliminary data, primary energy consumption in 2020 will be 187 petajoules or 1.6 % above the target.
- In order to achieve the 2030 target, primary energy consumption would have to be reduced by an average of 1.5 % per year from 2020 onwards.

Indicator online (latest data, data download): http://www.uba.de/57111
Detailed information: http://www.uba.de/12371
Last updated: 15.04.2021

Environmental importance

The use of energy plays an eminent role in the production of goods. We also require energy in various ways in our day-to-day life; for example for mobility, heating and electric appliances in our households.

However, using and generating energy is also associated with many forms of environmental pollution: Mining of raw materials such as coal or crude oil destroys the Earth's surface. In addition, water is polluted, compromising local ecosystems. The transport of raw materials consumes additional energy, generating greenhouse gas emissions and other air pollutants that damage human health. Transforming and providing energy puts further pressure on the environment.

Therefore, lowering the primary energy consumption is an important part of an energy transition, alongside the switch to alternative and renewable energy sources.

Assessing the development

In Germany 22 % less primary energy was used in 2020 than in 1990. As recently as 2006, energy consumption was still nearly as high as 1990. Since then, it has decreased significantly. In 2020, energy consumption was 11,691 petajoules (PJ), the lowest value since 1990. This decline is relativized by the economic impact of the Corona pandemic, as in 2020 alone consumption fell by 8.7 % compared to the previous year.

However, the current trend is not enough to achieve the targets set by the Federal Government. In its 2010 Energy Concept (BMWi, BMU 2010), it decided to aim for a reduction in primary energy consumption by 20 % by 2020 and by 50 % by 2050, compared to 2008 levels. The Energy Concept targets also became part of the German Sustainable Development Strategy published by the Federal Government (BReg 2016). The German federal government's Integrated National Energy and Climate Plan (NECP), which is based on the EU Governance Regulation, aims at a reduction in primary energy consumption by 30 % in 2030 and by 50 % in 2050 compared to 2008 (BReg 2019c, Energy Efficiency Strategy 2050). This requires the consistent implementation of measures laid out in the National Action Plan on Energy Efficiency (BMWi 2014).

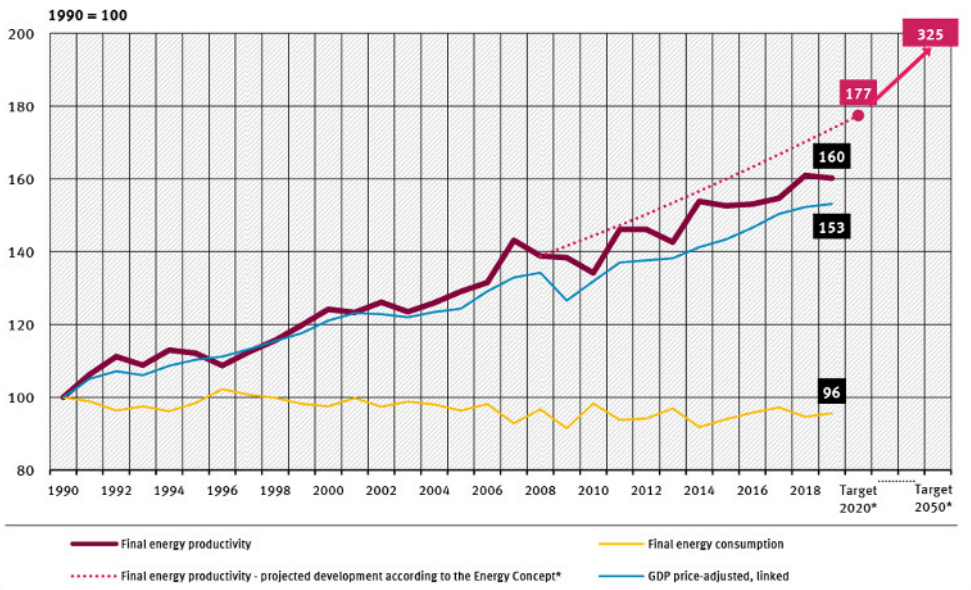
In 2020 the decrease compared to the base year 2008 was only 18.7 %. To achieve the 2030 target, primary energy consumption must fall by an average of 1.5 % per year from 2020 on. Prior to the crisis year 2020 primary energy consumption decreased by an average of 1.1 %.

Methodology

The total primary energy consumption is determined by the Working Group on Energy Balances (AGEB) on the basis of efficiency ratios. The energy carriers burnt in power stations and other combustion plants are multiplied by their calorific value. The efficiency ratio of electricity generated from wind, hydropower or photovoltaic is defined as 100 %, while in geothermal energy it is 10 % and in nuclear energy 33 %. Explanations of the calculation methods are published in the Preface to the Energy Balances (AGEB n.d.).

Final energy productivity

Final energy productivity
Final energy consumption in relation to gross domestic product (GDP)



* The projected development is based on the climate protection targets pointed out in the Energy Concept 2010 published by the Federal Government. According to that final energy productivity should rise by 2.0 % annually between 2008 and 2011 and by 2.1 % from 2012 onward. Therefore, the target value is 325.2 in 2050.

Source: German Environment Agency on the basis of gross domestic product, Federal Statistical Office of Germany, Bruttoinlandsprodukt, Bruttonationaleinkommen, Volkseinkommen, as of 09/2020; Source final energy consumption: Working Group on Energy Balances. Evaluation Tables on the Energy Balance for the Federal Republic of Germany 1990 to 2019

At a glance

- Energy efficiency can be measured using the indicator ‘final energy productivity’.
- Between 1990 and 2019 final energy productivity increased by approximately 60 %.
- The Federal Government aims to increase final energy productivity by 2.1 % every year.
- Between 2008 and 2019 the annual average growth has been 1.3 %. This is significantly below the target.

Indicator online (latest data, data download): http://www.uba.de/57113
Last updated: 15.04.2021

Environmental importance

Energy efficiency must be increased throughout the world in order to stop unrestricted growth of global energy consumption and to avoid severe consequences for the environment. The energy productivity indicator specifies how much economic output (gross domestic product) is produced per unit of energy used. Energy productivity thus measures energy efficiency.

Increasing energy efficiency also makes sense in an economic context: Using less resources to achieve the same economic output reduces the environmental impact and saves money. Private households can save money as well by using appliances with high energy efficiency ratings.

Energy productivity is assessed on the basis of final energy consumption rather than primary energy consumption. This enhances the validity of the indicator because losses in the energy supply system through energy conversion and transport do not appear in the balance. Final energy consumption includes electricity as well as heat, therefore, weather conditions and fuel provisions will cause fluctuations over the years.

Assessing the development

Between 1990 and 2019 final energy productivity rose by approximately 60 %. This increase in productivity was mainly driven by the gross domestic product growth, which has also grown by around 53 % since 1990. Final energy consumption fell by 4 % in the same period. This decoupling of economic growth and energy consumption can be the result of improved energy efficiency, but also of structural change, which favours less energy-intensive economic activities.

The Federal Government has set a target of increasing final energy productivity by 2.1 % annually from 2008 onwards. This target, which was first outlined in the Energy Concept of 2010 (BMWi, BMU 2010), also became part of the German Sustainable Development Strategy (BReg 2016). Productivity should increase by 28 % by 2020 compared to 2008 and by around 138 % by 2050.

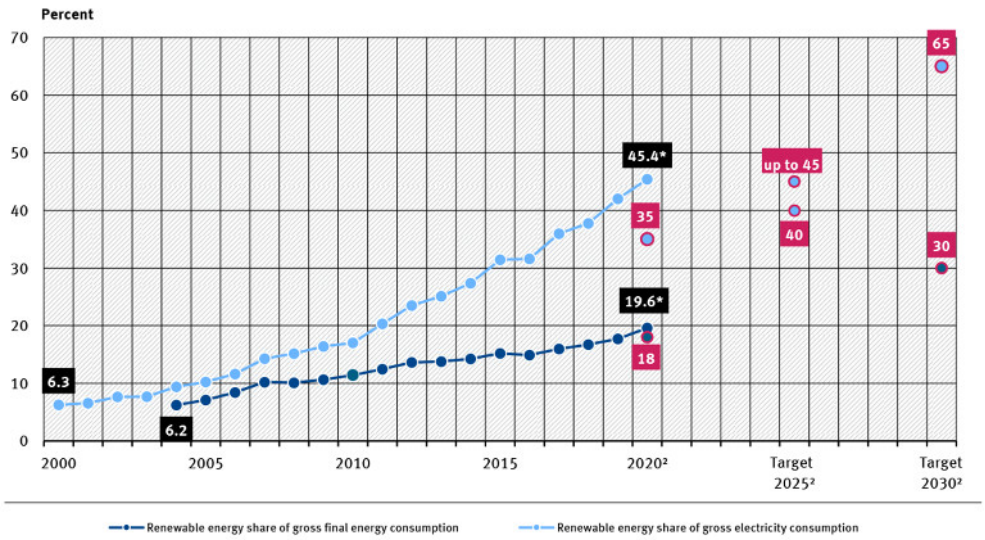
Final energy productivity actually grew 1.3 % per annum between 2008 and 2019. The target was thus missed. In 2014, the Federal Government adopted the 'National Action Plan of Energy Efficiency' to reach the targets it has set (BMWi 2014).

Methodology

The final energy productivity indicator is calculated as the ratio between gross domestic product and final energy consumption in Germany. The gross domestic product is calculated and published by the Federal Statistical Office of Germany as part of the macroeconomic accounts (Destatis n.d.). Final energy consumption is determined by Working Group on Energy Balances (AGEB) on a regular basis. Explanations of the calculation methods are published in the Preface to the Energy Balances (AGEB n.d.).

Renewable energy

Renewable energy share in gross final energy consumption and gross electricity consumption[1]



[1] Share of gross final energy consumption calculated according to the method given by the Federal Government's Energy Concept
[2] Source for target values: EU Directive 2009/28/EC, Energy Concept (2010), Renewable Energies Act (EEG) 2021
* Preliminary figures

Source: German Environment Agency on the basis of Working Group on Renewable Energy Statistics (AGEE-Stat), as of 02/2021

At a glance

- The share of renewable energies in electricity consumption increased from 6.3 % to 45.4 % between 2000 and 2020.
- Therefore, the target range of 40 to 45 % for the year 2025 was already exceeded in 2020.
- The share of renewables in gross final energy consumption increased from 6.2 % (2004) to 19.6 % (2020).
- According to preliminary calculations, the goal of increasing the share of renewables in gross final energy consumption to 18 % by 2020 was thus achieved.
- The 2030 targets can only be achieved with considerable additional efforts due to the sharp drop in expansion dynamics.

Indicator online (latest data, data download): http://www.uba.de/57114
Last updated: 15.04.2021

Environmental importance

Energy-related emissions are responsible for approximately 80 % of all greenhouse gas emissions in Germany. Increasing the share of renewables in gross electricity and gross energy consumption will help to reduce the use of fossil fuels such as coal or gas and thus the emission of greenhouse gases. Increasing the share of renewable energy is therefore an important contribution to climate protection and also helps to save resources (cf. 'GHG emissions avoided through the use of renewables' indicator).

Germany currently imports the majority of its energy carriers, whereas it is largely self-sufficient in renewables. Increasing the share of renewable energy therefore reduces dependency on the import of raw material.

Cross final energy consumption includes, in addition to final energy consumption, the internal consumption of the generating plants and transmission or line losses. Gross electricity consumption is an important component of gross final energy consumption alongside the consumption of heat and fuels.

Assessing the development

In recent decades, renewable energies have developed rapidly: While their share of gross electricity consumption was still at 6.2 % in 2000, it increased to 45.4 % by 2020. This development is a success for German energy and environmental policy. The Renewable Energy Sources Act (EEG) contributed to this development in particular. The share of gross final energy consumption also increased significantly – though at a much slower pace.

In the past, the German government's targets for the share of renewables in *gross electricity consumption* were regularly met. The target value of 35 % for the year 2020 was already reached in 2017. The target range for 2025 (40 to 45 %) was also surpassed ahead of schedule in 2020. Greater effort is now required to achieve the binding "65 % target" for 2030 set out in the 2021 amendment to the Renewable Energy Sources Act (EEG 2021), which was passed in 2020. To achieve this goal, in particular, the expansion of renewable power plant capacities, which has been slowing down in recent years, and an appropriate expansion of the electricity grids must be accelerated considerably.

According to preliminary calculations, the target of increasing the share of renewables in *gross final energy consumptio*n to 18 % in 2020 was achieved with a share of 19.6 %. This significant rise over the previous year was also substantially influenced by the Covid-19 pandemic. However, considerable additional efforts are necessary for the 2030 target (share of 30 %). Especially in the heating and transport sectors, the shares of renewable energies increased only slowly over the past ten years.

Methodology

The indicator shows the ratio of renewable energy use to the total gross energy consumption and gross electricity consumption in Germany. The data used are provided by the Working Group on Renewable Energy Statistics (AGEE-Stat) and Working Group on Energy Balances (AGEB).

07
Private households and consumption

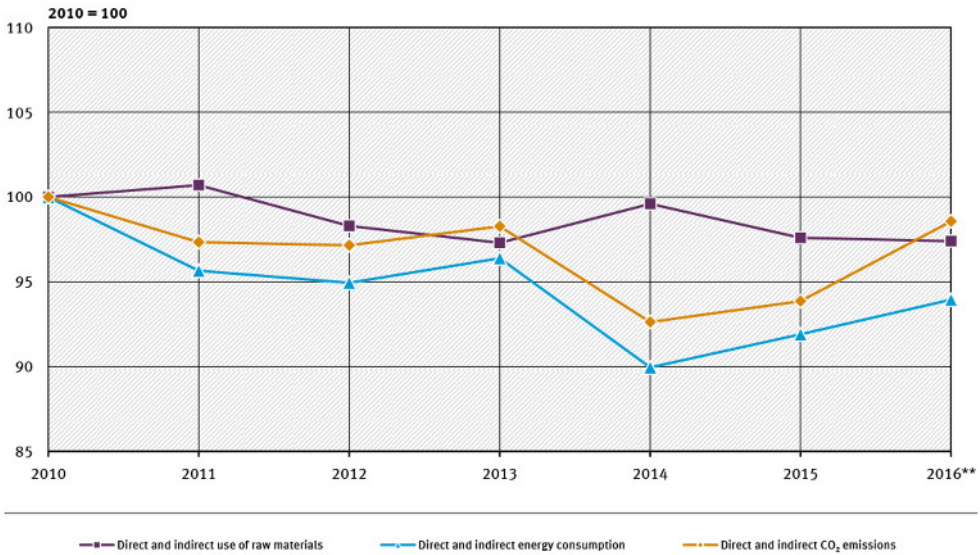
Global environment footprint of consumption

Environmentally friendly consumption

National Welfare Index

Global environmental footprint of consumption

Global environmental footprint of household consumption



* In the German Sustainability Strategy, the German government has set itself the goal of continuously reducing the ecological footprint associated with the consumption activities of private households in all three areas
** Comparability of 2016 figures is limited due to a revision of national accounts

Source: Federal Statistical Office 2020, Environmental-Economic Accounts, Direct and Indirect Energy Flows and CO_2 Emissions. Production and use in raw material equivalents

At a glance

- Compared with 2010, energy consumption and the use of raw materials by private households and associated carbon dioxide emissions decreased slightly overall.
- Since 2014, however, both energy consumption and carbon dioxide emissions have been rising again.
- In its Sustainability Strategy the German government sets the goal of reducing the global environmental footprint of private household consumption in all three areas

Indicator online (latest data, data download): http://www.uba.de/85704
Last updated: 11.03.2021

Environmental importance

Through their consumption activities, private households significantly contribute to the environmental impact caused by the German economy as a whole. A distinction is made between direct and indirect use of environmental resources, as well as direct and indirect emissions.

Direct resource use or direct emissions respectively result, for example, through energy consumption within private households (e.g. heating) or are directly related with consumption activities such as when fuel is used for driving. By contrast, CO_2 emissions, energy consumption and raw material use resulting from the production of consumer goods are labelled indirect. These can either occur in Germany or abroad. For indirect CO_2 emissions and energy consumption, the terms CO_2 or energy content of consumer goods apply. A significant part of the indirect environmental impact of our consumption is generated abroad through the import of goods or so-called intermediate inputs.

In its Sustainability Strategy, the German government set the goal of continuously reducing the global environmental footprint of private household consumption in all three areas (BReg 2021).

Assessing the development

Direct and indirect energy consumption by private households has declined by 6.1 % since 2010, but has risen again slightly since 2014. Around 28.3 % of the energy consumed by private households is generated abroad during the production of goods that are imported.

There is a similar trend in CO_2 emissions. Overall, CO_2 emissions from private household consumption in 2016 were 1.4 % lower than in 2010, with around 27.3 % of emissions resulting from the production of imported goods abroad.

The use of raw materials has decreased by 2.7 % since 2010. While usage of abiotic materials (ores, fossil fuels and other minerals) has decreased by 14 % since 2010, there has been a 7 % increase in biomass. In total, approximately 680 million tonnes of raw materials were used for private household consumption in 2016.

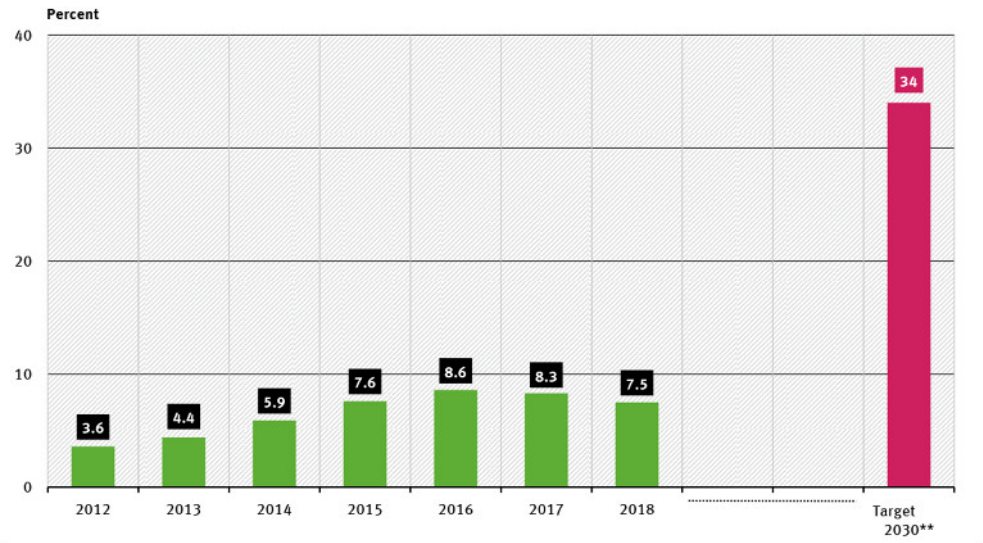
When the three sub-indicators are viewed together, the picture is mixed: While the use of raw materials overall is moving in the desired direction, achieving the German government's target requires further efforts regarding energy consumption and CO_2 emissions.

Methodology

Data on the global environmental footprint of private households are calculated from a number of different sources in the environmental economic accounts by the Federal Statistical Office using environmentally extended input-output analysis. The determination of indirect environmental impacts is particularly challenging, which is why new data for the indicator always comes with a delay. The Federal Statistical Office developed the basis of this indicator on behalf of the German Environment Agency as part of the research project "Global Environmental Consumption by Production, Consumption and Imports" and is described in a method manual (Destatis 2020b).

Environmentally friendly consumption

Weighted market shares by sales of products* with official eco-labels



* Cars, household appliances, lighting, flats creens (best class of European energy efficiency label); food (organic certification); household and sanitary papers, detergents (Blue Angel)
* Target of the German Sustainable Development Strategy 2016

Source: German Environment Agency calculations 2020, based on various sources

At a glance

- In the sector of products with official eco-labels, 7.5 % of turnover was generated with particularly environmentally friendly products in 2018.
- This is the second year in a row that the indicator value has fallen.
- The Federal Government has set the target of increasing the market share of environmentally friendly products to 34 % by 2030.
- More efforts are needed to achieve this goal, particularly in the food and mobility sectors.

Indicator online (latest data, data download): http://www.uba.de/57253
Detailed information: http://www.uba.de/11321
Last updated: 11.11.2020

Environmental importance

Private households can encourage sustainable consumption both directly and indirectly. Their purchasing decisions influences their own environmental footprint. For instance, energy-efficient vehicles or well-insulated homes need less energy and produce fewer greenhouse gas emissions. At the same time, consumers can reward manufacturers who have particularly sustainable production methods by favouring their products.

The indicator records the market shares of products with eco-labelling that sets stringent environmental standards. Up to now, only state-regulated eco-labelling has been considered: Energy labelling (cars, household appliances, lighting and televisions), organic labelling (food) and the Blue Angel label (sanitary tissues, washing and cleaning products). With this indicator it is possible to ascertain whether conventional products are being replaced by environmentally friendly versions. Sustainable consumption is all about replacing non-sustainable consumer habits with sustainable ones.

Assessing the development

In 2018, environmentally friendly products had a 7.5 % market share in the product groups investigated. The indicator fell for the second time – after previous continuous growth. This is mainly due to the fact that A+ cars' market share fell from 14 % (2016) to 9.6 % (2018). For television sets, the market share of A++ sets even fell for the fourth year in succession from 8.3 % in 2014 to below 1 % in 2018. The market share for hygienic papers is also falling for the fourth year in a row. In household appliances, the market shares of the most efficient products are increasing, but the growth dynamics of earlier years have faded here as well. Market shares vary considerably within the various product groups. In household appliances for example, washing machines in the highest efficiency class most recently had a market share of 85 %. In contrast, electric cookers and ovens in the highest efficiency class had a market share of less than 1 %.

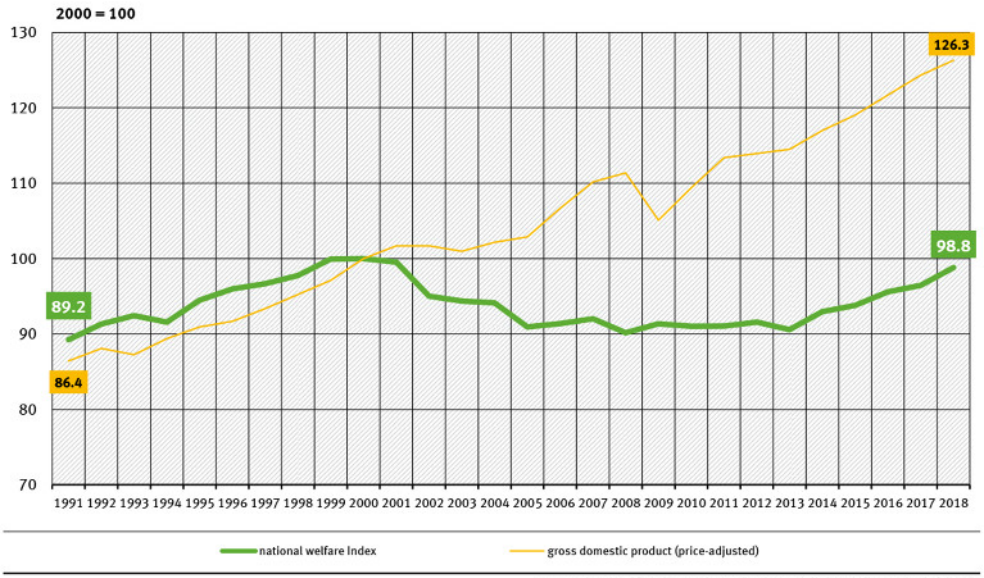
In the German Sustainable Development Strategy, the Federal Government has set targets for the market share of environmentally friendly products (BReg 2016). These are to increase to 34 % by 2030. This target requires above all a boost to the weakening or in some cases even negative growth momentum in energy-efficient products. Sales of organic food and the market share of particularly efficient cars must also increase significantly.

Methodology

To calculate the indicator, particularly environmentally-relevant product groups for which market data are available were identified in each consumer area. Since the market volumes for individual product groups vary greatly, the market shares were weighted by the volume of sales for the respective market as a whole. This guarantees that the indicator is not distorted by high market shares in small niche markets. A description of the methodology can be found in a study commissioned by the German Environment Agency (UBA 2015b), although not all the product groups described there are covered by this indicator.

National Welfare Index

Development of the national welfare index (NWI) and the gross domestic product (GDP)



Source: Freie Universität Berlin, Forschungsstätte der Evangelischen Studiengemeinschaft (FEST);
Data for 2018: The Macroeconomic Policy Institute (IMK) 2020, Policy Brief 96, NWI 2020 – Auswirkungen der Coronapandemie auf die Wohlfahrt

At a glance

- Gross domestic product (GDP) measures the economic performance of an economy, but does not reflect social welfare.
- The national welfare index (NWI) includes overall 20 activities that raise and diminish welfare.
- The NWI reached its peak in 1999 and declined afterwards until 2005. An upward trend has been observed since 2013.

Indicator online (latest data, data download): http://www.uba.de/57202
Last updated: 12.10.2020

Environmental importance

GDP indicates the economic performance of an economy and has been recognised as an internationally comparable statistical parameter. However, GDP is not a suitable measure of social welfare. The main criticisms include the fact that GDP does not take into account distribution of income and does not incorporate voluntary work and housework. Furthermore, it does not include costs through damage to the environment. Thus it does not show decreases in natural capital. So-called defensive expenses to combat crime, drug use or the subsequent costs of traffic accidents even tend to have a positive effect on the GDP.

The NWI has been developed as an indicator that takes account of such criticism. Based on consumption expenditure, it contains bonus and malus components, depending on whether they contribute to welfare or not. Greater income inequality lowers the value of the index. Environmental costs and consumption of non-renewable resources are examples of negative categories, voluntary work and housework for positive categories. The NWI has been increasingly used by the German Federal States (Diefenbacher et al. 2016).

Assessing the development

The GDP increase was continuous during that time, being only disrupted by the 2009 economic crisis. The development of the NWI has shown four phases since 1991. Until 1999 a continuous increase parallel to GDP can be observed. This is followed by a disparity: While GDP continues to rise, the NWI falls. The main cause was the increasing income inequality. Between 2005 and 2013 there are hardly any fluctuations of the NWI. Since then there has been a positive trend; growing by 2 percentage points in the latest year.

The main component of the NWI consists of real consumption expenditure weighted by the distribution of income (Gini coefficient). While real consumption expenditure has been essentially stationary since 1991, income distribution has become more unequal. This is the main reason for the drop in the NWI. On the other hand, there has been a modest reduction in other welfare reducing components including environmental damage. According to preliminary estimates, the NWI is expected to increase again for 2019. For 2020 there are contrary developments of the individual indicators, see the publication "NWI 2020 – Effects of the Corona Pandemic on welfare" (Held et al. 2020).

Methodology

The NWI is the sum of 20 monetarily assessed components, the most important of which is real consumption expenditure weighted by the distribution of income (Gini coefficient). There are more welfare-enhancing components such as housework, volunteer work and expenditure for health and education that have a positive impact on the NWI, whereas negative activities are subtracted, such as environmental damage or crime. A more detailed description of the calculation method is found at Diefenbacher et al. 2016. Up-to-date information on the NWI are published by the Macroeconomic Policy Institute (IMK). On the Research Institute of the Protestant Study Community (FEST) website the latest publications as well as detailed information on the estimates and methodology of the NWI can be found.

08
Environment and economy

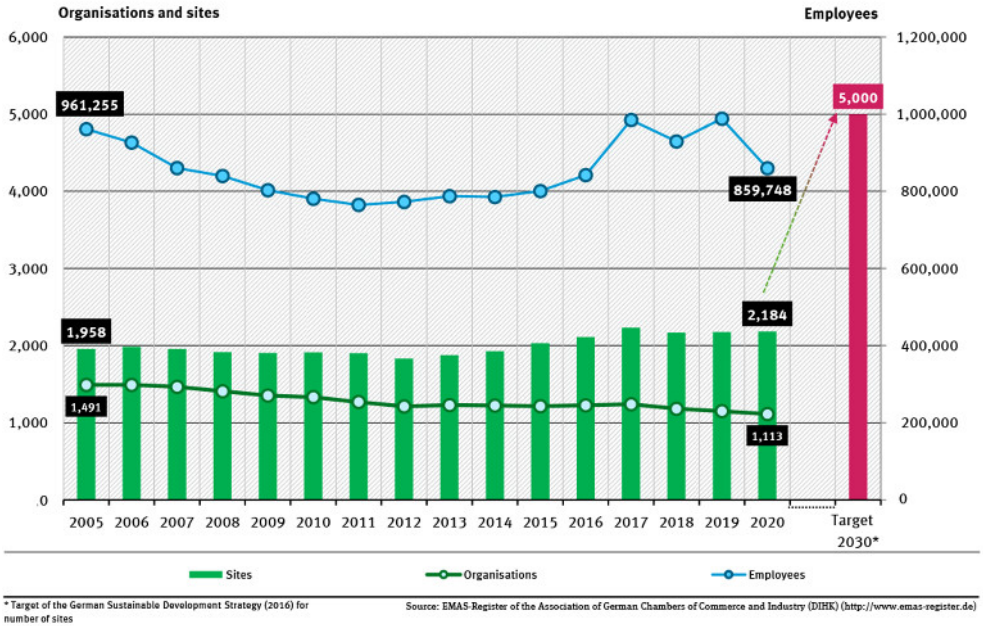
Environmental management

Environmental costs of energy and road transport

Employment in environmental protection

Environmental management

Number of EMAS-registered organisations, sites and employees



* Target of the German Sustainable Development Strategy (2016) for number of sites

Source: EMAS-Register of the Association of German Chambers of Commerce and Industry (DIHK) (http://www.emas-register.de)

At a glance

- EMAS is an internationally applicable system for environmental management. It is the most ambitious environmental management standard publicly available.
- By 2011 and 2012 respectively, the number of EMAS registered organisations, sites and employees had declined.
- A slight upward trend was then observed until 2017, which did not continue in 2018 to 2020.
- In its Sustainability Strategy, the German government has set the target that 5,000 sites should be registered according to EMAS by 2030.

Indicator online (latest data, data download): http://www.uba.de/57201
Detailed information: http://www.uba.de/22254
Last updated: 27.01.2021

Environmental importance

The number of organisations and sites registered with the Eco-Management and Audit Scheme (EMAS) and employees in EMAS-registered organisations are a measure for the acceptance of sustainable production patterns in the economy. EMAS is applicable for companies and other organisations that want to improve their environmental performance in a systematic, transparent and credible manner. The scheme's requirements are defined in the European EMAS regulation (EC regulation 1221/2009).

EMAS focuses on the environmental aspects of activities, products and services of organizations over the entire life cycle. These must be taken into account when defining and implementing processes, responsibilities and decision structures so that negative effects on the environment are continuously reduced. Progress is monitored by independent, accredited experts and reported in publicly accessible environment statements.

EMAS improves environmental protection and can help to save costs. An increased number of organisations joining the EMAS scheme will have an overall positive effect on environment, climate and resource protection. EMAS builds on the internationally widely used environmental management standard ISO 14001, but is more ambitious.

Assessing the development

After a decline until 2012, the development was positive until 2017. However, there has been a slight decline in EMAS organisations, sites and employees since 2018. The number of EMAS-registered sites in Germany has remained constant since then. The number of employees at EMAS-registered sites fell by 13 % in 2020. In December 2020, 1,113 organizations at 2,184 sites in Germany were EMAS-registered.

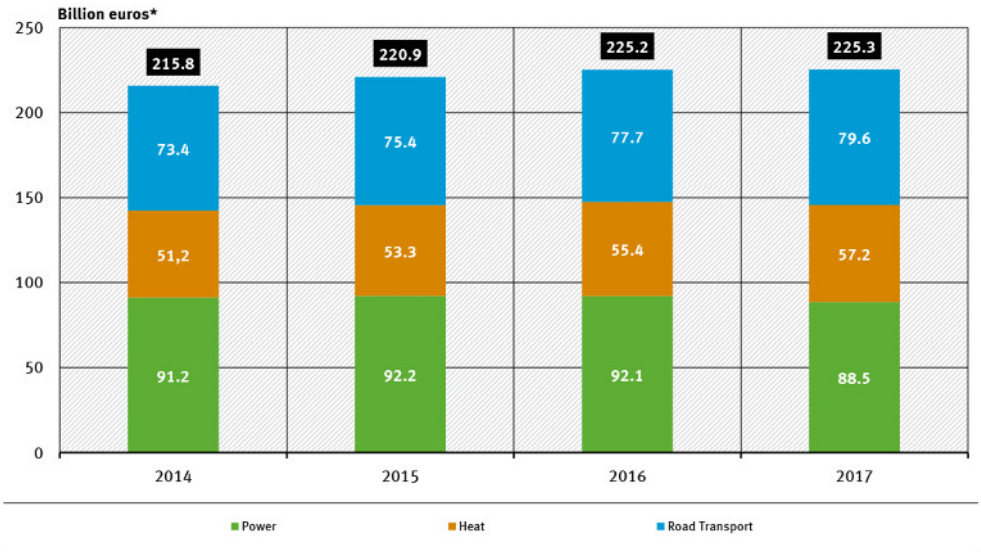
In the German Sustainable Development Strategy, the German Federal Government commits to further supporting EMAS (BReg 2016). In 2030, 5,000 sites should be EMAS-validated and registered. Since it will be easier in the future for certain industries to include multiple sites in an EMAS registration, this target does not seem unrealistic. However, EMAS still needs more support and further steps to be taken to achieve this goal. So far, companies that are EMAS-registered have advantages in water, waste and immission control legislation and can benefit from various exemptions.

Methodology

EMAS organisations and sites are registered by the competent Chambers of Industry and Commerce and Chambers of Handicrafts and enter the publicly accessible database of the Association of German Chambers of Commerce and Industry database (DIHK n.d). Data based on a unified collection method are available from 2005 onwards. The office of the German EMAS Advisory Board publishes a monthly summary of developments, based on relevant DIHK statistics (UGA n.d.).

Environmental costs of energy and road transport

Environmental costs (greenhouse gases and air pollutants) of power and heat generation as well as road transport



* Based on purchasing power in 2020

Quelle: German Environment Agency 2020, own calculations based on data from Working Group on Energy Balances; Working Group on Renewable Energy Statistics and Federal Ministry for Economic Affairs and Energy, Renewables in Figures, TREMOD 5.82

At a glance

- Power generation, heat generation and transport activities pollute the environment, among other things, through the emission of greenhouse gases and air pollutants.
- This results in high subsequent costs for society, for example through environmentally-induced diseases, damage to ecosystems or even buildings.
- For Germany, these environmental costs are estimated to amount to almost 225 billion euros in 2017, an increase of 4 % compared to 2014.

Indicator online (latest data, data download): http://www.uba.de/57228
Detailed information: http://www.uba.de/21998
Last updated: 29.01.2021

Environmental importance

Environmental costs are economically highly relevant, as was demonstrated by the economist Sir Nicholas Stern in his Review on the Economics of Climate Change in 2006 (Stern 2006). The Stern Report, as it became known, estimates that the costs caused by climate change will amount to 20 % of the global annual gross domestic product.

The use and transformation of energy resources for electricity and heat generation and road transport pollutes environment through the emission of greenhouse gases and air pollutants, e.g. particulate matter and nitrogen oxides. The air pollutants released cause an increase in morbidity, damage to buildings and monuments (facade pollution) and are a burden on ecosystems (cf. 'Population exposure to particulate matter pollution' and 'Agricultural nitrogen surplus'). This also brings economic costs, such as expenses for the repair of storm damage. These costs have to be borne by those affected or by the general public, whereas the polluters of the emissions are usually not – or not fully – charged.

Energy generation and road transport cause environmental damage through greenhouse gases and air pollutants, but also infringe further on the environment by land consumption, noise pollution and water pollution. These are not included in the indicator.

Assessing the development

Total environmental costs increased from 215.8 billion euros in 2014 to 225.3 billion euros in 2017. This is equivalent to an increase of 3 %. The most significant increase was in the environmental costs of heat supply (+12 %). The trend towards more 1-2 person households and larger living spaces per capita makes the decisive contribution to this.

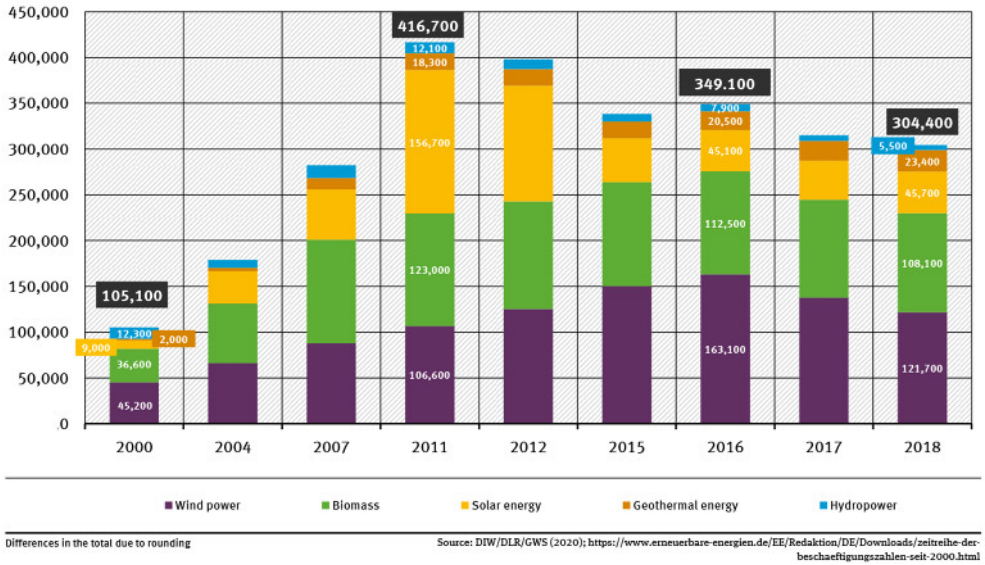
For electricity, the environmental costs fell by around 3 %. This is partially due to the increased use of renewable energies. Their use causes significantly less environmental damage from air pollutants and greenhouse gases than the use of fossil fuels such as coal, oil or natural gas. The environmental costs of transport rose by 8 %. Even the development of more efficient drive systems could not change this. The increase in road traffic and the trend towards more powerful vehicles are responsible for this development.

Methodology

Calculations of environmental damage are based on the 'Methodological Convention 3.0 for the Assessment of Enviromental Costs – Methodology' of the German Environment Agency (UBA 2018). The convention helps to determine costs for the use of the environment according to uniform and transparent criteria. It takes current research into account.The 'Methodological Convention 3.1 – Cost Rates' includes cost rates for the environmental costs of greenhouse gases, air pollutants and noise as well as cost rates per kilowatt-hour of electricity and heat generated and per kilometre travelled (UBA 2020b). The environmental costs incurred by electricity and heat generation as well as transport can be estimated on the basis of these cost rates.

Employment in the renewable energy sector

Number of employees in the renewable energy sector



Differences in the total due to rounding

Source: DIW/DLR/GWS (2020); https://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/zeitreihe-der-beschaeftigungszahlen-seit-2000.html

At a glance

- 304,400 people worked in the renewable energy sector in 2018. That is almost three times as much as in 2000.
- After strong employment growth until 2011, there has been a clear decline since.
- This was initially due to the widespread collapse of the domestic photovoltaic industry.
- Since 2017, production in wind energy has also been declining heavily. The main drivers are losses in foreign trade and unfavourable conditions at national level.

Indicator online (latest data, data download): http://www.uba.de/78005
Last updated: 29.06.2020

Environmental importance

The use of renewable energies – such as wind, solar, geothermal, hydro and biomass – is an indispensable contribution to climate protection and resource conservation. The increase in the use of renewable energies not only benefits climate protection, but also creates jobs in Germany, especially if the production of the plants takes place there.

The indicator shows the development of the number of people employed in the renewable energy sector in Germany: for planning tasks, for the production and maintenance of plants, for administration or for research, development and marketing. If renewable energies are used more intensively, this is also associated with a displacement of other energy production systems such as coal, oil and gas and thus a reduction in jobs in other economic sectors. However, model calculations and scenario analyses show that increasing the share of renewable energies also has a positive net effect on the labour market (Oehlmann et al. 2019).

Assessing the development

Between 2000 and 2018, the number of jobs in the renewable energy sector has almost tripled. In 2018, the figure was around 304,400 people. This makes renewable energies an important factor for the labour market. Wind power accounts for the largest share, followed by biomass and solar energy. After 2011, employment declined significantly. This was caused initially by the slump in domestic production in the most important sub-sector of the solar industry, photovoltaics. Most of it migrated to other countries - in particular to China. Wind energy maintained a steady upward trend and saw an increase in employment up until 2016.

In 2017, however, there was a sharp decline in the number of employees, which continues to this day. The main drivers for this are significant losses in foreign trade and a dramatic decline in newly installed wind turbines in Germany. Between 2017 and 2018 the output of newly installed wind turbines on land in Germany fell by about 55 % (UBA 2019c). This downward trend continued in 2019. The other renewable energy sectors (biomass, hydropower, geothermal energy) showed only minor changes in employment.

Methodology

It is not easy to determine how many people are employed in the renewable energy sector from statistics alone. For this purpose, sophisticated estimation methods have been developed based on input-output calculations, for example. The methods and the current results are described in detail in a study commissioned by the Federal Ministry of Economics and Energy (O'Sullivan et al. 2019).

09
Transport

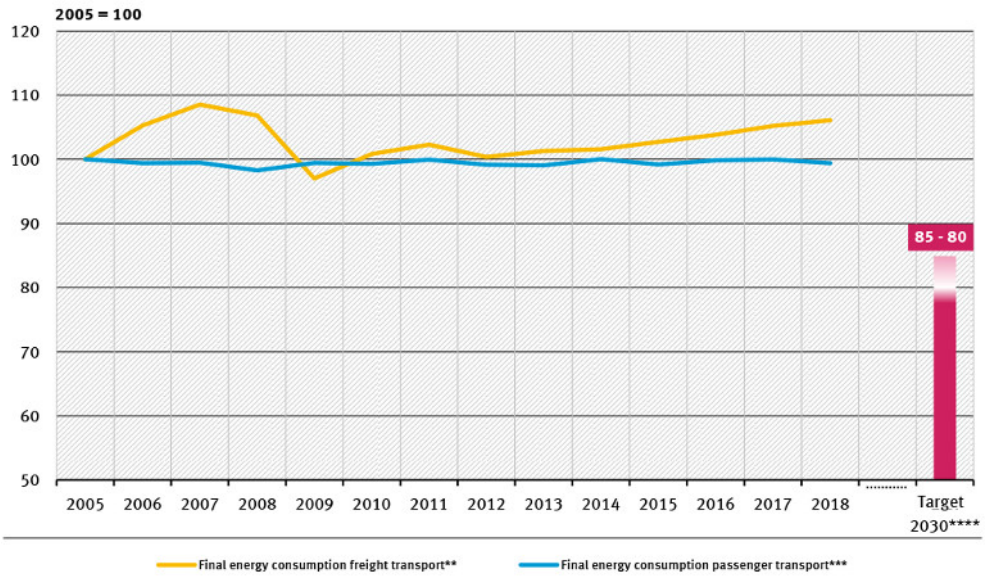
Final energy consumption in transport

Population exposure to traffic noise

Environmentally friendly passenger transport

Final energy consumption of transport

Final energy consumption of freight and passenger transport*



* For this indicator transport performance and mileage are the basis to calculate energy consumption and greenhouse gas and air pollutant emissions.
** Freight transport: inland waterways, rail and road freight transport (heavy commercial vehicles: trucks from 3.5 t payload, road trains, semitrailers)
*** Passenger transport: rail, road transport, national air transport
**** Target for final energy consumption freight transport and passenger transport: based on the Energy Concept of the Federal Government (2010) and the German Sustainable Development Strategy (2016)

Source: German Environment Agency January 2020, TREMOD 6.03

At a glance

- The Federal Government wants to lower final energy consumption of freight and passenger transport by 15 to 20 % by 2030 compared to 2005.
- However, final energy consumption in transport seems to stagnate at a high level with an upward trend in recent years. It will be difficult to reach the target in either sector.
- Freight and passenger transport have become significantly more efficient since the early 1990s, and the increase in final energy consumption goes along with increased transport performance.

Indicator online (latest data, data download): http://www.uba.de/57189
Detailed information: http://www.uba.de/12085
Last updated: 14.02.2020

Environmental importance

Transport requires energy. Making energy available, distributing and using it are causing multiple problems in a global context.

The predominant source of energy in the transport sector is oil, which is often extracted in or transported through ecologically sensitive areas. Further energy input is needed in refining the crude oil into petrol, diesel or aviation fuel, and finally, the combustion of fuels releases pollutants such as nitrogen oxides and particulate matter. The main focus, however, is on the greenhouse gases that arise from combustion and that are responsible for the global climate change.

For all these reasons, the Federal Government decided to reduce overall energy consumption – including the energy consumption of the transport sector.

Assessing the development

Final energy consumption is the consumption required to operate the vehicles. In the long term, the development of final energy consumption in transport does not show a clear direction: until 1999, consumption initially increased, then decreased and has been increasing again since 2010. From 2005 to 2018, the final energy consumption of passenger transport fell by around 0.6 %. In freight transport, on the other hand, it rose by around 6 % over the same period. Nevertheless, over the same time frame, transport performance rose faster than its energy consumption. As a result, both transport sectors have become significantly more energy-efficient.

In its Energy Concept the German Federal Government set an energy-saving target for the transport sector in 2010. By 2020, final energy consumption should be 10 % below 2005 levels, and 40 % below by 2050 (BMWi, BMU 2010). In its revised Sustainable Development Strategy of 2016, the Federal Government has defined an intermediate target for 2030 (BReg 2016). By then, energy consumption in the passenger as well as in the freight transport sector should fall by 15 to 20 %. This makes it hard to reach the 2020 reduction target.

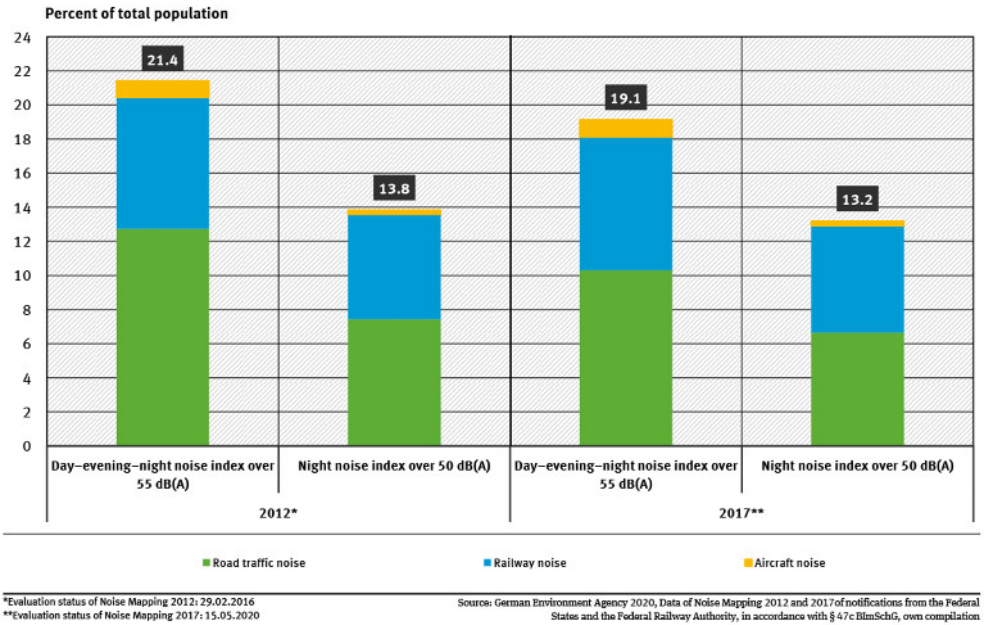
If the energy consumption of transport is to be reduced, energy-efficient alternatives must be promoted more strongly, transport demand must be slowed down or reduced or transport performance must be shifted to more environmentally friendly means of transport (cf. ‘Environmentally friendly passenger transport’ and ‘Environmentally friendly freight transport’).

Methodology

Final energy consumption in the transport sector is calculated using the tool TREMOD (Transport Emission Model), based on mileage and specific energy consumption. TREMOD was developed by the ifeu - Institute for Energy and Environmental Research in Heidelberg, commissioned by the German Environment Agency. Methodological backgrounds are found on their website.The Federal Government determines the final energy consumption of the transport sector as part of its energy transition monitoring, using data provided by the Working Group on Energy Balances (AGEB) as a baseline. These, in turn, are based on fuel sales. The data used for our indicator on the basis of TREMOD are different from those used by AGEB.

Population exposure to traffic noise

Fraction of population exposed to traffic noise



*Evaluation status of Noise Mapping 2012: 29.02.2016
**Evaluation status of Noise Mapping 2017: 15.05.2020

Source: German Environment Agency 2020, Data of Noise Mapping 2012 and 2017 of notifications from the Federal States and the Federal Railway Authority, in accordance with § 47c BImSchG, own compilation

At a glance

- According to the 2017 noise mapping, about 13.2 % of the total population was adversely affected by night-time noise. This is 0.6 percentage points less compared to 2012.
- The 2017 noise mapping further showed that 19.1% of the population was exposed to a noise level of above 55 decibels during the day. This is about 2.3 percentage points less than in 2012.
- The main source of noise is road traffic. Rail traffic is particularly relevant at night. Considering the area where people are affected, aircraft noise plays only a minor role.
- Noise that exceeds exposure limits can lead to health problems.

Indicator online (latest data, data download): http://www.uba.de/57235
Detailed information: http://www.uba.de/12399
Last updated: 02.06.2020

Environmental importance

Traffic noise affects the lives of a large number of people in Germany and can have severe effects on health. Noise adversely affects the quality of life and can promote cardiovascular diseases, lead to cognitive impairment, have a negative impact on the sleep quality and be associated with mental disorder. For additional information on the health effects of environmental noise, see the publication UMID 1/2016.

In 2018, the World Health Organization (WHO)published new guidelines on environmental noise for the European Region. These guidelines include source-specific recommendations for different types of transport. Herein, the WHO recommends that the noise exposure from road traffic should not exceed a mean level of 53 decibels (dB(A)) during the day and 45 dB(A) at night to avoid adverse consequences on health. According to the lowest available values used in noise mapping for measuring noise pollution, the values 55 dB(A) during the day and 50 dB(A) at night were used as threshold values for the indicator.

Assessing the development

According to the 2017 noise mapping, about 10.9 million people around major traffic routes, major airports and agglomerations were affected by traffic noise above 50 decibels (dB(A)) at night. During the day, around 15.8 million people were exposed to traffic noise exceeding 55 dB(A). This means that 13.2 % of the German population was affected by night-time noise, and 19.1 % by daytime noise.

The different types of transport produce different noise problems: The main source of noise is road traffic. Rail traffic tends to be a problem at night. Overall, only few people are affected by aircraft noise.

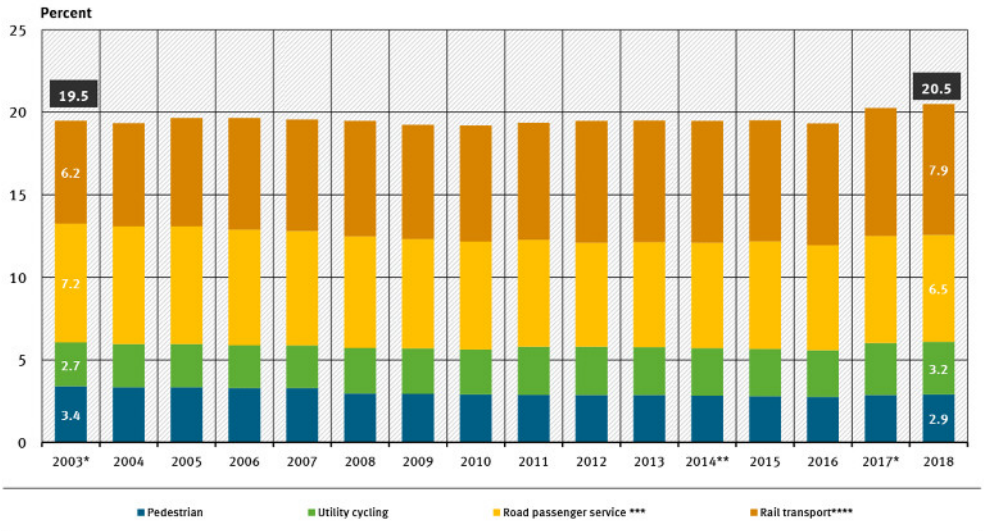
In 2009, the Federal Government passed a second national traffic noise protection package (‘Nationales Verkehrslärmschutzpaket II’, BMVBS 2009), which states that noise from road traffic and inland waterway transport is to be reduced by 30 %, air traffic noise by 20 % and rail traffic noise by as much as 50 % below 2008 levels by 2020. A number of measures have already been taken. More efforts are necessary, however, to achieve a significant reduction in noise pollution.

Methodology

The basis for calculating the indicator is noise mapping, which has been enshrined in the Federal Immission Control Act (BImSchG) since June 2005. Noise maps are the basis for informing the public and for noise action plans. In the European Union (EU), noise mapping is done by means of a uniform procedure based on the standards of the European Environmental Noise Directive. Noise maps have to be drawn up for agglomerations, major roads, major railways and major airports.Detailed calculation instructions can be found in two method documents published by the Federal Government (BMU, BMVBS 2006 and 2007). In the future, these procedures will be replaced by common European noise assessment methods (BMU, BMVI 2018).In agglomerations, double counting of people occurs to a small extent along roads with trams, since noise pollution from road traffic and rail traffic are recorded separately.

Environmentally friendly passenger transport

Share of pedestrian, utility cycling, railway and passenger transport services of total passenger transport performance*



* Results from 2003 and from 2017 are not entirely comparable to those of previous years (recalculation and changes in differentiation)
** From 2014 onwards determined by microcensus on the basis of the 2011 census
*** Contains among others public busses, tram, subway services
**** Including suburban railways

Source: Federal Ministry for Transport and Digital Infrastructure, Verkehr in Zahlen 2020/2021 p. 229 and various years; in German only; Information by the DIW from 25.04.2016 (for in-between years for which no figures have been published)

At a glance

- The share of environmentally friendly passenger transport has remained more or less constant since 2003, only slightly increasing and reaching 20.5 % in 2018.
- To keep the environmental impact of passenger transport low, the share of environmentally friendly transport in total passenger transport should be as high as possible.
- The Federal Government's National Cycling Plan is to support cycling as a means of transport; a federal strategy for pedestrian traffic is currently under development.

Indicator online (latest data, data download): http://www.uba.de/57190
Last updated: 28.01.2021

Environmental importance

Passenger transport has long been dominated by the car, what is known as individual motorised transport (IMT). In 2018 the IMT share was around 74 %, its transport performance increased significantly in the last years, then decreased since 2016. Car traffic is a heavy burden on the environment through greenhouse gas emissions, air pollution and noise. In addition, stationary as well as moving traffic takes up space. Overall, apart from aviation, public transport modes have a better environmental balance than cars with average occupancy. The use of bus, train, walking and cycling have been summed up under the term 'Umweltverbund' or eco-mobility. The indicator shows the share of eco-mobility in overall passenger kilometres. This share should be increased as much as possible to keep the burden on the environment from passenger transport low.

Assessing the development

Our mobility is increasing. Between 1976 and 2018, passenger transport almost doubled in Germany, to recently around 1.237 billion passenger kilometres. While in 1976 the share of environmentally friendly transport modes was around 24 %, it has fallen to 20.5 % by 2018.

In the period since 2003, the trend remained more or less constant and then increased slightly in the last two years. Pedestrian traffic and public transport on the roads declined. By contrast, proportionately more passenger kilometres are being travelled by bicycle.

In its 2010 Energy Concept, the Federal Government set the target of reducing transport energy consumption by 10 % by 2020 and by 40 % by 2050 (BMWi, BMU 2010). This can only succeed if environmentally friendly passenger transport is further encouraged. Therefore, the National Cycling Plan 2020 (NRVP 2.0) was developed to expand cycling. The new NRVP 3.0 will be presented in 2021. The Federal Ministry of Transport, Building and Urban Affairs is currently developing a strategy for the federal government, particularly for strengthening the safety and attractiveness of pedestrian traffic.

Methodology

Official statistics by the Federal Statistical Office of Germany do not actually monitor motorised individual transport, walking or cycling. Instead, the figures are approximated by the German Institute for Economic Research (DIW) using a passenger transport model. This model is based on results of the 'Mobilität in Deutschland' (BMVI 2018) survey and the 2011 microcensus. A more detailed description of the method can be found in the yearly published 'Verkehr in Zahlen' (BMVI 2020).

10
Agriculture and forestry

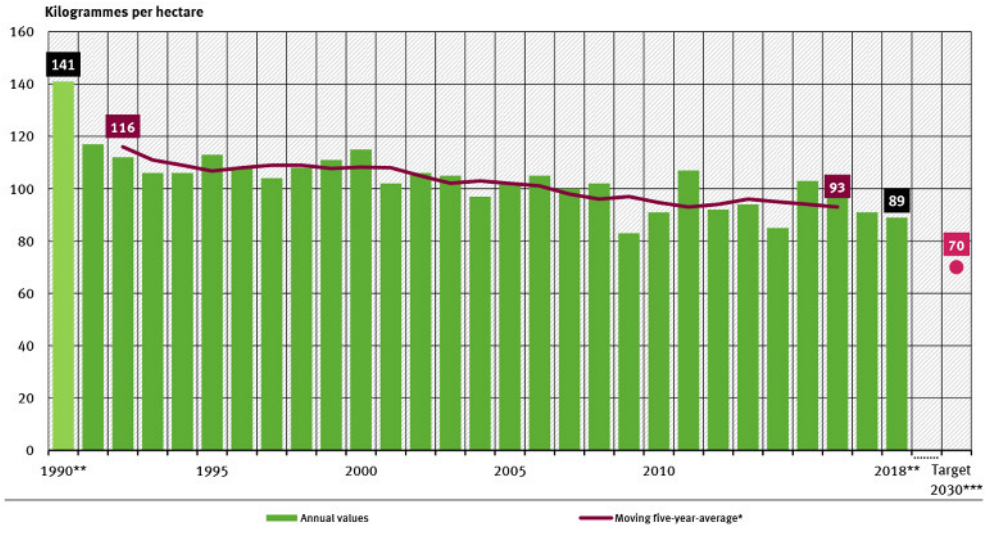
Agricultural nitrogen surplus

Organic farming

Grasslands

Agricultural nitrogen surplus

Nitrogen surplus of the national farm-gate balance



* Annual surplus referred to the middle year of the five-year-period (calcualted from rounded annual values)
** 1990: data partially uncertain and of only limited comparability with the following years. ** 2018: preliminary data
*** Target of the German Sustainable Development Strategy, referred to the average of the five-year-period 2028 - 2032

Source: Federal Ministry of Food and Agriculture (BMEL) 2020, Statistischer Monatsbericht Kap. A Nährstoffbilanzen und Düngemittel, Nährstoffbilanz insgesamt von 1990 bis 2018 (MBT-0111260-0000) (in German only)

At a glance

- The five-year average of nitrogen surplus of the total balance per hectare of utilized agricultural land has decreased by 20 % since 1992.
- The Federal Government aims to reduce the average nitrogen surplus of the total balance of the years 2028 to 2032 to 70 kilogrammes per hectare of agricultural land.
- If the current trend continues, the target will be missed.

Indicator online (latest data, data download): http://www.uba.de/57192
Last updated: 29.01.2021

Environmental importance

Nitrogen is an essential nutrient for all living organisms. However, excessive input of reactive nitrogen compounds to the environment has serious effects on the climate, biodiversity and landscape quality. For example, nitrogen which is not utilized by plants may lead to pollution of the groundwater, nutrient enrichment (eutrophication) of waterbodies, acidification of terrestrial ecosystems and the formation of greenhouse gases. An introduction to the issue of nitrogen surplus is given in the publication 'Reactive nitrogen in Germany' (UBA 2015a) and in the UBA-Umweltatlas "Reaktiver Stickstoff" (*in German only*).

In Germany problems occur especially in regions with high livestock density: Due to the high amount of farm manure (animal excrements), often more nitrogen is applied to the fields as the crops can convert into biomass. The nitrogen surplus is an indicator of the potential nitrogen losses from agriculture to the environment.

Assessing the development

Between 1992 and 2016, the 5-year average nitrogen surplus of the total balance per hectare of agricultural land decreased by around 20 %. Farmers are using nitrogen more efficiently, the area of cultivation of high-output crops has increased and feed conversion by domestic animals has improved. However, the nitrogen balance indicates that only half of the total nitrogen input is removed by agricultural products (BMEL 2020).

After the former target of the Strategy for Sustainable Development of 2002 had been missed, the Federal Government formulated a new target in the revised version of the Sustainable Development Strategy in 2016: the nitrogen surplus should not exceed 70 kg/ha on average for the years 2028 to 2032 (BReg 2016).

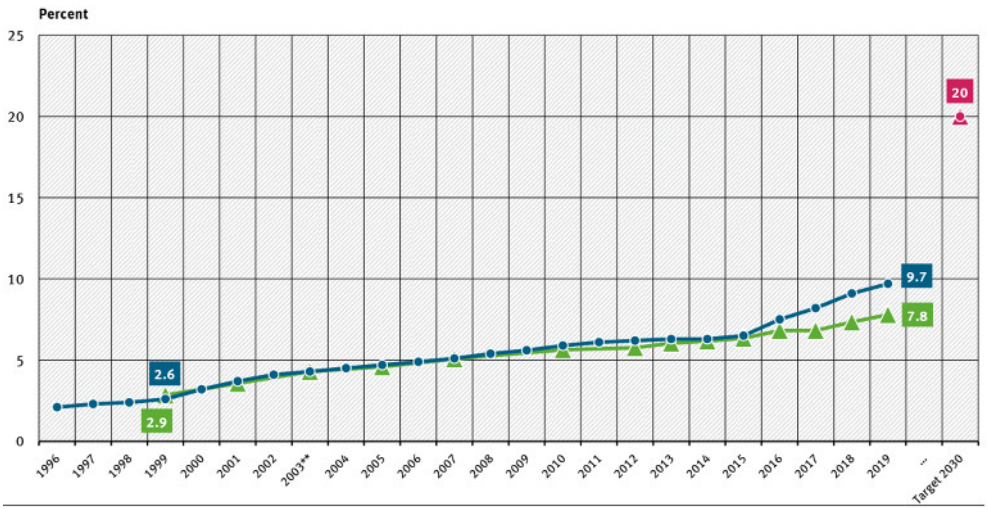
One of the key instruments to meet this target is the fertilizer legislation. It was fundamentally revised in 2020 to prevent penalties as a result of the European Court of Justice ruling against Germany for violating the EU Nitrate Directive. At present, the effects of the new fertilizer legislation cannot be forecasted. Whether additional adjustments will be necessary largely depends on the design of the Material Flow Balance Ordinance and the final designation of areas with high nitrate levels in groundwater bodies. Up to now, the UBA expects that additional efforts will be necessary for a comprehensive protection of climate and environment.

Methodology

The nitrogen surplus is determined from the total agricultural nitrogen balance. It is the difference between the input (e.g. fertiliser, feed, seed and seedlings, atmospheric inputs) and the output (animal and plant products) of the national farm-gate balance. The data are calculated by the Julius-Kühn-Institute and the University of Gießen and are published annually by the BMEL. Hints to the calculation method can be found in Bach et al. 2011 and Häußermann et al. 2019. The data are published annually by the Federal Ministry of Food and Agriculture (BMEL). In order to adjust for annual fluctuations a five-year moving average is calculated from the values of the individual years with the two previous and two following years.

Organic farming

Share of organic farming in total utilised agricultural area



* The data of the Federal Statistical Office is collected only every three years and estimated for the missing years since 2012. This method is not applicable for the Länder. At the federal state level, values are only available for the years collected.
** Only limited comparison possible with previous years due to a change to the survey boundaries in Thuringia.

Source: Federal Ministry of Food and Agriculture, Federal Statistical Office

At a glance

- According to the data of the German Federal Statistical Office, the share of area under organic farming of agricultural land increased from 2.9 % to 7.8 % from 1999 to 2019.
- The Federal Government aims to increase the proportion of organically cultivated areas in agricultural land to 20 % by 2030.
- At the growth rate of recent years, this aim will still take decades to achieve.

Indicator online (latest data, data download): http://www.uba.de/57196
Detailed information: http://www.uba.de/10952
Last updated: 29.01.2021

Environmental importance

Conventional intensive agriculture causes a range of environmental impacts and is partly responsible for a loss of biodiversity. Organic agriculture is a more environmentally sustainable and ecologically beneficial type of management. The aim is to close nutrient cycles as far as possible and to manage in harmony with nature.

Organic farming does not use any mineral fertilisers. A range of crop rotations with intercropping maintain and support soil organisms and soil fertility. Avoiding the use of synthetic chemical pesticides enhances biological diversity on agricultural land. A more species-appropriate animal husbandry serves animal welfare and ensures acceptance by the general public. Organic agriculture therefore has a pioneering role in sustainable land management.

Assessing the development

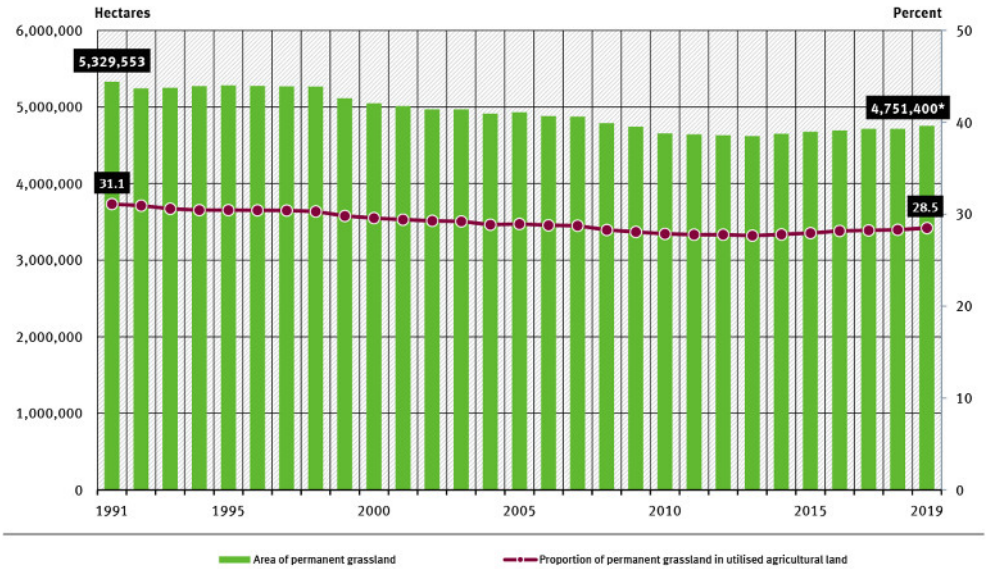
The share of organically managed areas has increased from 2.9 % to 7.8 % in the period from 1999 to 2019. According to that, the total area of organic farming has shown a small but steady increase over the period reviewed. As part of both the German Sustainable Development Strategy (BReg 2016) and the German National Strategy on Biodiversity (BMU 2007), the Federal Government aims to increase the proportion of organically cultivated areas in agricultural land to 20 %. This target shall be met by 2030. However, Germany is still a long way from achieving this aim: even if the steady increase continues at the level of recent years, the 20 % target would not be reached in 2030. Thus, it is important to identify obstacles to growth in organic farming and take efficient measures to eliminate them. Planning security and continuous support are needed to increase the willingness of farmers to convert to organic farming on a permanent basis.

Methodology

The German Federal Statistical Office uses various surveys (including the Agrarstrukturerhebung) to determine the area that is organically farmed. The survey covers organically farmed areas of farms larger than five hectares that are subject to the control procedure of the EU legislation. The reference used to calculate the area share is the agriculturally used area (again from five hectares upwards). A slightly different data set is used by the Federal Ministry of Food and Agriculture (BMEL). The indicator covers areas that are managed in accordance with the European Eco-Basis Regulation and are reported to federal state authorities. Small enterprises are also included in the data set. For methodological reasons, the data of the BMEL therefore show a higher proportion of organically farmed area.

Grasslands

Total area of permanent grassland and proportion of permanent grassland in utilised agricultural land



*2019: Representative results provided by the German land use survey

Source: Federal Ministry of Food and Agriculture (BMEL), Statistisches Jahrbuch (various years; in German only); Source for 2019: Federal Statistical Office of Germany 2019

At a glance

- Between 1991 and 2019 the area of grassland in Germany decreased by around 11 %.
- The area of permanent grassland has risen slightly in recent years.
- The national implementation of the European Common Agricultural Policy (CAP) aims, among others, at maintaining the 2012 level of (total) grassland area.
- Effective steps are required to achieve this target.

Indicator online (latest data, data download): http://www.uba.de/57193
Detailed information: http://www.uba.de/13793
Last updated: 21.08.2020

Environmental importance

Extensively managed grassland is important for species-rich plant communities that require nutrient-poor soils and which have become rare in agricultural landscapes. Approximately 40 % of the endangered ferns and flowering plants in Germany are found in grassland, as the 'Grünland-Report' shows (BfN 2014). But grasslands are also important for protecting soils and water and help to protect the climate by storing carbon. Permanent grassland is of particular value. It is defined as meadows and pastures that have not been used as arable land for at least five continuous years.

The loss of grasslands between 1991 and 2013 was due to more intensive agriculture and the associated changes in land use. Using grasslands for pasture and hay had become less attractive to farmers while there was a growing demand to cultivate the land for feed and energy plants. Many farmers therefore increasingly used former pastures and meadows as arable land. Particularly valuable sites from an environmental view such as semi-arid grasslands and humid grasslands were ploughed and converted into arable land. If these areas are then used for intensive arable agriculture, the above-mentioned positive effects of grassland are lost. Furthermore low yielding and remote grasslands are at risk of being abandoned due to not being economically viable (land abandonment). Such grasslands may convert to shrub lands and lose their function as habitat for rare plants and animals adapted to them.

Assessing the development

Permanent grassland in Germany has been under pressure in recent decades. In 1991 there were still over 5.3 million hectares (m ha) of utilised agricultural land managed as permanent grassland. By 2019, the total area of permanent grassland had declined by 11 % to around 4.8 m ha.

Since the decision of the EU agricultural reform in 2013, the 'Greening' obligations regulate the protection of permanent grassland. Farmers must comply in order to qualify for the direct payments system. By means of a general prior authorisation requirement for ploughing up of grassland and the complete prohibition of ploughing up and change of grassland with elevated environmental value, the loss of permanent grasslands shall be stopped.

Although the percentage of grassland has recently risen again slightly since 2013, the overall drivers of the loss of grassland remain largely unchanged. Major pressures such as the high demand of arable fodder, subsidies for the cultivation of energy plants and land abandonment continue to be exerted on grassland. It can therefore be assumed that the long-term pressure on grassland has not changed. Effective protection of grassland therefore remains of crucial importance.

Methodology

The indicator is based on information from the land-use survey by the statistical offices of the Federal States. The results are published in the Statistical Year Book and, prior to this, in the monthly reports by the Federal Ministry of Food and Agriculture. A detailed description of the method is given in the quality report on the land-use survey (Destatis 2019b).

Methodology for the assessment of indicators

The indicators of the Environmental Monitor are characterized by the fact that they are each based on an explicit target. As a priority – in line with the German government's Sustainability Strategy – quantitative targets are included for a target year in the future (17 indicators, e.g. reduction of primary energy consumption by 30 % by 2030, 5,000 sites in Germany registered under EMAS by 2030 or also average annual growth in total raw material productivity of 1.5 % by 2030).

So-called directional targets are available for 9 indicators. Here, a desired development is specified (e.g. increase in the National Welfare Index). For 4 indicators, quantitative targets already in force in the past or in the target year 2020 are considered (e.g. nitrate in groundwater, plastic waste in the North Sea, final energy productivity).

Basis for the assessment of the indicators is the question: Is the set target being achieved? For this purpose, the German Environment Agency uses an assessment procedure that takes into account the different types of targets and, as a result, enables a comprehensible assessment in four colour categories (extended traffic light system: green, yellow, orange, red).

The evaluation procedures used for the Environmental Monitor are comparable with those of various institutions (e.g. European Environment Agency, Eurostat, Federal Statistical Office). For targets that lie in the future, trend extrapolations are applied, which allow "if-then statements". However, these do not represent a forecast. An addition of expert judgments may be made.

Assessment of indicators with directional targets

Indicators with a **directional target** aim for a development direction (usually rising or falling). The long-term and short-term historical trends are determined for the evaluation. Both trends are then compared with the required target direction and the indicator is conclusively evaluated.

The long-term trend is calculated using simple linear regression, taking into account all indicator values from the year 2000 (or next available year). The long-term trend is considered to be in line with the target if the slope of the regression line matches the required target direction. When determining the short-term trend, the development of the last 3 changes of the time series is considered. The short-term trend is considered to conform to the target if the development of the last 3 (or more) years is continuous in the target direction.

Short-term and long-term target direction is given ⇢ *green rating*

Target direction short-term is given, long-term is not given ⇢ *yellow rating*

Target direction long-term is given, short-term is not given ⇢ *orange rating*

Target direction neither short-term nor long-term is given ⇢ *red rating*

Example: The indicator "National Welfare Index" (page 74) is an indicator with a directional target. According to the Federal Environment Agency, welfare should show an increasing development. Viewed over the entire period (from the year 2000 to 2018), this indicator shows a falling trend. This means that even the current value of the NWI in 2018 is still below the value of 2000. However, the development over the last 5 years is continuously in the target direction and thus indicates a trend reversal. The indicator is rated yellow.

Indicators with quantitative target values

For the assessment of indicators with an **already applicable target value**, the distance of the most current indicator value to the target value is compared with the distance of a historical value in a base year to the target value. The year in which the target was set or to which the target relates is selected as the base year. Target achievement reflects the proportion of the development towards the target that has taken place since the base year.

Example: The limit value for nitrate in groundwater has been in force since 2008. This limit value is to be complied with at all measuring sites. Since 2008, however, the share of measuring sites at which the limit value is exceeded has only decreased slightly (by about 13 %). The target achievement was therefore only 13 %. The indicator is rated red.

For the assessment of indicators with **a target value to be achieved in the future**, it is first determined what value the indicator would achieve in the target year if the current trend were to continue. Then, the distance of the indicator in the target year to the target value is set in relation to the distance of a historical value in the base year to the target value. Target achievement here reflects the fraction of the trend toward the target that would occur if previous trends since the base year were to continue in a linear fashion. These are not forecasts. The assessment estimates how closely the targets can be achieved if the development from the past were to continue.

Example: The indicator "Environmentally friendly consumption" (page 72) is an indicator with a target value to be achieved in the future. According to the German Sustainability Strategy (BReg 2021), the market share of products with a national eco-label should be at least 34 % in the target year 2030. A continuation of the linear trend of the entire time series shows that the gap to the target in 2030 would remain large and the target would thus be missed significantly (degree of target achievement lower than 80 %). The indicator is therefore given an orange rating.

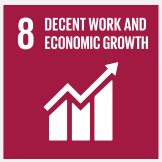
Expert judgments

In practice, the assessment can also be carried out or supplemented by expert assessments, e.g. if no reliable trend assessment is possible due to insufficient data (e.g. traffic noise, status of rivers); if the trend update shows high bandwidths or methodological breaks in the time series (e.g. settlement and transport area); or if scenario analyses or findings are available that allow a more well-founded expert assessment of future development than a pure trend update can provide (e.g. emissions of air pollutants). This may be due, for example, to the fact that measures have been initiated that will take effect in the future (e.g., air pollution control measures). Reference is then made to this in the assessment texts. Expert assessments were carried out for the four examples mentioned here.

Rating	Explanatory note
	If the trend continues, or according to expert assessment, green indicates that at least 95 % of the target will be achieved for quantitative indicators. For indicators that are expected to continue in a certain direction, green indicates that this development has taken place both in the long term and in recent years.
	If the trend continues or according to expert assessment, the target will be moderately missed (target achievement 80 % - 95 %). In the case of indicators that are supposed to move in a certain direction, yellow indicates that the development has not taken place as desired over a longer period of time, but has been moving in the desired direction in recent years.
	If the trend continues or according to expert assessment, the target will be missed by a wide margin (target achievement 30 % - 80 %). In the case of indicators that are supposed to move in a certain direction, orange indicates that although the development has been as desired over a longer period of time, it has no longer been moving in the desired direction in recent years.
	If the trend continues or according to expert assessment, the target cannot be achieved, and the distance to the target may even increase (target achievement lower than 30 %). In the case of indicators that are supposed to move in a certain direction, red indicates that the indicator shows a contrary development both in the long term and in recent years.

The Environmental Indicators and the 2030 Sustainable Development Goals

The table shows the allocation of the Environmental Monitor Indicators to the Sustainable Development Goals (SDGs) of the 2030 Agenda. An overview of all sustainability indicators of Germany and the United Nations (UN) can be found on the SDG platform of the Federal Statistical Office at: https://sdg-indikatoren.de/en/.

SDG	Indicators of the Environmental Monitor
	Organic Farming Agricultural nitrogen surplus
	Emission of air pollutants Population exposure to particulate matter pollution Air quality in agglomerations
	Nitrate in groundwater Ecological status of rivers
	Final energy productivity Renewable energy Primary energy consumption
	Total raw material productivity National Welfare Index Environmental costs of energy and road transport

SDG	Indicators of the Environmental Monitor
	Employment in the renewable energy sector
	Final energy consumption of transport Land-take for settlements and transport infrastructure Environmentally friendly passenger transport
	Amount of waste - municipal waste Global environmental footprint of consumption Raw material consumption Environmentally friendly consumption Environmental management
	Greenhouse gas emissions Global surface temperatures Hot days
	Plastic waste in the North Sea
	Species diversity and landscape quality Nitrogen eutrophication Grasslands

Annex

Bibliography

Updated for all internet sources: March 2021

Achtziger, R; Stickroth, H; Zieschank, R, (2004): Nachhaltigkeitsindikator für die Artenvielfalt. Ein Indikator für den Zustand von Natur und Landschaft. Angewandte Landschaftsökologie 63.

AGEB – Arbeitsgemeinschaft Energiebilanzen e.V. (**o. J.**): Erläuterungen zu den Energiebilanzen. https://ag-energiebilanzen.de/index.php?article_id=34&clang=0

Bach, M., Godlinski, F., Greef, J. (2011): Handbuch Berechnung der Stickstoff-Bilanz für die Landwirtschaft in Deutschland Jahre 1990 – 2008. Berichte aus dem Julius-Kühn-Institut 159. Download at: http://ojs.openagrar.de/index.php/BerichteJKI/article/download/1425/1756

BfN – Federal Agency for Nature Conservation (**2014**): Grünland-Report – Alles im Grünen Bereich? Download at: https://www.bfn.de/fileadmin/MDB/documents/presse/2014/PK_Gruenlandpapier_30.06.2014_final_layout_barrierefrei.pdf

BMEL – Federal Ministry of Food and Agriculture (**2020**): Statistischer Monatsbericht – Nährstoffbilanzen. Download at: https://www.bmel-statistik.de/fileadmin/daten/MBT-0111260-0000.xlsx

BMU – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (**2007)**: National Strategy on Biological Diversity, 3rd edition. Download at: https://biologischevielfalt.bfn.de/fileadmin/NBS/documents/Veroeffentlichungen/BMU_Natio_Strategie_en_bf.pdf

BMU – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (**2013**): Waste Protection Programme – of the German Government with the Involvement of the Federal Länder.Download at: https://www.bmu.de/en/publication/waste-prevention-programme-of-the-german-government-with-the-involvement-of-the-federal-laender/

BMU – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (**2020**): Deutsches Ressourceneffizienzprogramm III 2020 – 2023 - Programm zur nachhaltigen Nutzung und zum Schutz der natürlichen Ressourcen. Download at: https://www.bmu.de/download/deutsches-ressourceneffizienzprogramm-progress-iii/

BMU, BMVBS – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and Federal Ministry of Transport, Building and Urban Development (**2006**): Bekanntmachung der Vorläufigen Berechnungsverfahren für den Umgebungslärm nach § 5 Abs. 1 der Verordnung über die Lärmkartierung (34. BImSchV). In: Bundesanzeiger 58 (154a), 17. August 2006. Download at: http://www.umweltbundesamt.de/sites/default/files/medien/1/dokumente/bundesanzeiger_154a.pdf

BMU, BMVBS – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and Federal Ministry of Transport, Building and Urban Development (**2007**): Vorläufige Berechnungsmethode zur Ermittlung der Belastetenzahlen durch Umgebungslärm (VBEB) vom 9. Februar 2007. Nicht amtliche Fassung der Bekanntmachung im Bundesanzeiger Nr. 75 vom 20. April 2007. Download at: http://www.umweltbundesamt.de/sites/default/files/medien/pdfs/VBEB.pdf

BMU, BMVI – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and Federal Ministry of Transport and Digital Infrastructure **(2018):** Bundesanzeiger - Bekanntmachung - veröffentlicht am Freitag, 28. Dezember 2018 (BAnz AT 28.12.2018 B7). Bekanntmachung der Berechnungsverfahren für den Umgebungslärm nach § 5 Absatz 1 der Verordnung über die Lärmkartierung (34. BImSchV). Download at: https://www.bundesanzeiger.de/pub/publication/1FbcVABJ3TpUTOMTiS1/content/1FbcVABJ3TpUTOMTiS1/BAnz%20AT%2028.12.2018%20B7.pdf?inline

BMUB – Federal Ministry for the Environment, Nature Conservation, Housing and Reactor Safety (**2014**): Aktionsprogramm Klimaschutz 2020. Kabinettsbeschluss vom 3. Dezember 2014.

BMUB – Federal Ministry for the Environment, Nature Conservation, Housing and Reactor Safety (**2015a):** Indicator Report 2014 on the National Strategy on Biological Diversity. Download in German at: https://biologischevielfalt.bfn.de/fileadmin/NBS/documents/Veroeffentlichungen/indikatorenbericht_biologische_vielfalt_2014_bf.pdf

BMUB – Federal Ministry for the Environment, Nature Conservation, Housing and Reactor Safety (**2015b):** Naturschutz-Offensive 2020. Für biologische Vielfalt! Download at: https://biologischevielfalt.bfn.de/fileadmin/NBS/documents/Nationale_Foren/7._Nationales_Forum/Naturschutz_Offensive_2020_bf.pdf

BMUB – Federal Ministry for the Environment, Nature Conservation, Housing and Reactor Safety (**2016a):** Shaping Ecological Transformation Integrated Environmental Programme 2030. Download at: https://www.bmu.de/fileadmin/Daten_BMU/Pools/Broschueren/integriertes_umweltprogramm_2030_en_bf.pdf

BMUB – Federal Ministry for the Environment, Nature Conservation, Housing and Reactor Safety (**2016b**): Climate Action Plan 2050. Principles and goals of the German government's climate policy. Download at: https://www.bmu.de/en/publication/climate-action-plan-2050/

BMVBS – Bundesministerium für Verkehr, Bau und Stadtentwicklung (**2009**): Nationales Verkehrslärmschutzpaket II. Lärm vermeiden – vor Lärm schützen. https://www.bmvi.de/SharedDocs/DE/Anlage/StB/nationales-verkehrslaermschutzpaketII.pdf?__blob=publicationFile

BMVBS – Federal Ministry of Transport, Building and Urban Development (**2012**): Nationaler Radverkehrsplan 2020. Den Radverkehr gemeinsam weiterentwickeln. Download at: https://www.bmvi.de/SharedDocs/DE/Publikationen/StV/nationaler-radverkehrsplan-2020.pdf?__blob=publicationFile

BMVI – Federal Ministry of Transport and Digital Infrastructure(**2018**): Mobilität in Deutschland. Download at: http://www.mobilitaet-in-deutschland.de/publikationen2017.html

BMVI – Federal Ministry of Transport and Digital Infrastructure(**2020**): Verkehr in Zahlen 2020/2021. 49. Jahrgang. Download at: https://www.bmvi.de/SharedDocs/DE/Publikationen/G/verkehr-in-zahlen-2020-pdf.pdf?__blob=publicationFile

BMVI – Federal Ministry of Transport and Digital Infrastructure(**2021):** Nationaler Radverkehrsplan 3.0. https://www.bmvi.de/SharedDocs/DE/Artikel/StV/Radverkehr/nationaler-radverkehrsplan-3-0.html

BMWi – Federal Ministry for Economic Affairs and Energy (**2014**): Making more out of energy. National Action Plan on Energy Efficiency. Download at: https://www.bmwi.de/Redaktion/EN/Publikationen/nape-national-action-plan-on-energy-efficiency.pdf?__blob=publicationFile&v=1

BMWi, BMU – Federal Ministry for Economic Affairs and Energy, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (**2010**): Energiekonzept für eine umweltschonende, zuverlässige und bezahlbare Energieversorgung. 28. September 2010. Download at: https://www.bmwi.de/Redaktion/DE/Downloads/E/energiekonzept-2010.pdf?__blob=publicationFile&v=5

BReg – Federal Government (**2008**): German Strategy for Adaption to Climate Change. Download at: https://www.preventionweb.net/files/27772_dasgesamtenbf1-63.pdf

BReg – Federal Government (2016): German Sustainable Development Strategy. New Version 2016. Download at: https://www.bundesregierung.de/resource/blob/997532/188836/7d1716e5d5576bec62c9d16ca908e80e/2017-06-20-nachhaltigkeit-neuauflage-engl-data.pdf?download=1

BReg – Federal Government (**2019a**): Climate Action Programme 2030 by the Federal Government to implement the Climate Action Plan 2050. Download in German at: https://www.bundesregierung.de/resource/blob/975226/1679914/e01d6bd855f09bf05cf7498e06d0a3ff/2019-10-09-klima-massnahmen-data.pdf?download=1

BReg – Federal Government (**2019b**): Nationales Luftreinhalteprogramm der Bundesrepublik Deutschland. Download at: https://www.umweltbundesamt.de/sites/default/files/medien/1410/dokumente/luftreinhalteprogramm_bericht_bf.pdf

BReg – Federal Government (**2019c**): Energieeffizienzstrategie 2050. Download at: https://www.bmwi.de/Redaktion/DE/Publikationen/Energie/energieeffiezienzstrategie-2050.pdf?__blob=publicationFile&v=12

BReg – Federal Government (**2021):** Deutsche Nachhaltigkeitsstrategie. Weiterentwicklung 2021. Download at: https://www.bundesregierung.de/resource/blob/998006/1873516/3d3b15cd92d0261e7a0bcdc8f43b7839/2021-03-10-dns-2021-finale-langfassung-nicht-barrierefrei-data.pdf?download=1

Case C-543/16: InfoCuria Case law. Judgment oft he Court (Ninth Chamber) of 21 June 2018. https://curia.europa.eu/juris/liste.jsf?num=C-543/16

COM/2011/0571 – European Commission: Roadmap to a Resource Efficient Europe Download at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2011%3A0571%3AFIN

Destatis – Federal Statistical Office **(n.d.):** Volkswirtschaftliche Gesamtrechnungen, Inlandsprodukt. https://www.destatis.de/DE/Themen/Wirtschaft/Volkswirtschaftliche-Gesamtrechnungen-Inlandsprodukt/_inhalt.html

Destatis – Federal Statistical Office (**2019a):** Bodenfläche nach Art der tatsächlichen Nutzung - Fachserie 3 Reihe 5.1 – 2018. Download at: https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Landwirtschaft-Forstwirtschaft-Fischerei/Flaechennutzung/Publikationen/Downloads-Flaechennutzung/bodenflaechennutzung-2030510187004.pdf

Destatis – Federal Statistical Office (**2019b**): Qualitätsbericht. Bodennutzungshaupterhebung. Download at: https://www.destatis.de/DE/Methoden/Qualitaet/Qualitaetsberichte/Land-Forstwirtschaft-Fischerei/bodennutzung.pdf?__blob=publicationFile

Destatis – Federal Statistical Office (**2020a**): Abfallbilanz – 2018. Download at: https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Umwelt/Abfallwirtschaft/Publikationen/Downloads-Abfallwirtschaft/abfallbilanz-pdf-5321001.pdf

Destatis – Federal Statistical Office (**2020b**): Umweltökonomische Gesamtrechnungen. Methode der Berechnungen zur globalen Umweltinanspruchnahme durch Produktion, Konsum und Importe. Download at: https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Umwelt/UGR/ueberblick/Publikationen/Downloads/ugr-globale-umweltinanspruchnahme-methode-5851102209004.pdf

Diefenbacher, H., Held, B., Rodenhäuser, D., Zieschank, R. (2016): Aktualisierung und methodische Überarbeitung des Nationalen Wohlfahrtsindex 2.0 für Deutschland 1991 bis 2012. Download at: http://www.umweltbundesamt.de/publikationen/aktualisierung-methodische-ueberarbeitung-des

DIHK – Deutscher Industrie- und Handelskammertag **(o. J.)**: Das EMAS-Register.

EC regulation 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS), repealing Regulation (EC) No 761/2001 and Commission Decisions 2001/681/EC and 2006/193/EC. Download at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32009R1221

EEA – European Environment Agency (**2014**): Technical report No 11/2014. Effects of air pollution on European ecosystems. Past and future exposure of European freshwater and terrestrial habitats to acidifying and eutrophying air pollutants. Download at: https://www.eea.europa.eu/publications/effects-of-air-pollution-on

EEG – Erneuerbare-Energien-Gesetz **2021**, zuletzt geändert durch Artikel 1 des Gesetzes vom 21.12.2020 (BGBl. I S. 3138) geändert. Download at: https://www.gesetze-im-internet.de/eeg_2014/EEG_2021.pdf

EU Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources. Download at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31991L0676

EU Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. Download at: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1537185040879&uri=CELEX%3A32000L0060

EU Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. Download at:https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0050

EU Directive 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive

2001/81/EC. Download at: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1542011736987&uri=CELEX%3A32016L2284

Guse, N., Weiel, S., Markones, N., Garthe, S. (2012): OSPAR Fulmar Litter EcoQO – Masse von Plastikmüllteilen in Eissturmvogelmägen. Endbericht für das Bundesamt für Naturschutz. Download at: http://www.bfn.de/fileadmin/MDB/documents/themen/meeresundkuestenschutz/downloads/Berichte-und-Positionspapiere/Fulmar_EcoQO_Bericht_2010_BfN_deutsch_Feb2012.pdf

Häußermann, U., Martin Bach, M, Klement, L., Breuer, L. (2019): Stickstoff-Flächenbilanzen für Deutschland mit Regionalgliederung Bundesländer und Kreise – Jahre 1995 bis 2017 - Methodik, Ergebnisse und Minderungsmaßnahmen. German Environment Agency (ed.). Download at: https://www.umweltbundesamt.de/publikationen/stickstoff-flaechenbilanzen-fuer-deutschland

Held, B., Rodenhäuser D., Diefenbacher, H. (2020): NWI 2020 – Auswirkungen der Corona-Pandemie auf die Wohlfahrt. IMK (ed.), Düsseldorf. Download at: https://www.boeckler.de/pdf/p_imk_pb_96_2020.pdf

Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T.R., Perryman, M., Andrady, A., Narayan, R., Lavender Law, K. (2015): Plastic waste inputs from land into the ocean. SCIENCE 2015, Vol. 347, S. 768–771.

Kallweit, D., Wintermeyer, D. (**2013**): Berechnung der gesundheitlichen Belastung der Bevölkerung in Deutschland durch Feinstaub (PM10). In: UMID 2013 (4), S. 18 – 24. Download at: https://www.umweltbundesamt.de/sites/default/files/medien/360/publikationen/berechnung_belastung_feinstaub_dtl_s_18-24.pdf

KrWG (2012): Gesetz zur Förderung der Kreislaufwirtschaft und Sicherung der umweltverträglichen Bewirtschaftung von Abfällen (Kreislaufwirtschaftsgesetz) vom 24. Februar 2012 (BGBl. I S. 212), zuletzt geändert durch Artikel 1 des Gesetzes vom 27. März 2017 (BGBl. I S. 567). http://www.gesetze-im-internet.de/krwg/

Morice, C., Kennedy, J., Rayner, N; Winn, J., Hogan, E., Killick, R., Dunn, R., Osborn, T., Jones, P., Simpson, I. (2021): An updated assessment of near-surface temperature change from 1850: the 2 HadCRUT5 dataset. Confidential manuscript submitted to: Journal of Geophysical Research: Atmospheres. Download at: https://www.metoffice.gov.uk/hadobs/hadcrut5/HadCRUT5_accepted.pdf

Müller-Westermeier, G. (1995): Numerisches Verfahren zur Erstellung klimatologischer Karten. Berichte des Deutschen Wetterdienstes 193. Download at: https://www.dwd.de/DE/leistungen/pbfb_verlag_berichte/pdf_einzelbaende/193_pdf.pdf;jsessionid=1331F222EC710750EA2B1C7DFCB120C3.live31084?__blob=publicationFile&v=3

O'Sullivan, M., Edler, D. und Lehr, U. (2019): Ökonomische Indikatoren der Energiebereitstellung: Methode, Abgrenzung und Ergebnisse für den Zeitraum 2000-2017. Studie im Auftrag des Bundesministeriums für Wirtschaft und Energie. DIW (ed.), Politikberatung kompakt 135, VIII. Download at: https://www.bmwi.de/Redaktion/DE/Publikationen/Studien/oekonomische-indikatoren-der-energiebereitstellung.html

Oehlmann, M., Linsenmeier, M., Kahlenborn, W., Lehr, U., Flaute, M., Büchele, R., Andrä, P. (2019): Economic Opportunities of Climate Action, German Environment Agency (ed.). Download at: https://www.umweltbundesamt.de/en/publikationen/economic-opportunities-of-climate-action

OGewV (2016): Surface Waters Ordinance (Oberflächengewässerverordnung vom 20. Juni 2016, BGBl. I S. 1373). http://www.gesetze-im-internet.de/ogewv_2016/

OSPAR Commission (2014): Action Plan for Marine Litter. http://www.ospar.org/work-areas/eiha/marine-litter/regional-action-plan

Stern, N. (2006): Stern Review Report on the Economics of Climate Change. Download at: https://webarchive.nationalarchives.gov.uk/20100407172811/http://www.hm-treasury.gov.uk/stern_review_report.htm

TrinkwV (2001): Verordnung über die Qualität von Wasser für den menschlichen Gebrauch. http://www.gesetze-im-internet.de/trinkwv_2001/

UBA – German Environment Agency (**2014**): Modellierung und Kartierung atmosphärischer Stoffeinträge und kritischer Belastungs-schwellen zur kontinuierlichen Bewertung der ökosystem-spezifischen Gefährdung der Biodiversität in Deutschland – PINETI (Pollutant INput and EcosysTem Impact). Teil 4. Teilbericht 4 Critical Loads, Exceedance und Belastungsbewertung. Download at: https://www.umweltbundesamt.de/publikationen/modellierung-kartierung-atmosphaerischer-1

UBA – German Environment Agency (**2015a**): Reactive nitrogen in Germany. Causes and effects – measures and recommendations. Download at: https://www.umweltbundesamt.de/publikationen/reactive-nitrogen-in-germany

UBA – German Environment Agency (**2015b**): Marktbeobachtung Nachhaltiger Konsum: Entwicklung eines Instrumentes zur Langzeit-Erfassung von Marktanteilen, Trends und Treibern nachhaltigen Konsums. Download at: https://www.umweltbundesamt.de/publikationen/marktbeobachtung-nachhaltiger-konsum-entwicklung

UBA – German Environment Agency (**2016**): Rohstoffe für Deutschland. Bedarfsanalyse für Konsum, Investition und Export auf Makro- und Mesoebene. Download at: https://www.umweltbundesamt.de/publikationen/rohstoffe-fuer-deutschland

UBA – German Environment Agency (**2018**): Methodenkonvention 3.0 zur Ermittlung von Umweltkosten –Methodische Grundlagen. Download at: https://www.umweltbundesamt.de/publikationen/methodenkonvention-30-zur-ermittlung-von-0

UBA – German Environment Agency (**2019a):** Air Quality 2018. Preliminary Evaluation. Download at: https://www.umweltbundesamt.de/en/publikationen/air-quality-2018

UBA – German Environment Agency (**2019b**): 2019 Monitoring Report on the German Strategy for Adaption to Climate Change. Download at: https://www.umweltbundesamt.de/publikationen/2019-monitoring-report

UBA – German Environment Agency (**2019c**): Erneuerbare Energien in Deutschland 2018. Download at: https://www.umweltbundesamt.de/publikationen/erneuerbare-energien-in-deutschland-2018

UBA – German Environment Agency (**2020a**): German Informative Inventory Report. https://iir-de.wikidot.com/

UBA – German Environment Agency (**2020b**): Methodenkonvention 3.1 zur Ermittlung von Umweltkosten – Kostensätze. Download at: https://www.umweltbundesamt.de/publikationen/methodenkonvention-umweltkosten

UBA – German Environment Agency (**2021,** yet unpublished): Submission under the United Nations Framework Convention on Climate Change and the Kyoto Protocol 2021.

UGA – Umweltgutachterausschuss beim Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit **(n.d.)**: EMAS Statistik.

UMID –Umwelt und Mensch – Informationsdienst **01/2016** (ed.): Die körperlichen und psychischen Wirkungen von Lärm. Von Jördis Wothge, S. 38–43.Download at: https://www.umweltbundesamt.de/publikationen/umid-012016

UNECE – United Nations Economic Commission for Europe **(2012):** Amendments to the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone. Download at: http://www.unece.org/fileadmin/DAM/env/documents/2013/air/ECE_EB.AIR_111_Add.1__ENG_DECISION_1.pdf and http://www.unece.org/fileadmin/DAM/env/documents/2013/air/ECE_EB.AIR_111_Add.1__ENG_DECISION_2.pdf

UNFCCC – United Nations Framework Convention on Climate Change (**2015**): The Paris Agreement. Download at: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

Wahl, J., R. Dröschmeister, B. Gerlach, C. Grüneberg, T. Langgemach, S. Trautmann & C. Sudfeldt (2015): Vögel in Deutschland – 2014. DDA, BfN, LAG VSW, Münster. Download at: https://www.dda-web.de/downloads/texts/publications/statusreport2014_ebook.pdf

WHO – World Health Organization (**2006**): Air quality guidelines. Global update 2005. Particulate matter, ozone, nitrogen dioxide and sulfur dioxide. Download at: http://www.euro.who.int/__data/assets/pdf_file/0005/78638/E90038.pdf

WHO – World Health Organization (**2013**): Health risks of air pollution in Europe – HRAPIE project. Recommendations for concentration–response functions for cost–benefit analysis of particulate matter, ozone and nitrogen dioxide. Download at: http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/publications/2013/health-risks-of-air-pollution-in-europe-hrapie-project.-recommendations-for-concentrationresponse-functions-for-costbenefit-analysis-of-particulate-matter,-ozone-and-nitrogen-dioxide

List of abbreviations

%	percent
AGEB	Arbeitsgemeinschaft Energiebilanzen / Working Group on Energy Balances
AGEE-Stat	Arbeitsgruppe Erneuerbare Energien – Statistik / Working Group on Energy Balan-ces – Statistics
BfN	Bundesamt für Naturschutz – Federal Agency for Nature Conservation
BImSchG	Bundes-Immissionsschutzgesetz – Federal Immission Control Act
GDP	gross domestic product
BMEL	Bundesministerium für Ernährung und Landwirtschaft – Federal Ministry of Food and Agriculture
BMU	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit – Federal Mi-nistry for the Environment, Nature Conservation and Nuclear Safety
BMUB	Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit – Federal Ministry for the Environment, Nature Conservation, Housing and Reactor Safety
BMVBS	Bundesministerium für Verkehr, Bau und Stadtentwicklung – Federal Ministry for Transport, Construction and Urban Development
BMVI	Bundesministerium für Verkehr und digitale Infrastruktur – Federal Ministry of Transport and Digital Infrasrtucture
BMWi	Bundesministerium für Wirtschaft und Energie – Federal Ministry for Economic Affairs and Energy
°C	degree Celsius
CO_2	carbon dioxide
db(A)	decibel
Destatis	Statistisches Bundesamt – Federal Statistical Office
DIHK	Deutscher Industrie- und Handelskammertag – Association of German Chambers of Industry and Commerce
DIW	Deutsches Institut für Wirtschaftsforschung – German Institute for Economic Research
DWD	Deutscher Wetterdienst – National Meterological Service Germany
EEG	Erneuerbare-Energien-Gesetz – Renewable Energies Act
EC	European Community
EMAS	Eco-Management and Audit Scheme
et al.	et alia (and others)
EU	European Union
EEA	European Environment Agency
FEST	Forschungsstätte der Europäischen Studiengemeinschaft - Research Institute of the Protestant Study Community
ha	hectare
HELCOM	Helsinki Commission (Helsinki-Kommission zum Schutz der Meeresumwelt im Ost-seeraum)
ifeu	Institut für Energie und Umwelt – Institute for Energy and Environmental Research

IMT	individual motorized transport
ISO	International Organization for Standardization
kg	kilogram
km	kilometer
km²	square kilometer
KrWG	Kreislaufwirtschaftsgesetz – Closed Substance Cycle Waste Management Act
LAWA	Länderarbeitsgemeinschaft Wasser – German Working Group on water issues of the Federal States and the Federal Government
m³	cubic meter
max.	maximum
mg/l	milligrams per litre
min.	minimal
µg	microgram
µg/m³	microgram per cubic meter
µm	micrometer
n. d.	no date
NEC	National Emission Ceiling Directive
NH_3	Ammonia
NMVOC	Volatile organic compounds without methane
NO_x	nitrogen oxides
NO_2	nitrogen dioxide
NWI	National Welfare Index
O_3	Ozone
OGewV	Oberflächengewässerverordnung – Surface Water Ordinance
OSPAR	Oslo-Paris Convention
PJ	petajoule
PM10	Particulate Matter 10
PM2.5	Particulate Matter 2.5
RMC	Raw Material Consumption
RMI	Raw Material Input
SDG	Sustainable Development Goal
SO_2	sulfur dioxide
t	tonne
TREMOD	Transport Emission Model
TWh	Terawatt hour
UBA	Umweltbundesamt – German Environment Agency

UGA	Umweltgutachterausschuss – German EMAS Advisory Board
UN	United Nations (Vereinte Nationen)
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
WHO	World Health Organization

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