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TEST OF THE OECD SET OF GREEN GROWTH INDICATORS IN GERMANY

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Contents

1 Numbers of the OECD indicators are given in brackets.

Contents

List of abbreviations

General

CDM	=	Clean Development Mechanism
Corine LC	=	Corine Land Cover
DEHSt	=	German Emission Trading Authority
DGINS	=	Directors General of the National Statistical Institutes
DIW	=	German Institute for Economic Research
DMC	=	Domestic Material Consumption
EGS	=	Environmental Goods and Services
ESS	=	European Statistical System
EU	=	European Union
GDP	=	Gross Domestic Product
GVA	=	Gross Value Added
ODA	=	Official Development Assistance
OECD	=	Organisation for Economic Co-operation and Development
PM	=	Particulate Matter
R&D	=	Research and development
RUMEA	=	Resource use and management accounts
TPES	=	Total primary energy supply
UBA	=	Federal Environmental Agency
UNCED	=	United Nations Conference on Environment and Development
UNEP	=	United Nations Environment Program

List of abbreviations

Chemical compounds

CH_4	=	Methane
CO_2	=	Carbon dioxide
PFCs	=	Perfluorocarbons
HFCs	=	Hydrofluorocarbons
NMVOC	=	Non-methane volatile organic compounds
NO	=	nitrogen monoxide
NO_x	=	Nitric oxides (= nitrous oxide + nitrogen monoxide)
N_2O	=	Nitrous oxide (= laughing gas)
PM10	=	Particulate matter 10 µg
SF_6	=	Sulphur hexafluoride

Measures

EUR	=	Euro	
ha	=	hectare	(1 ha = 10,000 m^2)
kg	=	kilogram	
MJ	=	megajoule	(1 MJ = 10^6 J)
mn	=	million	
bn	=	billion	
µg	=	microgram	
m^3	=	cubic metre	
m^2	=	square metre	
PJ	=	petajoule	(1 PJ = 10^{15} J)
%	=	percent	

Introduction and results

Introduction

Economic growth is often considered to be a necessary requirement for well-being and quality of life. However, this economic growth is to take place in an orderly fashion so that it does not threaten its own foundations, endangering prosperity and quality of life, instead of promoting them.

The Brundtland Report (World Commission on Environment and Development 1987)[1] introduced the concept of sustainable development and it became a subject for international debate at the first Rio Conference and the Rio Convention (UNCED 1992)[2]. This concept of sustainability aims to achieve orderly development in all sectors of the economy, the environment and society and covers several aspects in terms of subject, timescale and location. It deals with:

- safeguarding the welfare of the present generation;
- creating intergeneration equity in the future by not endangering the welfare of future generations through the behaviour of the current generation; and
- applying these principles not only in one's own country but also taking account of the effects of national activity on other regions in the world.

In the meantime the sustainability aspect has become a policy guideline in many countries. It is reflected in international, supranational and national sustainability strategies. At the level of the European Union a new EU Sustainable Development Strategy was adopted in 2006[3] and in Germany – as in many other European countries – the national sustainability strategy (Federal Government 2002) is updated on a regular basis (Federal Government 2012)[4]. The sustainability strategies are characterised by the fact that they consider social development not only for certain aspects in isolation but overall. The state of the economy together with the environment and social development and all the areas where these aspects intersect are examined.

After the failure of important climate negotiations following the Kyoto Convention and more recently since the follow-up Rio+20 Conference in June 2012 it has become clear that the theoretical concepts of sustainable development have not yet been implemented sufficiently in practical policies. At the same time the importance of the individual sustainability issues has currently shifted in the international discussion. At EU level Europe 2020, the European Union's ten-year strategy for stability, growth and jobs for the period from 2010 to 2020 (European Commission 2010)[5] only considers sustainability to be one of several growth aspects. The aim is "to deliver a smart, sustainable and inclusive Europe" in order to overcome the structural weaknesses of the European economy and to promote its competitiveness and increase productivity. At the same time the EU Sustainable Development Strategy is currently not being updated, although monitoring is taking place through indicators. A shift of emphasis to the aspect of economic development can also be observed at the United Nations with

1 World Commission on Environment and Development (1987): "Our Common Future", also known as the Brundtland Report.
2 UNCED (1992): Agenda 21 – a programme of action in the field of development and environment for transition to sustainability in the 21st century.
3 Council of the European Union (2006): Renewed EU Sustainable Development Strategy.
4 Federal Government (2012): National Sustainability Strategy, Progress Report.
5 Commission Communication, Europe 2020 – A strategy for smart, sustainable and inclusive growth, COM (2010)2020.

the concept of the “Green economy“(UNEP 2012)[6] and at the OECD with its very similar concept of “Green Growth“(OECD 2011)[7].

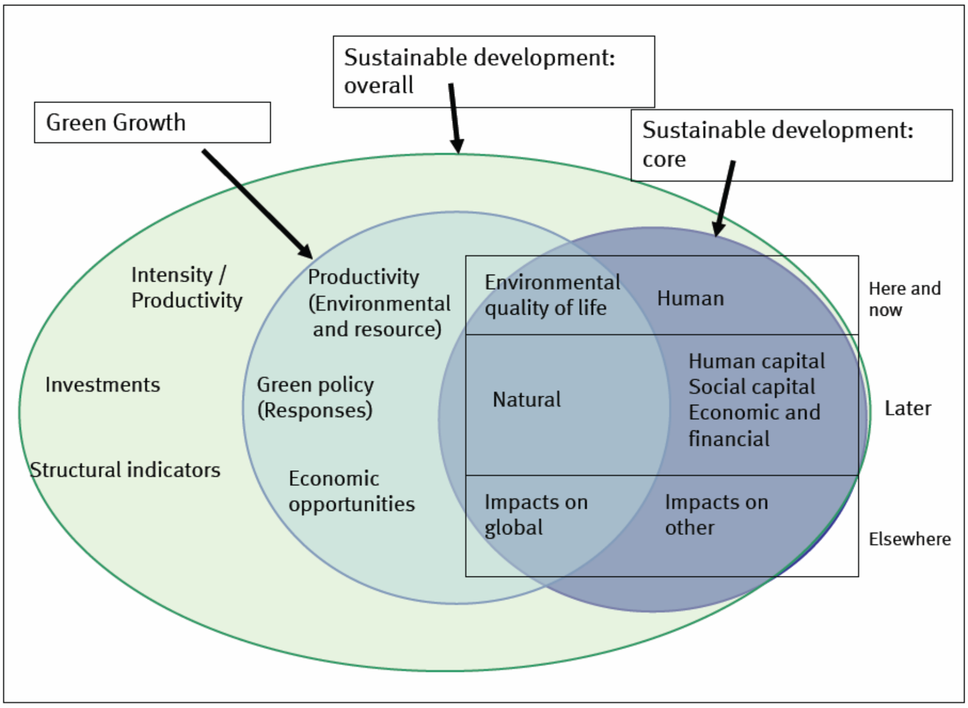
Green Growth

The OECD’s Green Growth initiative started in 2009 in order to dampen the consequences of the worldwide economic crisis in 2008/2009 and to foster economic growth after the global economic slump. Ministers from 34 countries signed a Declaration on Green Growth with the aim to “strengthen [their] efforts to pursue green growth strategies as part of [their] response to the current crisis and beyond, acknowledging that “green” and “growth” can go hand-in-hand. “[8] They granted a mandate to the OECD to develop a strategy for green growth combining the economic, environmental, social, technological and development-specific aspects into a framework concept (OECD 2012a). The publication “Towards Green Growth – Monitoring Progress: OECD Indicators” (OECD 2011a) sums up the results of the previous work. According to the definition of the OECD green growth means fostering economic growth and development while ensuring that natural assets continue to provide the resources and ecosystem services on which our well-being relies. To do this it must catalyse investment and innovation which will underpin sustained growth and give rise to new economic opportunities.” (OECD 2012, page 4).The OECD has stated that sustainability should continue to be the main concept of the Green Growth strategy: “Green growth is not a replacement for sustainable development. Rather, it provides a practical and flexible approach for achieving concrete, measurable progress across its economic and environmental pillars, while taking full account of the social consequences of greening the growth dynamic of economies. The focus of green growth strategies is ensuring that natural assets can deliver their full economic potential on a sustainable basis” (OECD 2012 a, page 6).

The core concepts of sustainability and Green Growth go hand in hand with their aim of maintaining the natural asset base for the future, safeguarding quality of life in relation to the environment and wishing to incorporate global aspects, in other words the global effect on the natural asset base (cf. Figure. 1 in accordance with v. d. Veen et al.). However, the sustainability concept overall goes beyond the environmental aspects and considers quality of life in every respect and in addition to the natural asset base also all the other forms of capital (i.e. human, social or economic capital) as well as the global effects on these forms of capital. In a broader sense, both concepts cover indicators on productivities, investments and structural indicators, but for Green Growth with the focus on the environment.

6 Cf. UNEP (United Nations Environment Programme) (2012): Measuring Progress towards a Green Economy.
7 Cf. OECD (2006): Towards Green Growth. Monitoring Progress: OECD Indicators, OECD Publishing.
8 Quote from the Declaration on Green Growth, adopted at the Meeting of the OECD Council at Ministerial Level on 25 June 2009; in accordance with OECD 2012, Towards Green Growth, A summary for policy makers, May 2012.

Figure 1: Simplified description of the relationship between green growth and sustainable development (in accordance with van der Veen, Schenau and Balde, 2012)[9]



The focus on economy and environment means that the Green Growth Strategy does not consider the social aspect of a comprehensive sustainability approach to a large extent. At the same time the Green Growth Strategy has fewer features of a long-term strategy compared with the sustainability concept, and should be regarded more as a short-term political framework for actual instruments and recommendations. It is intended to help promote the move towards greater sustainability.

The Green Growth Strategy was part of the OECD contribution to the Rio+20 Conference in June 2012. The Final Report (UN 2012)[10] of the Rio+20 Conference refers to the green economy, which is a strategy of UNEP closely related to the Green Growth Strategy with a stronger focus on social aspects, as one of many possible approaches to achieve sustainable development and as one of the important tools available for achieving sustainable development (cf. UN 2012, page 10). The Green Economy concept found broad political support, among others from the German Government.[11] The European Statistical System defined its position on the political concept of the

9 Van der Veen, G. and S. Schenau, K. Balde (2012): Monitoring Green Growth in the Netherlands – Best practices for a broader international scale. Template for DGINS, 2012.

10 UN (2012): Rio+20, United Nations Conference on Sustainable Development. Outcome of the Conference. Rio de Janeiro, 20-22 June 2012. A/Conf.216/L.1.

11 “We regard Green Economy as a concept combining the environment and the economy positively to increase social well-being. As part of this, growth is structured in an environmentally acceptable manner. However, it also emphasises the importance of the social dimension: „On the path towards a Green Economy social aspects and the consequences of the change and association with other political fields such as education, research and development cooperation must also be taken into consideration.“ (BMU 2012, page 6).

Green Economy in the so-called Prague Memorandum[12] and emphasised the growing need for statistics in this field. The ESS refers to the cross-cutting nature of the domain of environmental statistics, environmental-economic accounts and sustainable development and recommends the use of existing data as well as close co-operation with other international organisations, such as the OECD with its similar approaches.

The OECD's Green Growth indicator set

The OECD's Green Growth Strategy (2011a) already has a provisional if also still incomplete set of indicators that are intended to be used to measure a corresponding development. These indicators are allocated to four Groups:

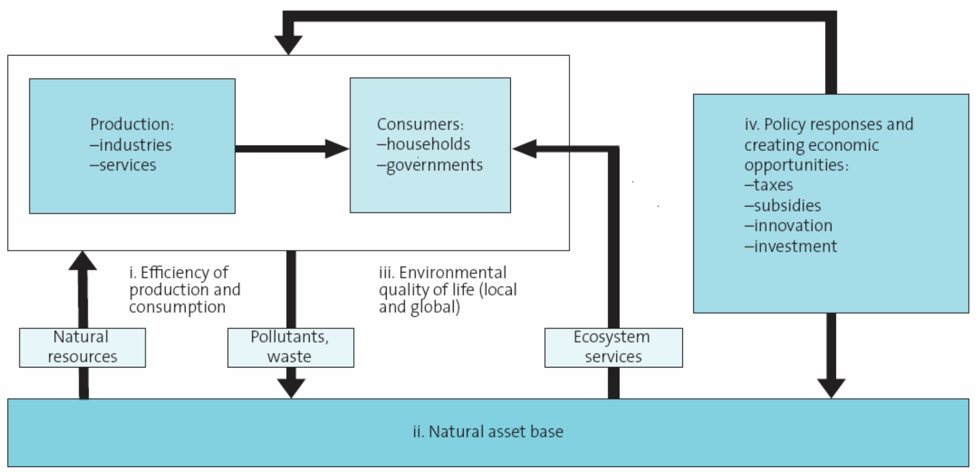
I Efficiency of production and consumption

II Natural asset base

III Environmental quality of life, local and global

IV Policy responses and creating economic opportunities

Figure 2: Overview of the Green Growth indicators



Source: Statistics Netherlands – CBS (2011): Green Growth in the Netherlands, The Hague 2011, page 13

Figure 2 shows how these four indicator groups are related and what conditions they are intended to map. The indicators in **Group I** on the efficiency of production and consumption form the cornerstone of the green growth indicator set. The indicators focus on the fact that economic activity is based on the exploitation of the environment either through the economic use of natural resources (such as energy, water or raw materials), or through the discharge of refuse and emissions back into the environment. It should be the aim of sustainable production and a sustainable economy to proceed carefully and efficiently in the use of environmental resources. "Efficiency" (synonymous with "productivity") is understood to mean economic output divided by the extent of environmental burden or use, e.g. gross domestic product divided by the use of natural resources. The more efficient the use of environmental

12 European Statistical System (ESS), Prague memorandum "Meeting new needs on statistics for green economy" on seminar II at the 2012 DGINS Conference, adopted by the ESSC on 26 September 2012 at the 14th ESSC Meeting.

resources, i.e. the fewer resources are required for a product, the larger is the amount of resources remaining for the future growth of the economy and therefore in general the lower the environmental burden caused by the use of resources.

However, efficiency indicators highlight only part of the problem. Efficiency can rise as desired, but so can the burden on the environment and the use of resources. This can for example be the case if production is moved abroad, but this is not included in national accounts or if economic growth is so strong that relative savings on the use of environmental resources as a whole still lead to an absolute increase in the use of resources. For this reason Group I also includes indicators that are intended to take account of the upstream activities for imports. Measurements that allow to prepare a kind of "footprint" of national economic activities or the consumption of environmental resources by the individual inhabitants of a country related to specific issues are suitable for this purpose. In other words global perspectives – and the global responsibility of countries – are taken into account and international comparison facilitated.

The indicators in **Group II** are intended to record the natural assets available and the change in the latter through economic use. Part of a green economy is to use natural assets only to the extent that their performance and regeneration capability remain intact. The indicators consider renewable natural assets (such as wood) and non-renewable stocks (such as fossil fuels).

The environmental situation is an important factor for the quality of life. Corresponding characteristics regarding the quality of life are included in indicator **Group III**. Health problems and risks caused by the environment (e.g. human exposure to air pollution) or ecosystem services, considered here as access to drinking water or waste water treatment are assessed.

Group IV includes indicators for new economic opportunities that open up from focusing on the conversion to a "green" economy. It considers fields such as research and development, patents and innovation or the production of environmental goods, environmental protection expenditure/investments, jobs in the environmental protection industry, trade in emission certificates, prices for energy and water. On the other hand, indicators regarding certain policies dealing with green growth such as corresponding legal regulations and how to train certain behaviour and develop certain skills in this field still need to be developed.

A detailed list of the indicators proposed to date by the OECD can be found in *Annex 1*.

In order to facilitate communication on the development of green growth, the OECD is also discussing a selection of **headline indicators** (cf. Figure 3) (OECD 2012b)[13]. These indicators are not specifically taken into account in this practical test for Germany. With the exception of the index for natural resources (No. 4 in Figure 3) these indicators are taken from the indicator set. According to the OECD, not all headline indicators can currently be measured.

13 OECD 2012b: Monitoring progress towards green growth: OECD Headline Indicators. Proposal by the Reflection Group on Green Growth Headline Indicators. Statistics Directorate /Committee on statistics STD/CSTAT(2012)11, 15.Oktober 2012.

Figure 3: Overview of the proposed headline indicators for the Green Growth Strategy

Group	Theme	Proposed headline indicator
Environmental and resource productivity	Carbon productivity	**1. CO_2 productivity**
	Resource productivity	**2. Non-energy material productivity**
	Multifactor productivity	**3. Multifactor productivity incl. environmental services**
The natural asset base	Renewable and non-renewable stocks	**4. Index of natural resource use**
	Biodiversity and ecosystems	**5. Changes in land use and cover**
Environmental quality of life	Environmental health and risks	**6. Air pollution (population exposure to PM 2.5)**
Economic opportunities and policy responses	Technology and innovation, environmental goods and services, prices and transfers, etc.	*Placeholder – no indicator specified*

Source: OECD 2012b

Actual implementation of the OECD indicators in the test for Germany and results

The OECD member countries were requested to test the indicator set in its current form in order to obtain an overview of its feasibility. The Federal Statistical Office in Germany has based its test on the 2011 version of the indicator set (OECD 2011a, 2011b). In doing so it preferably used data from official statistics, but also used some from other sources. The main aim was to test feasibility. It was a secondary consideration whether the data was up to date. The report therefore does not necessarily contain current data. The deadline for data was the middle of 2012. The selection of the indicators is closely geared towards the conceptual framework of the OECD. Should any details of the OECD indicator set have changed in the meantime and this was not taken into account here, this is regarded as acceptable for the test of basic feasibility.

Available data is used for the green growth indicators. Environmental-economic accounting is a central data source for the main question, in other words the relationship between the environment and the economy and the indication of efficiencies (economic growth in relation to the consumption and use of environmental resources). They are recommended by the OECD itself as a suitable data basis and established at EU level. The European Parliament and the Council adopted an EU regulation on European environmental economic accounts to be set up in all Member States in July 2011[14]. Data sets for initially three modules (air emission accounts, economy-wide material flow accounts and environmentally related taxes) shall serve to harmonise national environmental economic accounting and to create green accounts comparable throughout the EU. In a next step three additional modules shall be added (environmental protection expenditure, environmental goods and services sector, energy accounts). Additional modules shall follow as desired by MEPs (cf. Article 10 of the EU regulation). The internationally binding background for the structure of environmental-economic accounting is being drawn up by the United Nations Statistical Commission, which agreed an international standard for environmental-economic accounting in February 2012 after several years of preparatory work ("SEEA Central Framework"; European Commission/Food and Agriculture

14 Regulation (EU) No 691/2011 of the European Parliament and of the Council of 6 July 2011 on European environmental economic accounts. Official Journal of the European Union, L 192/1 of 22 July 2011.

Organisation/International Monetary Fund/Organisation for Economic Cooperation and Development OECD/United Nations UN/World Bank (2012)[15].

The test of the OECD Green Growth indicator set showed that a large share of the proposed indicators of the set can be implemented at national level in Germany (cf. *Overview 1* at the end of this Section). Results are submitted for 27 indicators. In principle attempts were made to be consistent with the definitions proposed by the OECD. However, this was not possible in every case. Occasionally the definitions had to be changed depending on the data situation or other conditions in order to be able to use an indicator.

16 indicators could be implemented for Germany completely or to a large extent in line with the OECD proposals, in the case of five others (No. 3.3, 16, 17, 19, 23) the definition used deviates from the proposals in the draft. The definitions used were partly more narrow and partly also broader than those of the OECD, but nevertheless appeared appropriate to us. For indicator 3.3 Nutrient flows and balances, for example, only the nitrogen surpluses were considered, but not phosphorous owing to a lack of data. Indicator 16 (on public R&D expenditure) focuses on public expenditure instead of public contributions for R&D and indicator 17 (on patents of importance to green growth) refers to patent applications filed for renewable energies instead of environment-related patents overall. Other differences occur in the field of production of environmental goods and services (Indicator 19), which is measured based on turnover instead of value added. Indicator 23 covers prices for drinking water but does not include cost recovery.

Indicators 6, 8 and 13 on the other hand deviate slightly more from the proposals. Instead of sustainably managed fish stocks, the occurrence, use and per-capita consumption of fish is shown (Indicator 8); ozone pollution (Indicator 13) is recorded using other limiting values owing to the data situation in Germany than those proposed in the OECD's indicator set. For Indicator 6 Freshwater resources on the one hand water resources are not shown. Although it would be possible to provide data on water quantities, quantity aspects are not relevant in Germany at national level. Instead, water use by economic activity was used as an indicator in the field of water resources. A new (additional) indicator is also proposed for forest resources (Indicator 7), namely the proportion of wood used from the usable growth.

The following indicators could not be provided as there was no data available in Germany or the quality did not appear sufficient:

- Multifactor productivity (no. 5)
- Mineral resources (no. 9)
- Soil resources (no. 11).

There was a conscious decision not to show economic framework conditions as part of this pilot study (growth, general productivities, jobs market, trade data etc.) This data is available in the economic statistics and does therefore not need to be “tested“. Furthermore, no trends in the indicators were calculated or presented. In contrast to the sustainability indicators of the national sustainability strategy, the OECD indicators do not include political targets, which means it is not possible to make the corresponding assessments related to the achievement of these targets.

15 European Commission/Food and Agriculture Organisation/International Monetary Fund/Organisation for Economic Cooperation and Development OECD/United Nations UN /World Bank (2012): System of Environmental Economic Accounting, Central Framework. White Cover Publication, pre-edited text.

In total 27 indicator sheets were drawn up, which show the status and development of the indicator with a diagram and brief description. The structure is based on the comparable publication of Statistics Netherlands 2011 and the indicator report under the German Sustainability Strategy[16].

In addition the relevant definitions were compiled to provide the necessary transparency for comparison purposes and follow-up work (cf. *Annex 2*).

Conclusion

In conclusion it may be asserted that out of the 23 Green Growth indicators (without sub-classifications) proposed by the OECD, it was not possible to implement three owing to the data situation or unclear definitions. The remaining ones are well-covered or could be replaced or supplemented by closely-related alternative suggestions.

16 Federal Statistical Office: Sustainable Development in Germany.

Overview 1: OECD Green Growth indicators and results of the test for Germany

Theme	Proposed subject (Number OECD indicator)	Proposed indicator (Numbers of OECD-indicators)	OECD example for implementation [17]	German examples / results of implementation (numbers of this report)	Adequacy	Reason for variation, comments
	Group I – Efficiency of production and consumption					
Carbon and energy productivity	**1** CO_2 productivity	**1.1** Production-based CO_2 productivity	Production-based CO_2 productivity: GDP per unit of energy-related CO_2 emitted	**1.1** CO_2 and green-house gas emissions and productivity (1990 = 100)	yes	Supplement: in addition to energy-related CO_2 also green-house gas emissions are presented (index)
		1.2 Demand-based CO_2 productivity	Production versus demand based CO_2 emissions (1995 versus 2005)	**1.2** Energy relatedCO_2 emissions depending on supply and use	yes	Includes methodological differences
				CO_2 emissions by private households (per capita)		Can be used as kind of „CO_2 footprint“
	2 Energy productivity	**2.1** Energy productivity: GDP per unit of TPES (Total primary energy supply)	Energy productivity: GDP per unit of TPES (Total primary energy supply)	**1.3** Energy productivity of primary energy consumption	yes	Indicator of the German national Sustainability Strategy

Theme	Proposed subject (Number OECD indicator)	Proposed indicator (Numbers of OECD-indicators)	OECD example for implementation	German examples / results of implementation (numbers of this report)	Adequacy	Reason for variation, comments
Carbon and energy productivity	**2** Energy productivity	**2.2** Energy intensity by sectors	Energy intensity (final consumption or by sectors: production, transport, households, services)	**1.4** Energy intensity by production sector 2009 versus 2000 (in %)	yes	Classification by production sectors
		2.3 Share of renewable energy in TPES (Total primary energy supply), in electricity production	Share of renewable energy in total energy supply	**1.5.1** Share of renewable energy in final energy consumption (in %)	yes	Indicator of the German national Sustainability Strategy; final energy consumption instead of primary energy supply
			Share of renewable energy in electricity production	**1.5.2** Share of renewable energy in electricity consumption	yes	Indicator of the German national Sustainability Strategy; consumption instead of supply
Resource productivity	**3** Material productivity	**3.1** Production based and demand based material productivity of non-energy materials	Domestic (non-energy) material productivity (GDP / DMC) – biotic materials – abiotic materials	**1.6** Material productivity (non-energy) (GDP / DMC)	yes	The indicator presented here differs from that used in the German sustainability strategy, which is based on abiotic direct material input (including energy).

Theme	Proposed subject (Number OECD indicator)	Proposed indicator (Numbers of OECD-indicators)	OECD example for implementation	German examples / results of implementation (numbers of this report)	Adequacy	Reason for variation, comments
Resource productivity	**3** Material productivity	**3.2** Waste generation intensities and„Recovery ratios“	Municipal waste per GDP, per value added or per capita	**1.7** Municipal waste per capita	yes	
		3.3 Nutrient flows and balances in agriculture (nitrogen, phosphorus) per agricultural land area and change in agricultural output	Nitrogen- and phosphorus surplus in kg/ha (three-year average)	**1.8** Nitrogen surplus in agricultural land area (1991 = 100)	yes	Presented as index to compare three different features.
			Change in nitrogen balance and agricultural outputs (2008 versus 1990, in % per year)	herbal biomass production and value added in agriculture (1991 = 100)	yes	No data on phosphorus available
	4 Water productivity	Value added per unit water consumed, by sector	--	**1.9** Water intensity by production sector (2007 versus 2000, in %)	yes	by production sectors
Multi-factor productivity	**5** Multi-factor productivity	--	--	--	--	Indicator is vague

Theme	Proposed subject (Number OECD indicator)	Proposed indicator (Numbers of OECD-indicators)	OECD example for implementation	German examples / results of implementation (numbers of this report)	Adequacy	Reason for variation, comments
	Group II – Natural asset base					
Renewable stocks	**6** Freshwater resources	Available renewable resources (groundwater, surface water) and abstraction rates	Freshwater resources per head	Freshwater resources, total and per head (here: background information)	Assessment available	Indicator is possible, but without national relevance, because quantity of the resource is unproblematic
		Freshwater consumption (Groundwater, surface water) per head	Water stress: consumption of available resources in %	Water stress: consumption of available resources in % (here: background information)	Would be possible	Indicator is possible, but without relevance, because quantity of the resource on a national level is unproblematic
			Water consumption per head		Would be possible	
				2.1 Water use by economic activity	supplement	Alternative indicator with supplementary information
	7 Forest resources	Area and volume of forests; stock changes over time	Share of forest area in total area of the country	**2.2.1** Share of forest area in total area of the country	yes	
			Forest area per head	**2.2.1** Forest area per head	yes	

Theme	Proposed subject (Number OECD indicator)	Proposed indicator (Numbers of OECD-indicators)	OECD example for implementation	German examples / results of implementation (numbers of this report)	Adequacy	Reason for variation, comments
Renewable stocks	**7** Forest resources		Standing timber in forests and other wooded land (volume over bark)	**2.2.1** Standing timber in forests (volume over bark)	yes	
				2.2.2 Share of wood extraction from usable growth, in %	supplement	Supplementary indicator related to the stress from using the resource
	8 Fish resources	Proportion of fish stocks within safe biological limits (global)	Fish stocks and fish production (global) by catches and aquaculture	**2.3** Supply, domestic use and per-capita-consumption of sea-water and freshwater animals	changed	Proposed indicator not feasable. Variation represents the pressure on the resource from a national perspective
Non-renewable resources	**9** Mineral resources	Stocks (global) or reserves of selected minerals: metallic minerals, industrial minerals, fossil fuels, critical raw materials; related extraction rates	--	--	no	No data

Theme	Proposed subject (Number OECD indicator)	Proposed indicator (Numbers of OECD-indicators)	OECD example for implementation	German examples / results of implementation (numbers of this report)	Adequacy	Reason for variation, comments
Biodiversity and ecosystems	**10** Land resources	Land cover types, conversions and cover changes	Land use: state and changes	**2.4** Land use changes (settlement and transport land, agricultural land, forests, Water area (2010 versus 1992), in %	yes	National data source; relates to the indicator „Increase in land use for housing and transport“ from the national strategy for sustainability
	11 Soil-resources	Degree of top soil losses on agricultural land, other land	--	--	--	No data
	12 Wildlife resources		Species threat status, in % species assessed or known		feasable	Indicator was not implemented
			Trends in farmland or forest bird population or in breeding bird populations	**2.5** Species diversity using breeding bird species as an example	yes	Application of the indicator on species diversity and landscape quality from the national strategy for sustainability

Theme	Proposed subject (Number OECD indicator)	Proposed indicator (Numbers of OECD-indicators)	OECD example for implementation	German examples / results of implementation (numbers of this report)	Adequacy	Reason for variation, comments
	Group III – Environmental quality of life					
Environmental health and risks	**13** Environmental induced health problems and -costs	**13** Population exposed to air (by ozone or by particulates)	Population weighted yearly sum of maximum daily 8-hour mean ozone concentrations above a threshold (70 microgram Ozone per m^3) at urban background stations in agglomerations)	**3.1** Hazard to human health by ozone (number of more than 25 days per year, at which a max. limit of 120 µg as an eight hours average was exceeded)	yes	Depending on the available data source other than the OECD limits were used
			Population weighted annual mean concentration of fine particulate matter (PM10, i.e. particulates whose diameter is less than 10 micrometers) at urban background stations in agglomerations	**3.2** Hazard to human health by posed by fine particulate matter (% of monitoring stations exceeding the 24-hours limit of 25 µg/m^3 PM10 at more than 35 days per year)	yes	Alternative definition of the indicator (by exceeding of limits of the air polluting substance)

Theme	Proposed subject (Number OECD indicator)	Proposed indicator (Numbers of OECD-indicators)	OECD example for implementation	German examples / results of implementation (numbers of this report)	Adequacy	Reason for variation, comments
Environmental health and risks	**14** Exposure to natural or industrial risks and related economic losses	--	--	--	--	--
Environmental services and amenities	**15** Access to sewage treatment and drinking water	**15.1** Population connected to sewage treatment	Proportion of population connected sewage treatment (primary, secondary) in % of total population	**3.3.1** Residents connected to the public sewage system (in % of all residents)	yes	
				3.3.1 Residents connected to public or private sewage treatment (in % of all residents)	yes	
		15.2 Population with sustainable access to safe drinking water	Population with sustainable access to safe drinking water	**3.3.2** Proportion of the population with public water delivery	yes	
				3.3.2 Water usage per capita	yes	

Theme	Proposed subject (Number OECD indicator)	Proposed indicator (Numbers of OECD-indicators)	OECD example for implementation	German examples / results of implementation (numbers of this report)	Adequacy	Reason for variation, comments
	Group IV – Policy responses ans creating economic opportunities					
Technology and Innovation	**16** R&D expenditure of importance to GG	R&D expenditure for – renewable energy – Environmental technologies – all purpose business as share of total R&D expenditure	Public R&D expenditure for environment and energy	**4.1** Government expenditure on research and development in the fields of environment and energy	yes	Indicator differs from OECD proposal
			R&D expenditure of industries for environment and energy	--	--	No data available
	17 Patents of importance to GG	Patent applications – environmentally related patents – Structure of environmentally related patents		**4.2** Patent applications for selected renewable energies	yes	Definition more close than proposed by OECD
	18 Environmentally-related innovation in all sectors	Environmentally- related innovation in all sectors				

Theme	Proposed subject (Number OECD indicator)	Proposed indicator (Numbers of OECD-indicators)	OECD example for implementation	German examples / results of implementation (numbers of this report)	Adequacy	Reason for variation, comments
Environmental goods and services	**19** Production of environmental goods and services	**19.1** Gross value added in the EGS sector (in % of GDP)	Enterprises in EGS sector (Environmental Goods and Services)	**4.3** Turnover with goods, construction work and services for environmental protection	yes	Definition differs from OECD proposal (turnover instead of value added)
		19.2 Employment in environmental protection	Employed persons in EGS sector	Employed persons in production of goods, construction work and services for environmental protection		Employed persons not shown as a seperate indicator but as additional information to indicator 19.1 (Main reason: Data originate from DIW (Deutsches Institut für Wirtschaftsforschung), not from Destatis. Therefore no detailed indicator description.)
International financial flows	**20** International financial flows with importance to GG	Each with importance to GG:				
		20.1 Official Development Assistance (ODA)	Share of expenditure relevant for the environment or renewable energy in total ODA.	--	--	Detailed ODA data not available.

Theme	Proposed subject (Number OECD indicator)	Proposed indicator (Numbers of OECD-indicators)	OECD example for implementation	German examples / results of implementation (numbers of this report)	Adequacy	Reason for variation, comments
International financial flows		**20.2** Carbon market financing	Emission trading, prices of emission certificates	**4.4** CO_2 emission certificates	yes	No data available on prices of emission certificates
			CDM projects (CDM = Clean Development Mechanism)	--	--	No data available.
		20.3 Foreign direct investment	--	--	--	Detailed data not available.
Prices and transfers	**21** Environmentally related taxation	**21** Environmentally related tax revenues – in relation to total tax revenues – Structure of environmentally related taxes by type of tax base	Environmentally related tax revenues in relation to total tax revenues	**4.5** Environmentally related tax revenues as share of total tax revenues	yes	Structure of environmentally related taxes is presented in the description of the indicator
			Structure of environmentally related taxes by type of tax base			

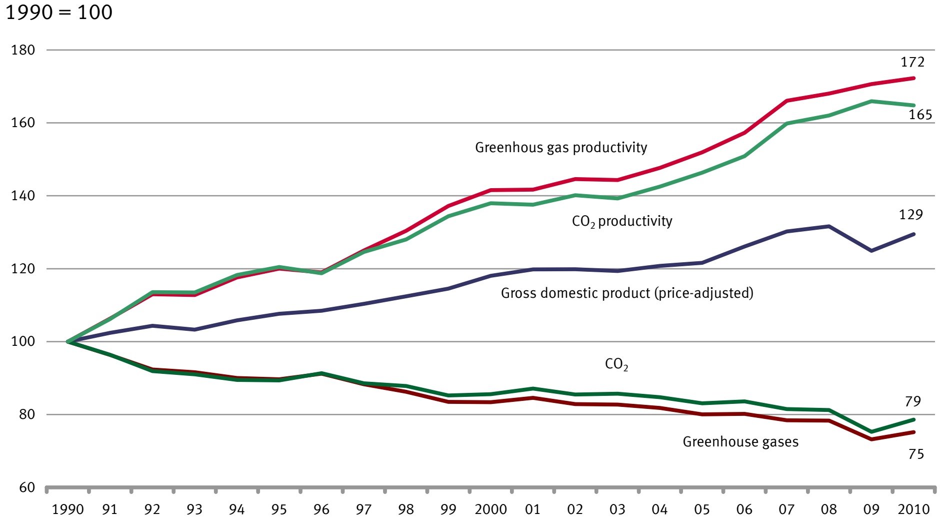
Theme	Proposed subject (Number OECD indicator)	Proposed indicator (Numbers of OECD-indicators)	OECD example for implementation	German examples / results of implementation (numbers of this report)	Adequacy	Reason for variation, comments
Prices and transfers	**22** Energy prices	**22** Consumer prices for energy products; Share of taxes in energy consumer prices	Development of end-use prices for important energy products (light heating oil, petrol, electricity)	**4.6** Development of petrol price and petrol taxation	yes	Presentation focussed on Petrol
			Share of taxes in enduse prices for energy products			
	23 Water prices and cost recovery	tbd	--	**4.7** Development of drinking water prices	Partly	OECD stresses cost recovery aspect which is not available for Germany
	Supplementary indicators	Environmentally related transfers	--	--	--	Concepts not yet mature enough
		Level and structure of expenditure for environmental protection and for resource management	--	**4.8** Environmental protection expenditure by domain	yes	Concepts for resource management expenditure accounting (RUMEA) not yet mature enough

17 Basis: OECD (2011a): Towards Green Growth: Monitoring Progress; OECD Indicators. OECD (2011b): Towards Green Growth – Monitoring Progress, OECD Indicators, Meeting of the Council at Ministerial Level, 25-26 May 2011, Paper C/MIN(2011)5/FINAL, 1. July 2011, page 32.

Carbon and energy productivity

1.1 CO_2 and greenhouse gas emissions and productivity

Greenhouse gas productivity (domestic concept)



Source: Federal Statistical Office, Federal Environment Agency

The climate change caused recently by human economic activity is an enormous challenge for people and nature. It is mainly caused by the so-called greenhouse gases. These gases are mainly emitted during the combustion of fossil fuels, such as coal, crude oil and natural gas. Furthermore, they are emitted in other activities not involving energy sources, such as when producing iron and steel, in the use of solvents, in the employment of minerals as fertilisers, in animal husbandry and on waste dumps. According to the Kyoto Protocol, the following six substances are included as greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous monoxide (previously: nitrous oxide) = laughing gas (N_2O), partly halogenated hydrofluorocarbons (HFCs), perfluorocarbons (PFC) and sulphur hexafluoride (SF_6).

In 2010 937 million tonnes of greenhouse gases (in CO_2 equivalents) were emitted in Germany. With 87.4 % carbon dioxide accounted for by far the largest share in greenhouse gas emissions. Methane accounted for 5.1 %, laughing gas for 5.9 % and fluorocarbons for 1.2 %.

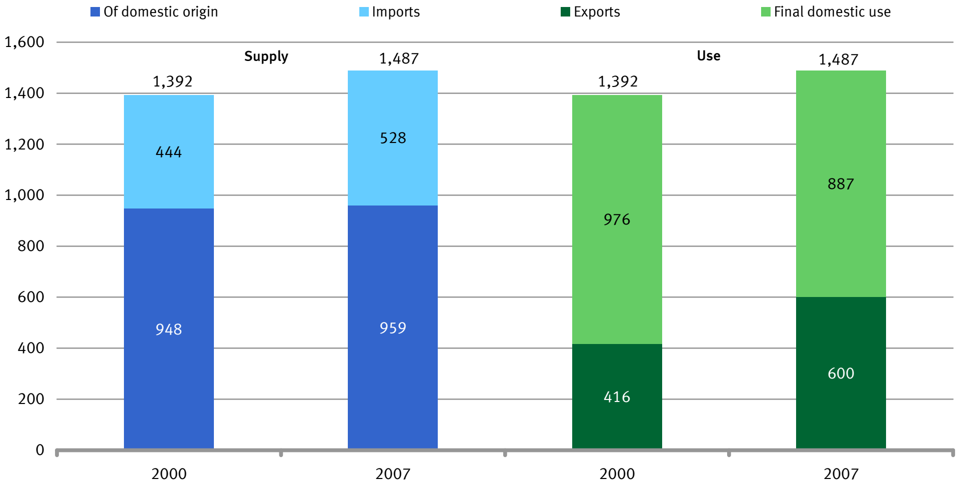
From 1990 until 2010 greenhouse gas emissions in Germany fell substantially by 25 % (310 million tonnes CO_2 equivalents). In the case of the most important component, namely CO_2, the decrease was 223 million tonnes (–21 %). A large proportion was above all saved by companies closing down during the first five years after German reunification. After this, environmental and climate policies had an effect. Between 1990 and 2010 the gross domestic product rose by 29 %. Overall, greenhouse gas productivity rose by 72 % between 1990 and 2010, CO_2 productivity alone, however, only by 65 %. This means that resources were used more efficiently with increasing economic growth. The trend in economic growth and greenhouse gas emissions was decoupled so that the environmental burden from a German perspective also declined when considered in absolute terms (without taking account of imports). At the end of the time series the trend reflects the economic crisis of 2008/2009 as well as the subsequent recovery.

Carbon and energy productivity

1.2 Energy-related CO_2 emissions depending on supply and use

CO_2 - supply and use

mn tonnes



1 Including emissions from bunkering and biomass.

Source: Federal Statistical Office, Federal Environment Agency

Carbon dioxide (CO_2) is the most important greenhouse gas with regard to the quantity of emissions (cf. Indicator 1.1). In 2007, Germany produced 1,487 million tonnes of CO_2 emissions from the use of fossil fuels as sources of energy. This share has risen by 7 % compared with 2000. It was composed of 959 million tonnes of CO_2 from domestic production (rise of 1 % compared with 2000) and 528 million tonnes CO_2 for the manufacture of imported goods (rise of 19 %). This shows that – with an overall increase in emissions – the source of emissions was increasingly moving abroad. In 2000 imported goods still accounted for 32 % of CO_2 produced, whilst this had risen to 36 % in 2007.

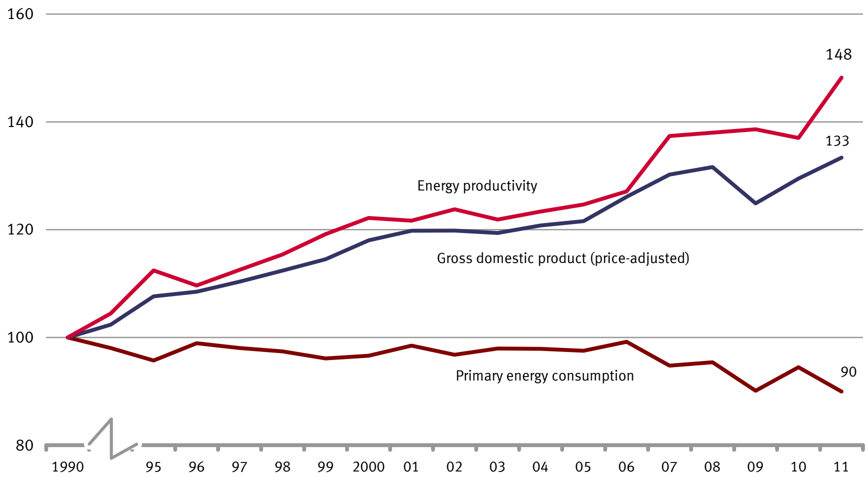
Of the amount produced in 2007 (supply) 887 million tonnes of CO_2 could be attributed to consumption in Germany (of which 609 million tonnes for private consumption, with the rest for the government, investments etc.). A further 600 million tonnes was due to the production of export goods. Compared with 2000, emission figures for the latest domestic consumption rose by 7 %, however related solely to consumption by private households, emissions declined by 7 %. On the other hand a sharp rise of 44 % was recorded for exports (including offshore bunkering). Rising emissions reflect a strong link to imports and exports of the German economy, which was accompanied by comparably smaller rises in emissions produced in Germany.

In 2009 every inhabitant of Germany was responsible for an average of 7.5 tonnes CO_2 energy-related emission owing to the energy consumption of private households (for living, transport and consumer goods), whilst it was still 8 tonnes in 2000. This value can be considered a “CO_2 footprint“. About one-third of emissions in 2007 (216 million tonnes) occurred directly in households (through heating and fuel consumption for private vehicles) and about two-thirds (402 million tonnes) indirectly (through the production of goods consumed).

Carbon and energy productivity

1.3 Energy productivity of primary energy consumption

Energy productivity and economic growth
1990=100



Source: Federal Statistical Office, Working Group on Energy Balances

The availability of energy and the energy consumption are key indicators of an economy. They are decisive for the standard of living and private consumption, production processes and economic competitiveness. On the other hand, energy consumption causes a wide range of environmental burden, including the depletion of energy sources, emissions of greenhouse gases and other pollutants and their consequences for humans and nature. In addition, excessive use of non-renewable resources restricts the opportunities for future generations. The decline in energy consumption and more efficient energy use are necessary. In the German sustainability strategy targets are set for the reduction of primary energy consumption and energy productivity until 2020 and 2050 respectively.

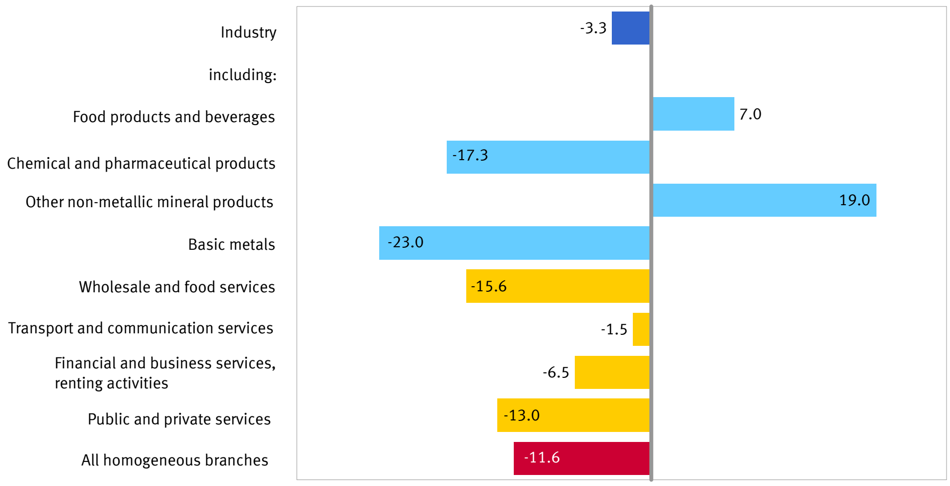
Energy productivity increased by 48.2 % in Germany between 1990 and 2011. This corresponds to an average yearly increase of 1.9 %. This rise in productivity does indicate a more efficient use of energy. While the gross domestic product increased, primary energy consumption fell by 10 % over the period mentioned. This shows a decoupling of economic output and consumption. The absolute decline in energy consumption could have been greater if efficiency gains through technical innovation had not to a large extent been cancelled out by higher economic growth of 33.4 %. This observation shows that considering energy productivity as a green growth indicator can lead to incorrect conclusions unless the data on the economy and resource consumption on which they are based are also taken into account.

The sharp decline in primary energy consumption in 2011 was the result of the relatively mild weather, which reduced the demand for heat. Replacing nuclear power with renewable energy led to an additional increase in the overall energy efficiency of the economy for methodological reasons (fall in conversion losses).

Carbon and energy productivity

1.4 Energy intensity by homogeneous branches

Primary energy intensity* by homogeneous branches
Change in 2009 as against 2000 in percent



* Energy consumption (MJ) per 1,000 EUR gross value added (price-adjusted).

Source: Federal Statistical Office, Working Group on Energy Balances

Green growth requires economic use of energy. Considering energy consumption by production sector makes it possible to recognise different intensities in the economy and gives indications where savings measures would be particularly important. In 2009 in Germany 13,628 PJ energy were used, of which 65.5 % was accounted for by the manufacturing sector and 34.5 % by private households. Chemical production alone accounted for 11.9 % of total energy consumption. A high proportion of use in the manufacturing sector can also be attributed to the steel industry (metal production and processing sector, 5.7 %) and the transport and information transmission sector (9.3 %). In total the service sector used almost one quarter of total energy (24.4 %).

Energy consumption in 2009 fell by 4.7 % compared with 2000. In manufacturing industry the decline stood at 8.6 %. Major energy consumers such as metal production and processing (– 25.8 %), glass, ceramics, processed stone and earth (– 13.2 %) or the chemical/pharmaceutical industry (– 5.3 %) contributed to this decline. The service sector recorded a fall of – 0.8 %.

The increase in energy efficiency hoped for through green growth can be measured roughly through the energy productivity of the whole economy (cf. Indicator 1.3) and in more detail through the energy intensity of individual economic sectors (primary energy consumption / gross value added of production sectors, price-adjusted). In 2009 energy intensity in manufacturing industry averaged 10 MJ per EUR. A large amount of energy was required for economic output in the chemicals sector (40.5 MJ/EUR) and metal production and processing (49.0 MJ/EUR), but also in the glass, ceramics and processing of stone sector (28.9 MJ/EUR). The energy intensity in the service sector was considerably below the average at 2.1 MJ/EUR (however in the transport, transmission of information sector it totalled 6.9 MJ/EUR).

The energy intensity of all manufacturing industries declined by 11.6 % between 2000 and 2009, in other words more sharply than energy consumption (– 4.7 %). In the manufacturing industry the reduction stood at 3.3 % (cf. diagram). The decline was particularly marked in the energy-intensive chemical industry and for metal production and processing with 17.3 % and 23.0 % respectively. In the service sector energy intensity fell by 11.4 % with substantial declines in commerce and the hotel and restaurant industry (– 15.6 %) and public and private services (– 13.0 %).

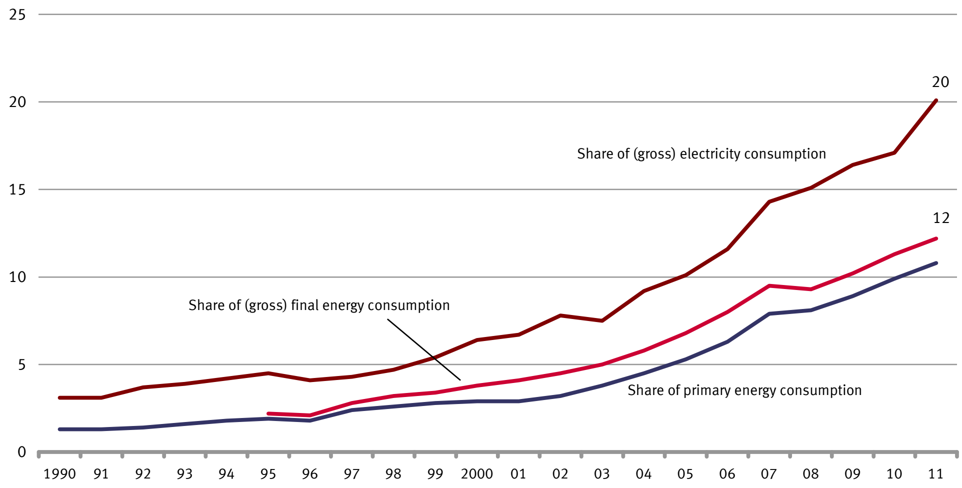
Carbon and energy productivity

1.5.1 Share of renewable energies in final consumption

1.5.2 Share of renewable energies in electricity consumption

Share of renewable energy sources in total energy consumption

in %



Source: Working Group on Renewable Energies – Statistics, Working Group on Energy Balances, Centre for Solar Energy and Hydrogen Research Baden-Württemberg, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

The reserves of important fossil energy sources such as oil and gas are limited, and their use is associated with greenhouse gas emissions. A move towards renewable energy reduces the economy's dependence on energy imports and fosters innovation. However, in particular it reduces energy-related greenhouse gas emissions and is therefore an important measure against anthropogenic climate change. The use of renewable energy is being promoted politically and is subsidised in Germany. Ambitious targets have been set for the share of renewable energy in energy consumption in the national sustainability strategy, which were achieved and exceeded for the target year of 2010. With continued progress, the targets for 2020 which have been set an even higher level, can also be reached easily.

During the last twenty years the share of renewable energy in final energy consumption has increased substantially from just under 2 % in 1990 to 12 % in 2011. Information on primary energy consumption also contains the relevant energy that is lost during the conversion process from primary energy to final energy. The share of renewable energy in primary energy consumption rose from 1 % to 11 % during the period mentioned. The share of renewable energy in electricity consumption also went up sharply. Starting at 3 % in 1990, it had already reached 20 % in 2011.

Renewable energies include hydropower, wind power, solar energy and geothermal energy, but also biomass and the biodegradable portions of domestic refuse. In 2010 the share of the individual energy sources in total energy consumption from renewable energies varied greatly. 71 % came from bio-energies (biomass), 13 % from wind power and 7 % from hydropower. They were used to produce electricity (38 %), heat (49 %) and fuel from biomass (13 %).

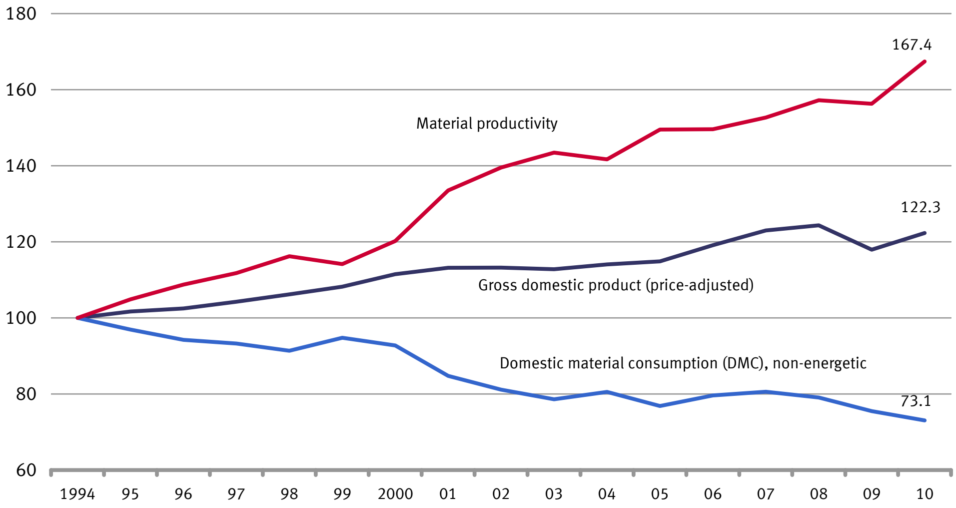
When assessing the positive aspects of green growth through renewable energy, its negative effects in other sectors must not be forgotten. For example when biomass is used for biogas, fuel or solar energy plants, there has been evidence of increasing competition for agricultural land if fuel crops become more lucrative for farmers than growing food and feedstuffs. This can lead to food shortages globally. Negative consequences for biodiversity, quality of the landscape, soil or ground water should also be considered.

Resource productivity

1.6 Material productivity

Material productivity and economic growth

1994 = 100



With an increase in gross domestic product of 22.3 % and a decrease in non-energy material usage of 26.9 % since 1994, material productivity rose by 67.4 % during this period. Non-energy material usage includes mineral raw materials, in other words ores, building and industrial minerals, as well as biotic raw materials, i.e. mainly agricultural products and products from forestry. Material productivity sets gross domestic product in relation to non-energy domestic material consumption (domestic extraction plus imports minus exports). Any change in material productivity shows how efficiently an economy manages non-energy materials.

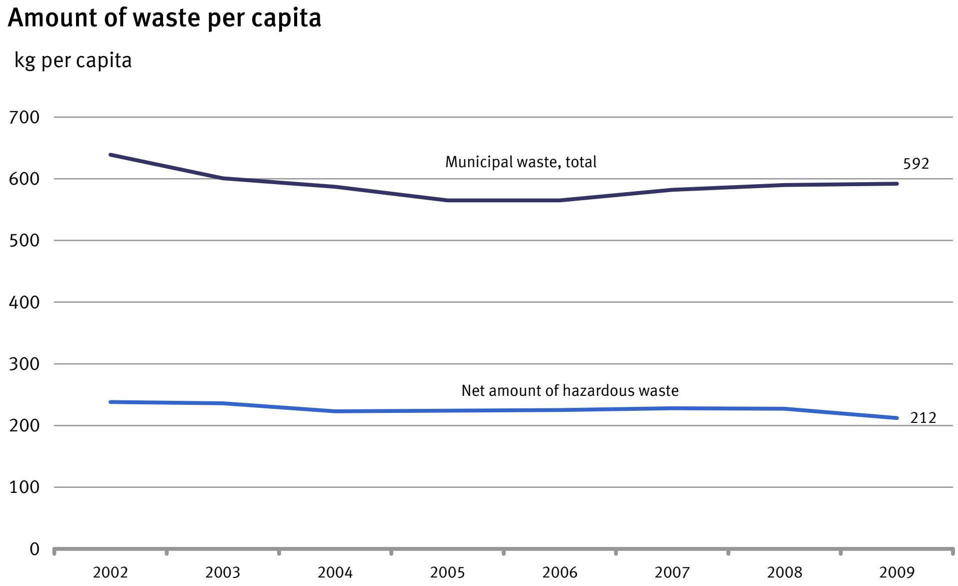
If one considers mineral raw materials, there are currently opposing trends: the use of building raw materials fell by 34.4 % or 274 million tonnes between 1994 and 2010, whilst the use of ores and their products increased by approximately 45 % or 39 million tonnes. In total the use of mineral raw materials therefore declined with a rising gross domestic product so that an increase in productivity of 87.1 % was recorded during the period mentioned related to this material category.

There was no uniform picture for biotic raw materials. Whilst the extraction of biotic raw materials was subject to considerable fluctuations, foreign trade in these products has risen substantially in terms of quantity during the last decade and a half. A rise of 57 % was recorded for imports, whilst exports almost doubled (+92 %). Overall there were however major fluctuations in productivity and only a slight upwards trend was discernible.

The indicator described here is different in several aspects from that used in the German sustainability strategy, which includes the extraction and import of all abiotic raw materials and goods, i.e. the indicator also includes energy raw materials, but no biotic materials; in addition exports are not offset against this.

Resource productivity

1.7 Waste generation (municipal waste) per capita



Another aspect of the efficiency of material usage is shown in the development of waste generation. In 2009 the generation of municipal waste stood at 592 kilogrammes per capita and was therefore 47 kilogrammes lower than in 2002. This represents a decline of 7.4 %. With 212 kilogrammes per capita, almost half of municipal waste in 2009 could be classified as hazardous, which is 26 kilogrammes less than seven years earlier.

In 2009 approximately 44.5 million tonnes of municipal waste were produced in Germany. This corresponds to nearly 14 % of total waste generated (359 million tonnes). More than half of the waste produced was construction and demolition waste (195 million tonnes). Other waste was generated from the extraction and treatment of subsoil assets (27.5 million tonnes) as well as in production (51.3 million tonnes) and from waste processing plants (37 million tonnes).

The largest share of municipal waste is accounted for by households (43.2 million tonnes 2009). One-third of household waste consists of household refuse and commercial waste similar to household refuse, 5.6 % is bulky waste, and approximately 20 % is accounted for by bio-waste containers or garden and park waste. Approximately 41 % of household waste is collected separately (glass, paper, lightweight packaging etc.).

By far the largest proportion of total waste produced (258 million tonnes or 72 % in 2009) was recycled; a further 25 million tonnes (7 %) were used for energy. Approximately 75 million tonnes was disposed of in waste disposal plants through storage or through thermal or other processing.

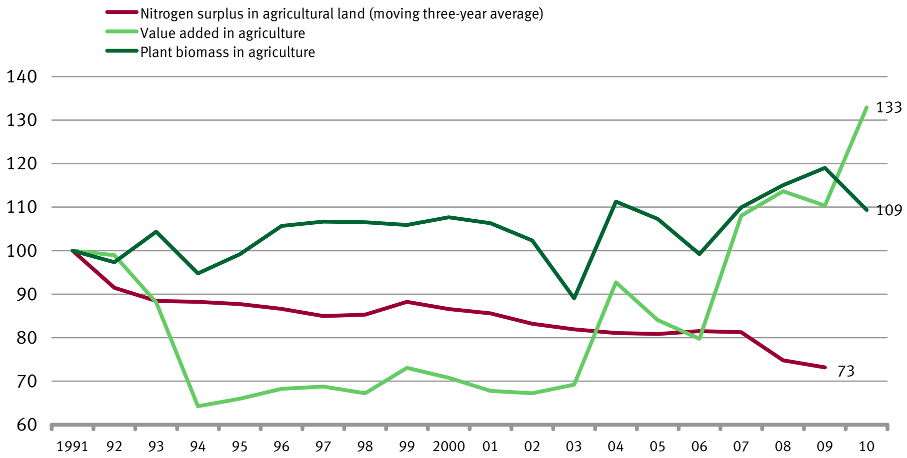
The waste balance sheet summarises the results of various waste statistics using a mathematical model. The waste balance sheet follows the following arithmetic: municipal waste plus waste from extraction and treatment of subsoil assets plus construction and demolition waste plus other waste equals net waste plus waste from waste processing plants (secondary waste) equals total waste.

Resource productivity

1.8 Nitrogen surplus, herbal biomass and value added in agriculture

Nitrogen surplus, value added and plant biomass in agriculture

Index 1991 = 100



Source: Federal Research Centre for Cultivated Plants – Julius Kühn-Institut and Institute of Landscape Ecology and Resources Management, University of Gießen

Next to phosphor, nitrogen is one of the most important plant nutrients. It is used as a fertiliser (as a mineral fertiliser or farm fertiliser) for areas under cultivation. For ecological and economic reasons it is important to apply the nutrient economically and use it efficiently. Excessive fertilisation is expensive and has harmful consequences for the environment, e.g. for the condition of water bodies and ground water, drinking water usage, the climate, biodiversity. Apart from using fertilisers, there are other sources of nitrogen deposits in agricultural areas (deposits from animal production and emissions from traffic and households, airborne biological nitrogen fixation amongst other things). The limitation of surplus nitrogen in Germany is a concern of the national sustainability strategy.

Nitrogen surpluses in areas used for agriculture (total balance) declined between 1991 and 2009 from 130 kg/ha to 95 kg/ha (– 27 %). During the same period the production of plant biomass rose by 18 % and the gross value added by 10 %. Plant yields were affected by the weather to a varying extent during the individual years of the period under review. However, their development shows that it was possible to achieve a decoupling between plant yields and nitrogen surpluses, so that production became more efficient in relation to nutrient input.

The added value is partly portrayed by the production quantities. However, other factors must be included additionally (over- or underproduction, world market prices or agricultural and environmental policies and developments). Recently the production of biomass that has been supported by financial measures started to play a role for renewable energy and the competition this creates between feedstuffs and foodstuffs production.

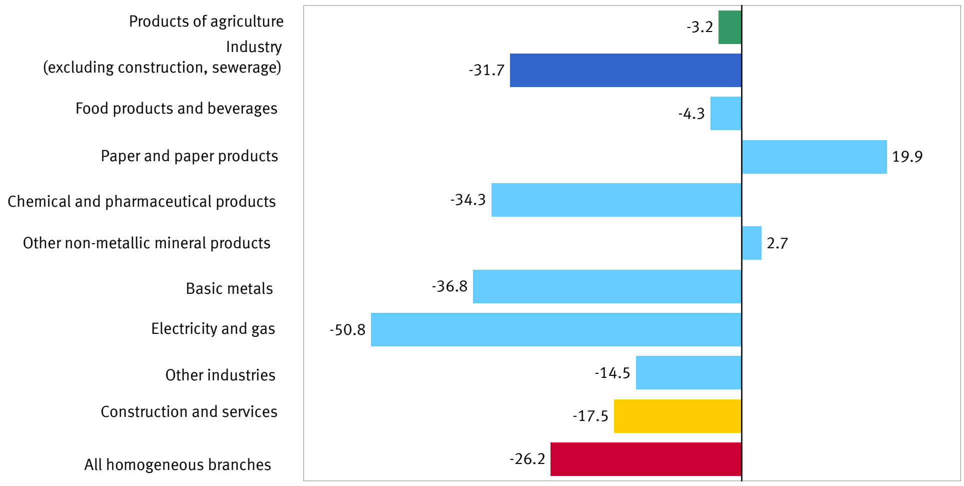
Data on the phosphorous balance are not available. Phosphorous is an essential plant nutrient which is becoming increasingly scarce owing to its limited occurrence and to this extent must be used particularly sparingly.

Resource productivity

1.9 Water intensity by homogeneous branches

Water intensity* by homogeneous branches

Change in 2007 as against 2000 in percent



* Water (m^3) per 1,000 EUR gross value added (price-adjusted).

Water intensity is the amount of water used in the individual production sectors of the economy in relation to its gross value added. The higher the intensity, the more economically inefficiently water is being used. As the production sectors have varying water requirements, the time comparison is particularly interesting for the sectors with a high demand for water.

On average, all production sectors used 15.9 m^3 water per EUR 1,000 gross value added in 2007 while the manufacturing industry (without the construction industry) used 57.3 m^3 water per EUR 1,000 gross value added. By far the greatest intensity with 590.8 m^3 water per EUR 1,000 gross value added occurred during the production of electricity and gas. For chemicals and pharmaceuticals the intensity stood at 72.8 m^3 water per EUR 1,000 gross value added, for paper products at 43.8 m^3 water per EUR 1,000 gross value added and at 21.2 m^3 water per EUR 1,000 gross value added for metal production. In agriculture water intensity (irrigation water) totalled 21.9 m^3 water per EUR 1,000 gross value added.

During the last decade water has been used increasingly efficiently and water intensity declined in 2007 compared with 2000 in many production sectors. If all the production sectors are taken together, the intensity declined by 26.2 % and therefore more than water use in the production sectors (16.9 %). In the production sector of the generation of electricity and gas alone that has the greatest use of water, the intensity fell by 50.8 %.

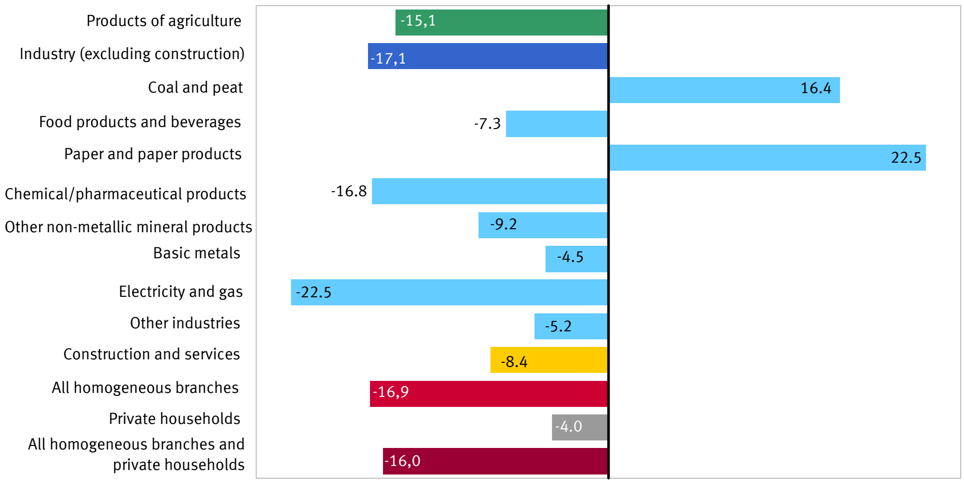
There was also a clear decline in the production of metals (– 36.8 %) and for chemicals and pharmaceuticals (– 34.7 %), whilst the intensity was only 4.3 % lower for the production of food and beverages. On the other hand, water use and water intensity for the production of paper and cardboard rose (+ 19.9 %). In agriculture the intensity fell by 3.2 %. This decrease was significantly less marked than that of water use (– 15.1 %).

Renewable stocks

2.1 Water use by homogeneous branches

Water use by homogeneous branches

Change in 2007 as against 2000 in percent



The water supply in Germany is estimated at 188 billion m^3 (long term average). This means that in 2007 water resources totalling 2,284 m^3 were available for every inhabitant. In 2007 approximately 37.7 billion m^3 of water were taken from natural sources. The water use intensity (annual extraction in relation to supply) amounted to 20%. The "water stress" (extraction in per cent of the renewable resource) at national level is moderate and not a problem at present, but may become a problem at regional level.

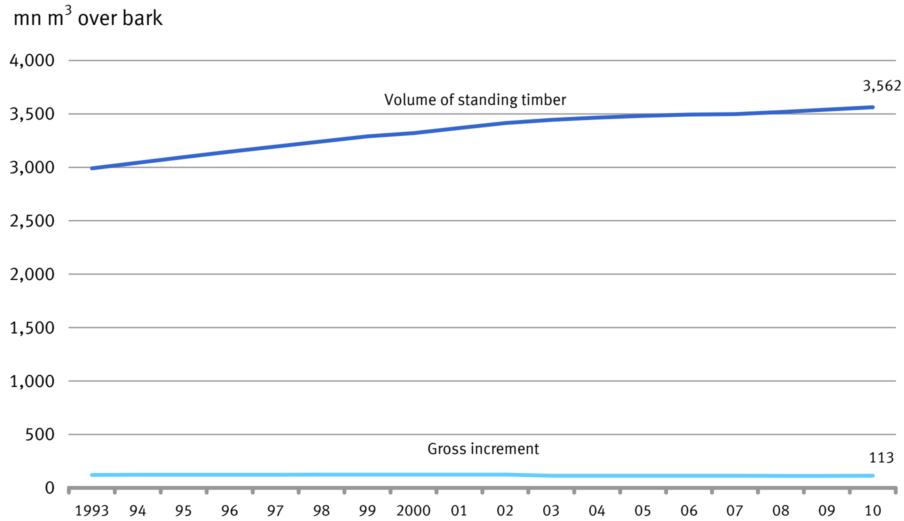
Of the water extracted from natural sources in 2007, over half was used as cooling water. The production sectors used 92 % of total water with only 8 % used in private households. Well over half of the water was accounted for by the production sector of electricity and gas generation (55.7 %, here primarily as cooling water). Chemicals and pharmaceuticals also had comparably high shares (8.4 %) together with extraction of coal and peat (3.5 %, primarily as channelled mine water).

Between 2000 and 2007 water extracted fell by a total of 16 % (7,176 million m^3), whilst at the same time gross domestic product increased by 10.3 %. From an economic perspective, water was therefore used more efficiently. The production sectors used 16.9 % (7,046 million m^3), but private households only 4 % (129.5 million m^3) less water. Rising prices for water and waste water as well as new technologies played a role. The consideration of water usage according to individual production sectors shows a varying picture. A sharp decline was recorded for energy supplies both as a share in total consumption and in absolute figures (22.5 % or 6,105 million m^3). This reduction also characterises the overall trend. Chemicals and pharmaceuticals showed a sharp decline in water use of 16.8 % (639 million m^3), as one of the largest water consumers. Smaller decreases were recorded for the production of food and beverages (– 7.3 % or – 42 million m^3) and in metal production (– 4.5 % or – 25 million m^3), whilst there was a substantial increase for paper and cardboard production (of 23 % or 80 million m^3). In agriculture less water was used for irrigation (decline of 15 % or 70 million m^3).

Renewable stocks

2.2.1 Forest resources: percentage of total land area, area per capita, volume of standing timber

Standing timber and gross increment



Source: Johann Heinrich von Thünen-Institut

Forests are a comparably natural type of ground cover. They fulfil varied economic, ecological and social functions that are important for humans. Forests cover approximately 30 % of the area of Germany and are a characterising feature of the landscape. In 2010 11.2 million ha of the country was covered by forests[1]. This is a rise of 3.8 % compared with 1993. This means that every inhabitant has a share of the forest of 0.14 ha (in 1993 it was 0.13 ha/head).

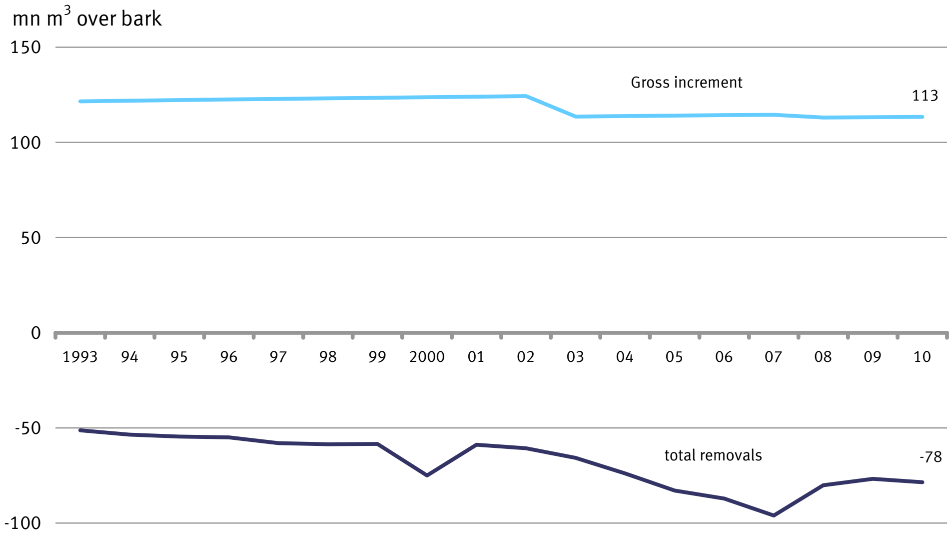
In 2010 the forest area was stocked with 3.6 billion solid cubic metres (m^3 of wood over bark) of standing timber, of this 97.4 %, (3.47 billion m^3) was available for wood supply; the remainder was not available for timber harvesting. In the period between 1993 and 2010 growing stock increased by a total of 19.1 %.

1 For methodological reasons the figures used here on the forest area are not identical with those in the official area statistics (cf. Indicator 2.4).

Renewable stocks

2.2.2 Forest resources: share of wood extraction from usable growth

Gross increment and total removals



Source: Johann Heinrich von Thünen-Institut

As part of a Green Growth Strategy, the use of forests as a supplier of renewable and climate neutral resources (as a building material or energy source) is of particular interest. Amongst other things the relationship between wood increase and extraction in the forest expresses how sustainable use is. The wood extracted should not exceed the increase in growing stock.

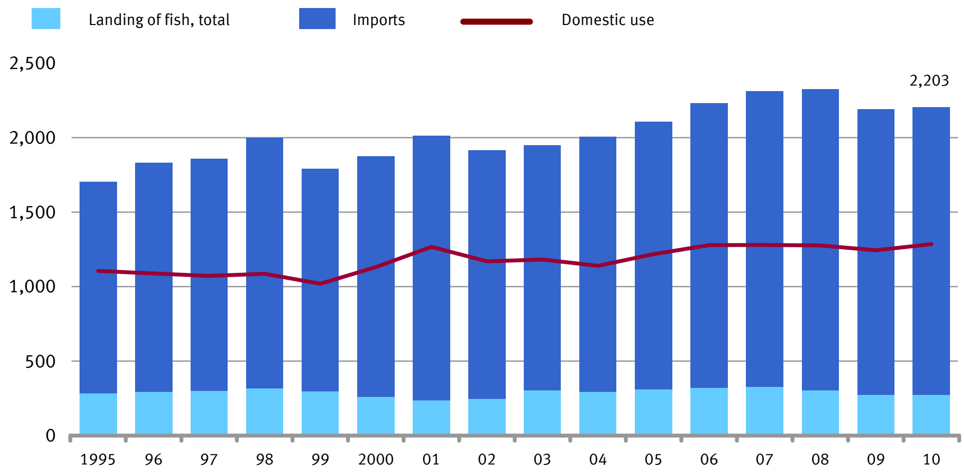
Forests in Germany are being increasingly used for wood harvest. Whilst only about half (49 %) of usable growth was harvested in 1993 (51 million m^3), in 2010 already 80 % of growth was extracted, namely 78 million m^3. The annual gross growth in working forests fell from 120 million m^3 in 1993 to 111 million m^3 in 2010. In 2010 only 20 million m^3 of new supplies were created, whereas it had still been 53 million m^3 in 1993.

Renewable stocks

2.3 Fish resources: supply, domestic use and per-capita consumption of seawater and freshwater animals

Fish and fishing products

1,000 tonnes (fishing weight)



Source: Federal Ministry of Food, Agriculture and Consumer Protection

The biological resources of the seas are common property. Sustainable management requires international regulations so that they can regenerate sufficiently and remain usable on a continuous basis. The balance between the short-term interests of the economy (local fishermen, globally active fishing industry, trade and processing industry as well as consumers) and protection of the environment is particularly difficult here. Instead of information on sustainably managed stocks, here the supply, domestic use and per-capita consumption are used as indicators for usage.

In 2010 the supply of fish and fish products in the German economy (input: total landings and imports) stood at 2.2 million tonnes (catch weight). This represents a clear growth of 29 % (1.7 million tonnes) compared with 1995.

In Germany on average 15.7 kg fish and fish products (on the basis of catch weight) were consumed per inhabitant as food in 2010. Compared with 1995 (13.5 kg/head), this corresponds to a rise of 16 %.

The extraction for domestic use (total landings, in other words without by-catches, and imports, minus exports) amounted to 1,285 million tonnes in 2010, of which 1,283 million tonnes was for human consumption alone (in other words without the share for animal feed). Compared with 1995, domestic consumption rose by 16 %. Landings and catches by German fisheries (in Germany and abroad, including inland fishing in ponds, lakes and aquaculture) fell by 4 % between 1995 and 2010 and most recently to 274,200 tonnes (41,200 tonnes or 15 % of which was inland fish). The level of self-sufficiency in Germany (in other words the share of German fisheries in domestic use) stood at only 21.3 %. It even fell by 4.6 percentage points compared with 1995.

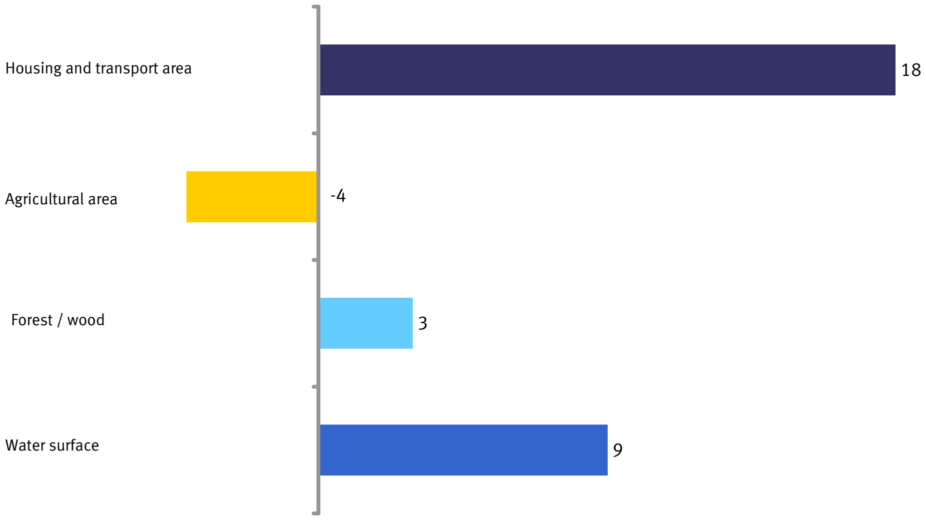
The increased demand from consumers and the economy was served by rising imports. In 2010 a total of 1,928 million tonnes was imported, 36 % more than in 1995. 0.918 million tonnes were exported which is an increase of 53 % compared to 1995.

Biodiversity and ecosystems

2.4 Land resources: land use changes (housing and transport area, agricultural land, forests, water surface)

Land use: change in 2010 as against 1992

in %



Undeveloped, unfragmented and unspoilt land is a limited resource and therefore in very high demand. A variety of interests are competing for such land, including those of agriculture and forestry, housing and transport, nature conservation, resource extraction and energy generation. Of these, the greatest increase in land use is being seen in the area of settlement and transport. Whilst on the one hand the greatest gross value added takes place on these areas, on the other hand substantial pressures are being made into the natural environment. The direct environmental consequences of the increase in land used for housing and transport include the loss of natural soil functions through sealing, the loss of fertile agricultural land or the loss of areas still close to their natural state and the associated loss of biodiversity. In addition to this, each new instance of land development near urban areas and outside existing settlement centres brings with it more traffic and more land fragmentation. This leads to consequential damage such as noise and pollutant emissions, and also to an increased expenditure for providing the necessary infrastructure.

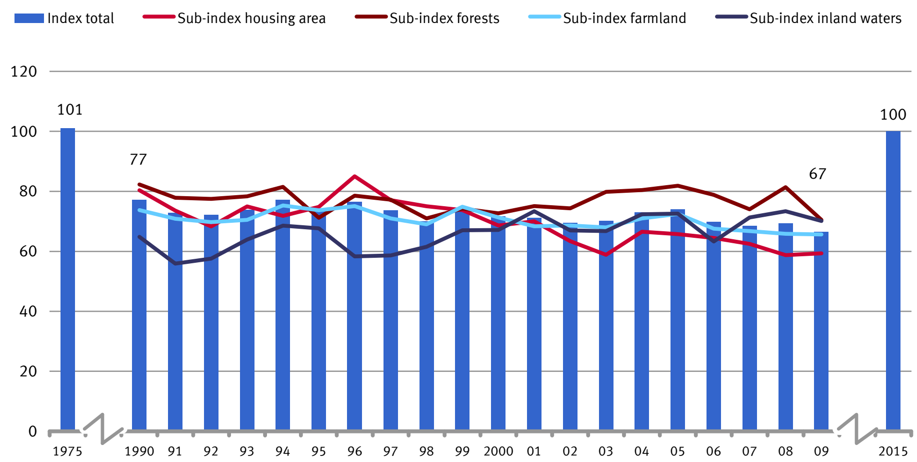
In 2010 13.4 % of Germany was covered with built-up areas and transport infrastructure (6.9 % of which was accounted for by building and adjacent open land and 5 % by transport land). This share has risen by 18 % compared with 1992. Converted to daily rates, in 1996 an average of 120 ha per day was used for settlement and transport for the first time (moving average). In 2010 it was still 87 ha that were used for the first time every day, although there has been a constant decline during the last few years. The aim of the national sustainability strategy of Germany to limit the newly settled area to 30 ha per day, is still a long way from being achieved.

Settlement and transport areas are often expanding at the expense of cropland. In 2010 the latter covered 52.3 % of the area of the country and had shrunk by 4 % compared with 1992. Forests most recently covered 30.1 % of the area of the country, an increase of 3 % compared with 1992. The areas of water (2.4 % of total area) expanded by 9 %. Amongst other things the natural regeneration of mines for example in brown coal open-cast mines contributed to this.

Biodiversity and ecosystems

2.5 Diversity of species using breeding bird species as an example

Species diversity and landscape quality*
Index 2015 = 100



* The historical values for 1975 have been reconstructed. For some bird species in the habitats of coasts and seas, inland waters and in the Alps, values for individual years have been extrapolated.

Source: Federal Agency for Nature Conservation

Preserving and improving the range of wild species and near-natural ecosystems are clear sustainability targets. Diversity represents a complex network of ecosystem services and resources for potential future use. Bird species are linked to a richly structured landscape with intact habitats. One indicator on the presence of selected bird species in Germany (total index as well as partial index for important types of habitat) therefore supplies not only ornithological information, but also indirectly provides conclusions on the corresponding development of numerous other species with complex habitat requirements, the landscape quality and the sustainability of land use.

The value of the indicator in 1990 was considerably below the values reconstructed for 1975. In the last 10 years under consideration (1999 to 2009) the indicator value has hardly deteriorated and has shown a statistically significant trend. In 2009 it stood at almost 67 % of a target value of 100, which more or less corresponds to the historical circumstances of 1975 and was included in the Sustainability Strategy for Germany for 2015.

The partial indicators for the types of habitat of farmland (66 % of the target value in 2009), settlements (59 %), coasts and seas (56 %) and for the Alps (77 %) moved away from the target during the last 10 years up to 2009 to a statistically significant extent. For forests and inland waters (each at 70 %) no statistically significant trend is evident during this period.

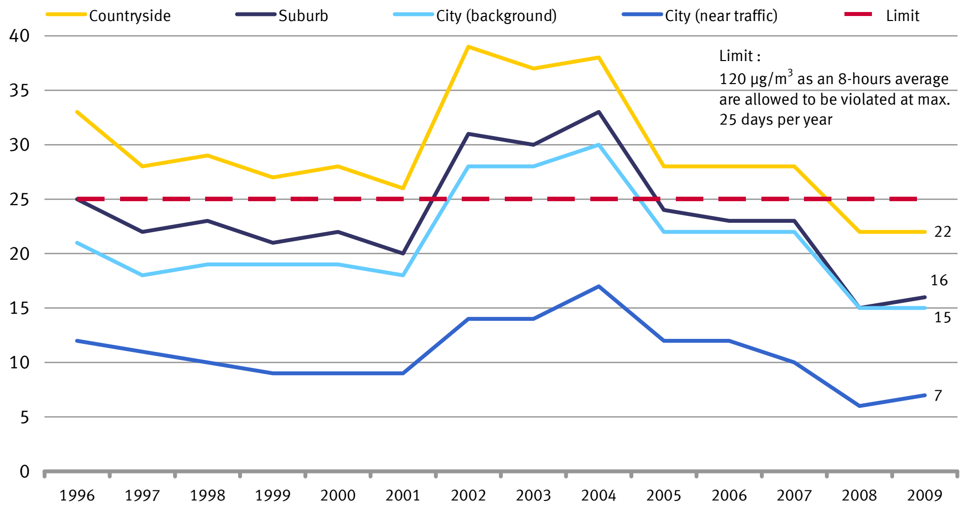
Some of the chief causes of the decline in species diversity are – with regional differences – the intensification of farming use and forestry, the fragmentation and urban sprawl, the depositing of substances such as acidifiers or nutrients. Climate change caused by human activity could in the future considerably alter both species diversity and the range of species through the migration and extinction of animal and plant species. Grassland ploughing and the increasing cultivation of fuel crops can also have a negative impact on the quality of the landscape and biodiversity.

Environmental health and risks

3.1 Hazard to human health posed by ozone

Violation of the ozone-limit for the protection of health

Number of days violating the limit (moving three-year average)



Source: Federal Environment Agency

Ozone is the main substance in summer smog, which is characterised by high concentrations of so-called photo-oxidants in the lower layers of the atmosphere. Photo-oxidants are anthropogenic air pollutants such as ozone, peroxides, aldehydes and organic nitrogen compounds. They are not emitted directly but arise from the precursor substances NO_x (nitrogen oxide) and NMVOC (non-methane volatile organic compounds) in the atmosphere as a result of strong, continuous sunshine. Major sources of emissions of the precursor substances are traffic fumes, power plants (NO_x) or the use of varnishes and solvents (volatile organic compounds). However, some also arise through natural processes.

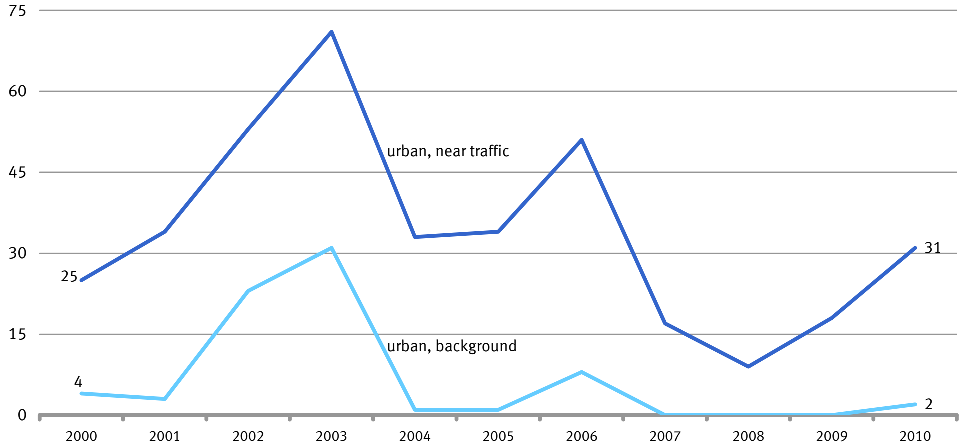
Increased concentrations of the harmful substance adversely affect lung function and can lead to inflammation of the lung tissue, irritation of the airways and headaches. This is why in order to protect human health, it was determined that from 2010 ozone concentration may not exceed 120 µg/m³ (as a daily eight-hour mean) on more than 25 days per calendar (as a three year mean). From 2020 it shall no longer be exceeded at all.

The indicator exceeded the threshold during the period under review since 1996 above all in the rural and suburban background monitoring stations. The cause for this unexpected situation is that the nitrous oxide (NO) in car fumes reacts with the ozone created and breaks the latter down. As a result ozone pollution in urban areas is significantly lower than in the suburbs. In addition, the ozone precursory substances are transported by the wind out of the cities and contribute to the creation of ozone away from the actual sources of the latter. During the last few years the target value aimed at was exceeded in many parts of Germany. The sharp fluctuations over the years are also associated with weather conditions. Most recently for 2009 (three-year average 2008 – 2010) the thresholds were exceeded on 22 days in rural areas and on 7 days in urban areas.

Environmental health and risks

3.2 Hazard to human health posed by fine particulate matter

Measuring stations for particulate matter violating a limit*
in % of all measuring stations



* Measuring stations at which the 24 hours limit of 50 microgrammes per cubic metre is exceeded on more than 35 days a year.

Source: Federal Environment Agency, Measuring grid German Bundeslaender

The indicator considers the share of fine particulate matter in suspended particulate matter in urban air. Here fine particulate matter with a particle size of 10 µm is recorded. Fine particulate matter poses a hazard to health because it – in contrast to larger particles – can penetrate deep into the airways and lungs and sometimes together with adherent heavy metals or other substances can lead to health problems such as coughs, bronchitis etc.

Fine particulate matter arises through economic activity, but also naturally. Anthropogenic sources are chiefly traffic (diesel soot, wear on tyres, brake pads, road surface), industrial production, heating plants and private households (wood fires), but also agriculture (here over half from livestock farming). Natural sources for fine particulate matter are pollen, forest fires and volcano eruptions amongst other things. Fine particulate matter occurs indoors e.g. from tobacco smoke, photocopiers or laser printers. It is not covered by the indicator.

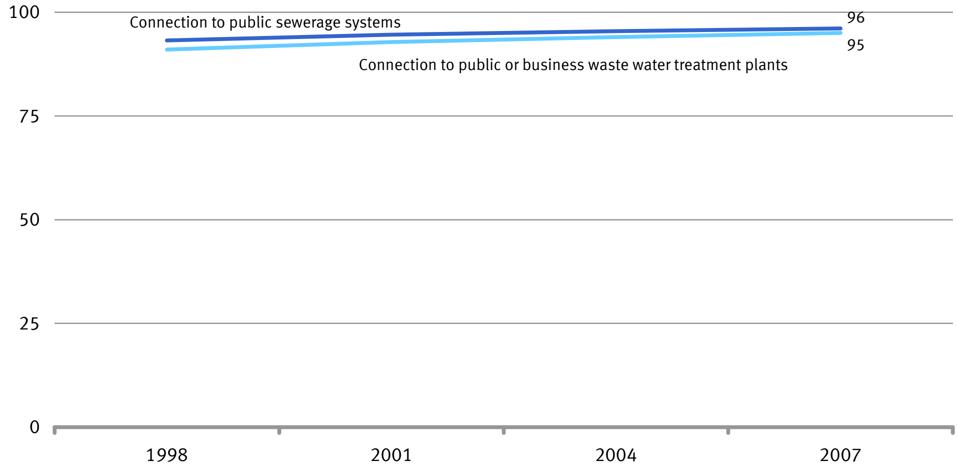
The EU has stated that a daily average value for particulate matter PM_{10} of 50 µg/m³ may not be exceeded more than 35 times a calendar year (Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe). The series of measurements available for Germany since 2000 shows parallel trends for urban traffic-oriented measuring stations on the one hand as well as the measuring stations at urban background locations. As expected, the level of pollution is higher at the traffic-oriented measuring stations. In 2010 the limit value was exceeded on more than 35 days of the year at 31 % of traffic-oriented stations, but at only 2% of measuring stations in the urban background. The threshold was exceeded the most in 2003 (at 71 % of the traffic-oriented measuring stations and 30 % of background stations). According to provisional results, the concentrations of PM_{10} in 2011 were on average above the level of the previous four years (Federal Environment Agency, January 2012). Over the course of the year episodes of higher values were observed across a wide area, which chiefly occurred in the late winter (February/March) and in November together with a temperature inversion.

Ecosystem services

3.3.1 Sewage: residents connected to the public sewage system and municipal or private sewage treatment plants

Waste water: connection to sewerage systems and waste water treatment plants

Share of population in %



In 2007 9 % of the population was connected to the public sewage system. Waste water from 95 % of the population was treated in municipal or private sewage treatment plants.

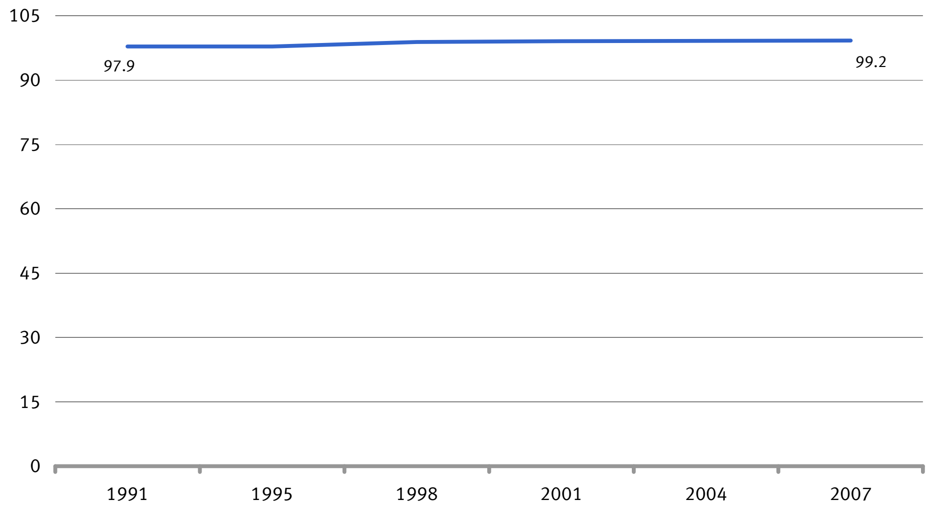
Almost 99 % of the total sewage (of 5,275 million m^3, without infiltration water and precipitation) was treated in public sewage plants, 97 % in biological treatment plants with additional processes and almost 97 % in sewage treatment plants with nitrification.

Ecosystem services

3.3.2 Drinking water: proportion of the population with public water delivery and per capita water usage

Population connected to public water supply

Share in %

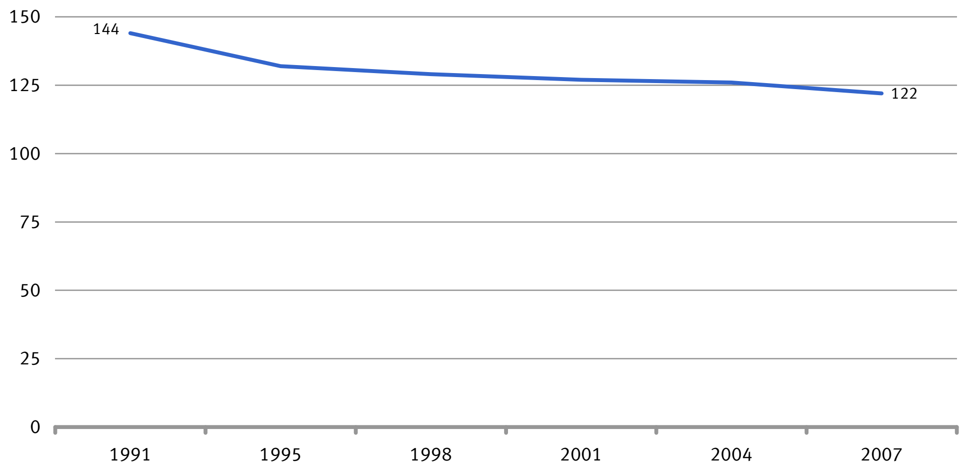


In 2007 99.2 % of inhabitants, in other words almost the entire population, was connected to the public drinking water supply.

The public drinking water extraction companies handled a total of 5.1 billion m^3 water in 2007. 70 % of the drinking water extracted in Germany originates from ground and spring water (3,157 million m^3 from ground water, 424 million m^3 from spring water), 22 % of the volume of water was extracted from surface water (1,137 million m^3, 615 million m^3 of which from lakes and dams, 58 million m^3 from river water and 464 million m^3 from enriched ground water) and 8 % originates from bank filtration.

Water distributed to final consumers

Litre per capita and day



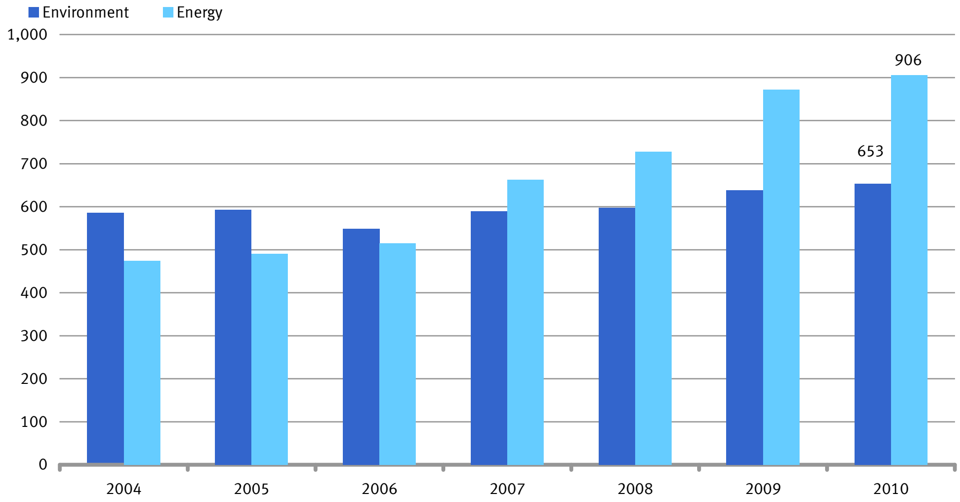
The volume of water supplied in 2007 by the water supply companies to households and small businesses corresponded to an average per capita usage of 122 litres per day. This continued the long-term trend of a reduction in water consumption. In 1991 every inhabitant of Germany still used an average of 144 litres per day. The daily per capita usage has since declined by 22 litres.

Technology and innovation

4.1 Government expenditure on research and development in the fields of environment and energy

Public funding of R & D for environment and energy

EUR mn



Source: Federal Statistical Office, Statistical Office of the European Union (Eurostat)

Spending on research and development (R&D) is a significant parameter in determining the pace of innovation of an economy. With the corresponding earmarked expenditure, the state can provide targeted support for innovation. Public expenditure for research and development in the fields of the environment and energy in 2010 amounted to almost EUR 1.6 billion and was therefore almost 50 % higher than in 2004 (respective prices).

The environment accounted for approximately EUR 653 million of expenditure in 2010, the energy sector for EUR 906 million. Funds almost doubled since 2004 (+ 91 %) for the energy sector, while they rose by only 11 % for the environment.

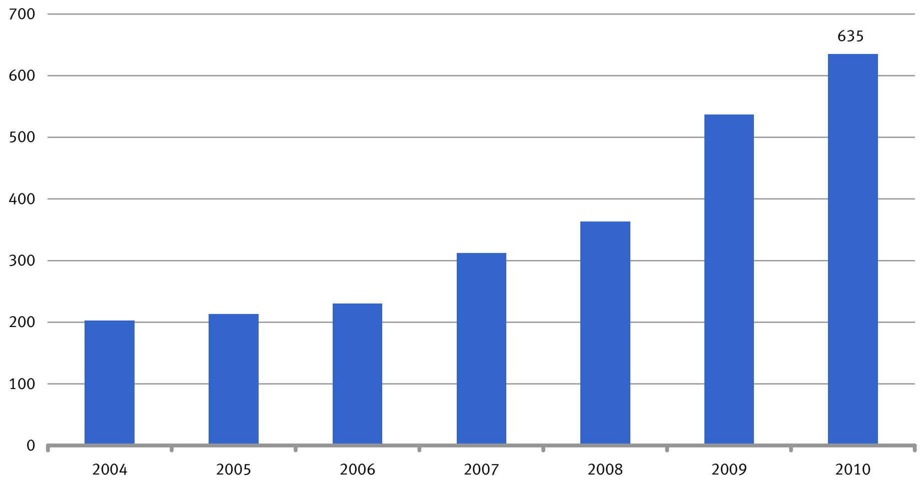
In 2009 total public expenditure on research (excluding institutions of higher education) stood at EUR 9.9 billion, that by institutions of higher education at EUR 11.8 billion and the private economy spent EUR 45.1 billion on research and development.

This includes all expenditure from the public budgets of the Federal Government and the German federal states, both for institutions (e.g. institutional support for research establishments) or project support programmes (e.g. research contracts to companies, institutions of higher education, research establishments), insofar as it is used for research in the fields of the environment or energy. It also includes funds spent abroad.

Technology and innovation

4.2 Patent applications in selected areas of renewable energy

Patent applications concerning regenerative energies*



* Solar energy, wind power, hydropower/wave/tide, geothermal energy, biogas and other energy sources.

Source: German Patent and Trade Mark Office

Patents – similar to research expenditure (cf. 4.1) – give an indication of an economy's willingness to innovate and the speed of the latter. Patent applications in selected areas of renewable energy represent the many comprehensive patents relevant to green growth.

In 2010 635 patent applications from Germany related to renewable energy were filed with the German Patent and Trade Mark Office or the European Patent Office, which means that the number of patent applications has tripled since 2004 (202 applications). Compared with this figure total patent applications in 2010 stood at approximately 59,200 and were therefore slightly lower than in 2008 and at the same level as in 2004.

Patents relevant to green growth are difficult to identify in detail. They might for example also include patent applications for hybrid vehicles, which reached a total of 692 in 2010 in Germany, compared with 95 in 2004. Other topics could cover waste, waste water, exhaust technology for vehicles – to mention but a few. It should be pointed out that for the interpretation of the figures innovative activity is not always manifested in patents or patent applications. In addition, non-technological inventions may also be significant for green growth, such as changes to town and traffic planning, working models, production or logistic structures and much more.

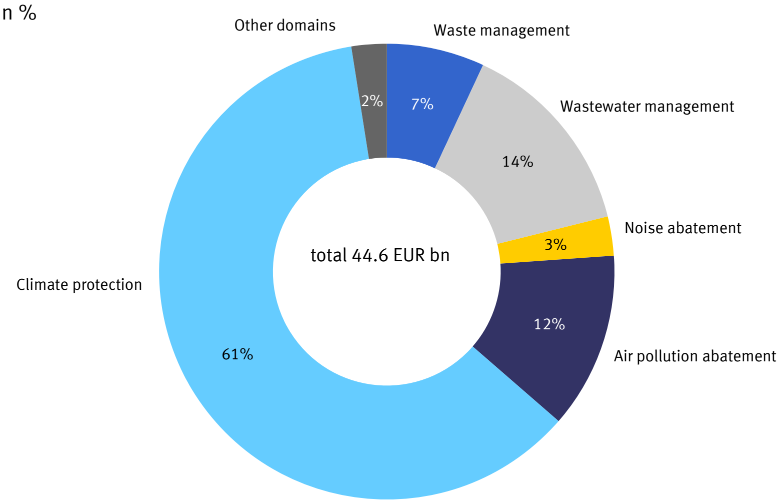
The indicator covers patent applications from German applicants with the German Patent and Trade Mark Office and the European Patent Office without double counting. Renewable energy includes the following: Photovoltaic, wind power generating units, hydropower/wave/tidal, geothermal, biogas, other sources of energy.

Environmental goods and services

4.3 Turnover of goods, construction work and services for environmental protection

Sales of goods and services for environmental protection 2009

in %



The production of environmental goods and services clearly shows the economic opportunities arising from the efforts to achieve environmentally acceptable growth. These opportunities are portrayed using two indicators linked to each other – turnover of goods, construction work and services for environmental protection on the one hand and the number of persons employed in environmental protection on the other hand.

Turnover with environmental goods and services in 2009 totalled approximately EUR 44.6 billion. This corresponds more or less to the production value of German agriculture. The most important environmental sectors with regard to turnover are climate protection (61 % of turnover), followed by prevention of water pollution (14 %) and protection of ambient air (12 %). The most important goods were photovoltaic plants with a turnover of about EUR 8 billion in 2009. Construction work for climate protection amounted to almost EUR 6 billion and turnover of approximately EUR 5 billion was achieved through the production of wind turbines. Emission control systems for vehicles and construction services for the prevention of water pollution each had a turnover of approximately EUR 2.6 billion.

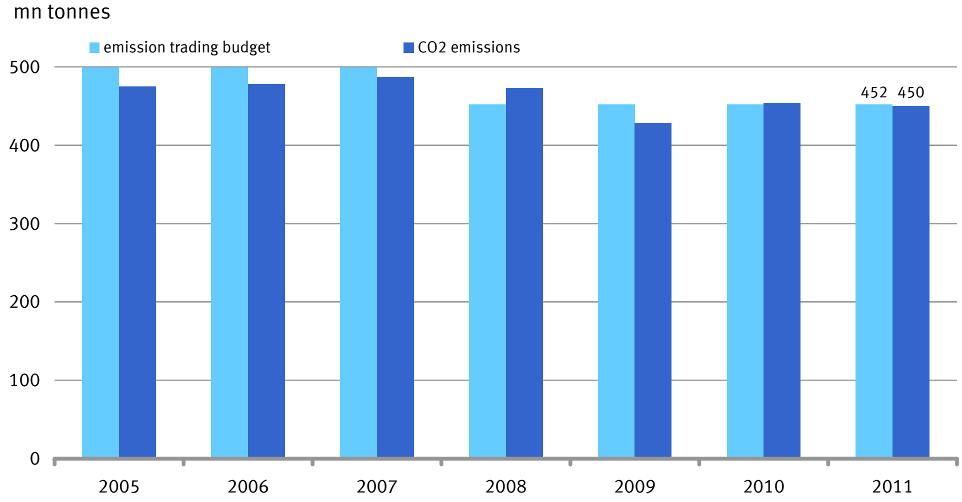
As part of the statistics of the goods, construction work and services for environmental protection, 8,326 companies, corporations and establishments with 180,288 of staff were recorded. The construction industry was particularly labour-intensive with almost 40,000 employees, followed by mechanical engineering (almost 34,000 employees).

If one also includes employees who provide environmental protection services for internal purposes or for the market (e.g. waste and waste water disposal, protection of ambient air, street cleaning, R&D etc.) as well as employees working in the renewable energy sector, then the total comes to approximately 1.9 million or 4.8 % of all persons in employment. The number of “Green Jobs” defined in this way rose by 37 % from 1998 until 2008, corresponding to 521,000 employees. (Source: Report on the Environmental Economy 2011, page 33; DIW Wochenbericht 10/2010, page 5).

International financial flows

4.4 CO_2 emission certificates

Emission trading budget and actual CO_2 emissions of plants liable to emission trading



Source: Federal Environment Agency, German Emissions Trading Authority

Trading of emission certificates is an economic instrument for an efficient reduction of CO_2 emissions. Emission trading was introduced in the EU in 2005. An emissions limit is set for every country (emission trading budget) and corresponding emission rights are allocated according to a certain key to plant operators (energy-efficient plants, plants to produce iron and steel, refineries, cement production etc.) If one plant creates higher emissions than the available emission rights, additional certificates must be purchased.

At the start of emission trading between 2005 and 2007 the CO_2 emission certificates issued in Germany (and therefore the emission limit) were regularly above the actual emissions from the plants that are obliged to participate in emission trading. As of 2008 the emission limit was lowered from the previous 499 million tonnes to 452 million tonnes. This led to emissions being higher in 2008 and 2010 than the total scope of the available certificates. However, in the "crisis year" of 2009 this was not the case and in 2011 emissions were also slightly under the German emission limit at 450 million tonnes.

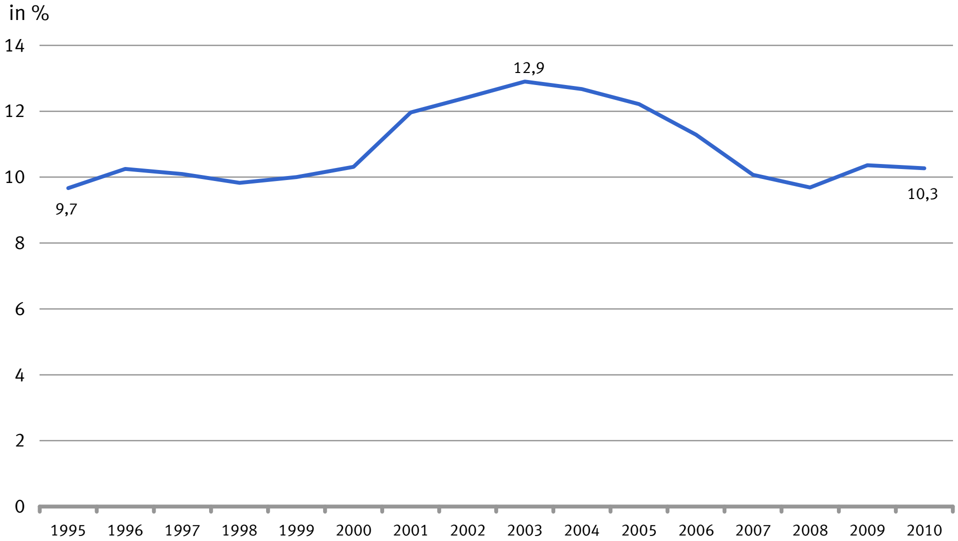
In 2011 the energy sector had a share of 78% of carbon dioxide emissions in German emissions trading with the remaining emissions originating from industrial plant. The industrial sector therefore had a surplus of certifications over emissions from 2008 until 2011, whilst the energy sector had fewer certificates than it required. (Source: Federal Environment Agency, German Emissions Trading Authority)

As of 2012 aircraft operators are obliged to participate in emissions trading, namely for flights flying to or from airports within the European Economic Area. The operators assigned to Germany had emissions of about 52.5 million tonnes. The total emission certificates allocated stood at 41 million tonnes in 2012, so that the need to purchase additional emission certificates is also expected here.

Prices and transfers

4.5 Environmentally related taxation

Share of environment-related taxes in total tax revenue



Environmental taxation – just like trading in emission rights – is one of the economic instruments of environmental policy. Environmental taxes refers to physical units (or a proxy of it), with specific negative impacts on the environment – regardless of the named purpose of the tax or the use of the revenue.

In 2011 the share of environmentally related taxation in total tax revenue stood at 10.0 %, in other words slightly above 1995 when it amounted to 9.7 %. In 2011 revenue from environmentally related taxation totalled to EUR 57.5 billion, compared with EUR 40.2 billion in 1995.

By the so-called “eco tax“ the mineral oil tax rates were increase in stages between 1999 and 2003 and an electricity tax was introduced. During the next few years the share of environmentally related taxation rose continually until a new peak of 12.9 % was reached in 2003. The percentage fell back to 10.1 % again up to 2007 and has since remained at approximately this level. The reasons for the falling share of environmentally related taxation in total tax revenue after 2003 were in particular the decline in the taxed volume of carburettor fuels on the one hand and the simultaneously rising share of diesel fuel on the other hand. The latter is taxed at EUR 0.47 to EUR 0.49 per litre, whilst carburettor fuels incur EUR 0.65 to EUR 0.67 of tax per litre.

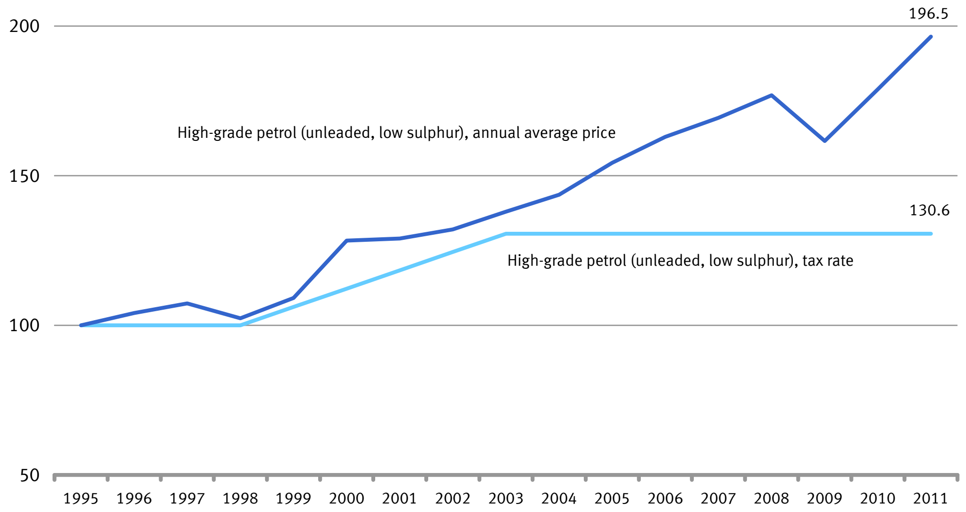
Of total revenue from environmentally related taxation in 2011 EUR 40.0 billion was accounted for by the energy tax (formerly mineral oil tax), EUR 8.4 billion by vehicle tax and EUR 7.2 billion by the electricity tax. Approximately EUR 900 million is earned from the nuclear fuel tax and the aviation tax in each case. The major proportion of environmentally related taxation is associated with road traffic. In 2011 road traffic related tax revenue (on carburettor and diesel fuels as well as vehicle tax) amounted to 74.4 %.

Prices and transfers

4.6 Development of petrol price and petrol taxation

Petrol prices and taxes

1995 = 100



Source: Federal Ministry of Finance, Federal Ministry of Economics and Technology, Federal Statistical Office

Energy supplies are of great importance for an economy (cf. indicator “Energy productivity“[1.3 – 1.5]). Energy prices and their development influence energy consumption and the efficiency of energy usage. Energy taxation on the other hand generally has a direct effect on the energy price.

Since 1995 energy prices have risen considerably more than the tax rates: the average annual price for super grade petrol (including energy and value added tax) rose from EUR 0.79 to EUR 1.56 (+ 96.5 %) between 1995 and 2011, for diesel it was EUR 0.58 in 1995, compared with EUR 1.43 in 2011 (+ 147 %). Light heating oil for households cost almost EUR 0.22 per litre 15 years ago on average, whilst it was nearly EUR 0.82 (+ 272 %) in 2011. As a comparison, during this period the tax rates for super grade petrol rose by just under 31 %, diesel and light heating oil for households were taxed 48 % more.

With effect from 1 April 1999 the so-called “eco tax“ was introduced in Germany. It included a gradual rise in energy taxation by increasing the mineral oil tax rates between 1999 and 2003 and by introducing the electricity tax with the aim of making energy use more efficient and therefore reducing resource usage and lowering environmental pollution. Since 2003 tax rates have remained unchanged and stand at 65.45 Cents per litre for example for sulphur-free super grade petrol and 47.04 Cents for diesel. The tax rate per litre on light heating oil for households comes to 6.1 Cents (cf. Indicator “Environmentally related taxation“ [4.5]).

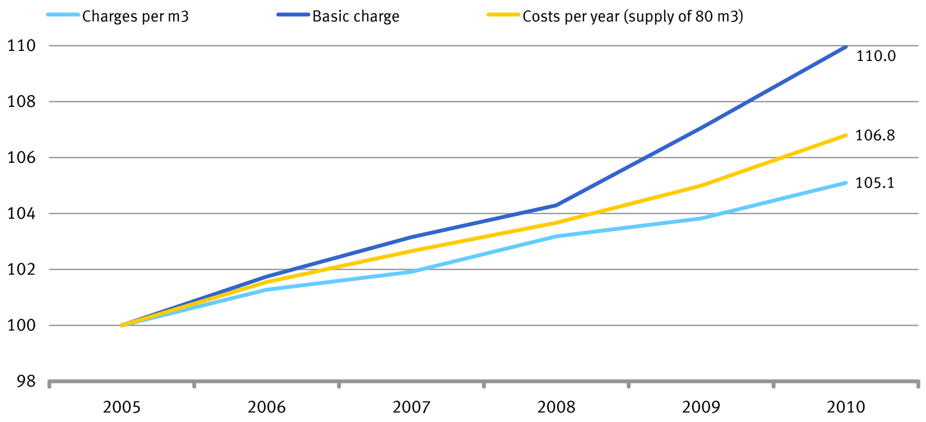
Industry, agriculture and public transport partly pay lower taxes or receive reimbursements on energy taxes. In 2010 for example reimbursements as part of energy tax (mineral tax and electricity tax) for the sectors mentioned amounted to approximately EUR 2.8 billion. Tax revenue during the same year totalled EUR 46.1 billion.

Prices and transfers

4.7 Water pricing

Drinking water charges and costs for private households*

2005 = 100



* Data at reference date 01.01. Costs weighted in relation to inhabitants .

Protecting water as a natural resource and using it in an economically and socially justifiable, efficient manner is one of the central tasks of a green economy. The water price is one possible approach to influence water consumption and the efficient use of water (cf. also Indicator “Water resources“[1.9]).

The price that private households pay per cubic metre of drinking water rose by 5.1 % between 2005 and 2010. The mean price per cubic metre was most recently EUR 1.65. The basic charge to be paid per household rose by 10.0 % during the same period. This meant that the costs of drinking water supply in 2010 for a 2-person model household with average water consumption of 80 m^3 totalled EUR 197.60 p.a., which is 6.8 % more than 5 years earlier.

This nation-wide average fluctuates greatly from region to region. In 2010 for example in Lower Saxony the price for one cubic metre was an average of EUR 1.21, whilst it was EUR 2.17 in Berlin. The annual costs of the model household described ranged from EUR 145.40 in Schleswig-Holstein to EUR 275.93 in Saxony. A comparison at a lower regional level is difficult because the individual federal states and municipalities apply very different charging systems.

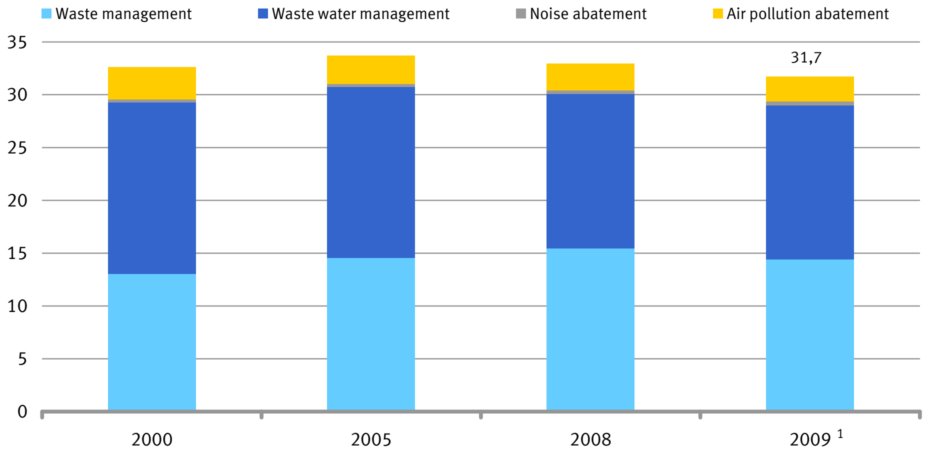
If one also includes waste water disposal, then in 2010 the average annual costs of a sample household stood at EUR 440.99. This is about 8.4 % more than in 2005. The calculations for the model household are based on an annual water consumption of 80 m^3 and a sealed area of 80 m^2. Clear regional differences are also evident here. The highest costs were incurred in Saxony-Anhalt (EUR 589.89 per household per year) and the lowest in Bavaria (EUR 324.26 per household per year).

Prices and transfers

4.8 Environmental protection expenditure

Environmental protection expenditure* 2000 bis 2009

EUR bn



* The following industries are not included: construction, energy and water supply. - 1 Preliminary results.

The efforts of the economy and society to avoid or reduce environmental pollution are reflected in the environmental protection expenditure. Environmental protection expenditure is composed of investment in plants for the protection of the environment as well as current expenditure for their operation, insofar as they are operated by manufacturing industry, as part of public budgets or by privatised public enterprises. This includes the areas of waste disposal, water protection, noise control and protection of ambient air.

In 2009 environmental protection expenditure stood at approximately EUR 31.7 billion, which was almost EUR one billion less than in 2000. The share of this expenditure in gross domestic product declined during this period from 1.6 % to 1.3 %.

The analysis of the expenditure flows according to environmental domain clearly shows the dominance of waste disposal and water protection. Both these domains accounted for approximately 45 % and 46 % respectively in 2009 of total environmental expenditure. The protection of ambient air reached a share of environmental expenditure of 7.4 %. Noise control accounted for 1.1 % of total expenditure.

When differentiated according to investment and current expenditure, clear differences are evident. In 2009 the highest level of investment was accounted for by water protection with 70.6 % of total investment. Waste disposal had a share of 16.0 %. The reverse is true for current expenditure, with more than half being accounted for by waste disposal (54.2 %), followed by water protection (38.8 %) and air protection in manufacturing industry (6.6 %).

When classified according to economic sector, the privatised public companies had the highest expenditure with EUR 19.2 billion, followed by the public budgets (EUR 6.5 billion) and the manufacturing industry (EUR 6.1 billion). Within manufacturing industry metal production and processing, chemicals and mineral oil processing had particularly large shares in the environmental protection expenditure undertaken (between 10 % and 25 % of the expenditure of manufacturing industry).

OECD proposal for a set of Green Growth Indicators[1]

Annex. Proposed list of OECD indicators: Overview by group and by theme

The proposed list of indicators presented below includes:

- M: **Main indicators** (numbered and in bold), and their components or supplements (numbered);
- P: **Proxy indicators** (bulleted) when the main indicators are currently not measurable.

The proposed indicators are to be accompanied with contextual information or additional indicators to accompany the message conveyed.

Each indicator is accompanied with a first evaluation of its relevance for green growth (R), its analytical soundness (S), and the measurability of the underlying data (M). The classifications used for evaluating the indicators are as follows:

Criteria	Classification
Relevance (R)	1 = high 2 = medium 3 = be further reviewed
Analytical soundness (S)	1 = good 2 = average 3 = to be further reviewed
Measurability (M)	S = short term basic data currently available for a majority of OECD countries M = medium term basic data partially available, but calling for further efforts to improve their quality (consistence, comparability, timeliness) and their geographical coverage (number of countries covered) L = long term basic data not available for a majority OECD of countries, calling for a sustained data collection and conceptual efforts.

Proposed list of indicators

The socio-economic context and characteristics of growth		
Economic growth, productivity and competitiveness	**Economic growth and structure** GDP growth and structure , Net disposable income	M
	Productivity and trade Labour productivity; multifactor productivity Trade weighted unit labour costs Relative importance of trade: (exports + imports) / GDP Inflation and commodity prices	M

1 Source: OECD (2011a), Towards Green Growth: Monitoring Progress; OECD Indicators.

Labour markets, education and income	**Labour markets** Labour force participation & unemployment rates				M
	Socio-demographic patterns Population growth, structure & density Life expectancy: years of healthy life at birth Income inequality: GINI coefficient Educational attainment: Level of and access to education				M

Group/theme	Proposed indicators	Type	R	S	M
Environmental and resource productivity					
Carbon and energy productivity	**1. CO_2 productivity**				
	1.1 Production-based CO_2 productivity GDP per unit of energy-related CO_2 emitted	M	1	1	S
	1.2 Demand-based CO_2 productivity Real income per unit of energy-related CO_2 emitted	M	1	2	S/M
	2. Energy productivity				
	2.1 Energy productivity (GDP per unit of TPES)	M	2	1	S
	2.2 Energy intensity by sectors (manufacturing, transport, house-holds, services)	M	2	1	S/M
	2.3 Share of renewable energy in TPES, in electricity production	M	1	1	S
Resource productivity	**3. Material productivity (non-energy)**				
	3.1 Demand based material productivity (comprehensive measure; original units in physical terms) related to real disposable income	M	1	3	M/L
	• Domestic material productivity (GDP/DCM)	P	1	2	S/M
	- Biotic materials (food, other biomas)				
	- Abiotic materials (metallic minerals, industrial minerals)				
	3.2 Waste generation intensities and recovery ratios by sector, per unit of GDP or VA per capita	M	1	1	M/L
	3.3 Nutrient flows and balances (N,P)	M	1	3	L
	• Nutrient balances in agriculture (N, P) per agricultural land area and change in agricultural output	P	2	1	S/M

Group/theme	Proposed indicators	Type	R	S	M
Resource productivity	**4. Water productivity** VA per unit of water consumed, by sector (for agriculture: irrigation water per hectare irrigated)	M	1	1	M
Multi-factor productivity	**5. Multi-factor productivity reflecting environmental services** (comprehensive measure; original units in monetary terms)	M	1	2	M/L
Natural asset base					
Renewable stocks	**6. Freshwater resources** Available renewable resources (groundwater, surface water, national, territorial) and related abstraction rates	M	1	1	S/M
	7. Forest resources Area and volume of forests; stock changes over time	M	1	1	S/M
	8. Fish resources Proportion of fish stocks within safe biological limits (global)	M	1	1	S
Non-renewable stocks	**9. Mineral resources** Available (global) stocks or reserves of selected minerals (tbd): metallic minerals, industrial minerals, fossil fuels, critical raw materials; and related extraction rates	M	1	2	M/L
Biodiversity and ecosystems	**10. Land resources** Land cover types, conversions and cover changes State and changes from natural state to artificial or man-made state	M	1	1	M/L
	• Land use: state and changes	P	1	2	S/M
	11. Soil resources Degree of top soil losses on agricultural land, other land	M	1	2	M/L
	• Agricultural land area affected by water erosion by class of erosion	P	1	2	S/M
	12. Wildlife resources (tbd)				
	• Trends in farmland or forest bird population or in breeding bird populations	P	1	2	S/M
	• Species threat status: mammals, bird, fish, vascular plants in % species assessed or known	P	2	2	S
	• Trends in species abundance	P	1	2	S/M

Group/theme	Proposed indicators	Type	R	S	M
Environmental quality of life					
Environmental health and risks	**13. Environmentally induced health problems & related costs** (e. g. years of healthy life lost from degraded environmental conditions)	M	1	3	L
	• Population exposure to air pollution	P	2	2	S/M
	14. Exposure to natural or industrial risks and related economic losses	M	1	2	L
Environmental services and amenities	**15. Access to sewage treatment and drinking water**	M			
	15.1 Population connected to sewage treatment (at least secondary, in relation to optimal connection rate)		2	2	S/M
	15.2 Population with sustainable access to safe drinking water	–	1	2	S/M
Economic opportunities and policy responses					
Technology and innovation	**16. R&D expenditure of importance to GG**	M	1	1	S/M
	- Renewable energy (in % of energy related R&D)		1	1	S
	- Environmental technologies (in % of total R&D, by type)		1	1	S
	- All purpose business R&D (in % of total R&D)		1	1	S
	17. Patents of importance to GG in % of country applications under the Patent Cooperation Treaty	M	1	1	S/M
	- Environmentally related and all-purpose patents		1	1	S/M
	- Structure of environmentally related patents		1	1	S/M
	18. Environment-related innovation in all sectors	M			
Environmental goods and services	**19. Production of environmental goods and services (EGS)**	M	1	2	S/M
	19.1 Gross value added in the EGS sector (in % of GDP)				
	19.2 Employment in the EGS sector (in % of total employment)				

Group/theme	Proposed indicators	Type	R	S	M
International financial flows	**20. International financial flows of importance to GG** (in % of total flows; in % of GNI)		2	1	L
	20.1 Official Development Assistance		2	1	S
	20.2 Carbon market financing		2	1	S
	20.3 Foreign Direct Investment (tbd)		3	3	L
Prices and transfers	**21. Environmentally related taxation**	M	2	2	S/M
	- Level of environmentally related tax revenues (in % of total tax revenues, in relation to labour related taxes)				
	- Structure of environmentally related taxes (by type of tax base)		2	2	S/M
	22. Energy pricing (share of taxes in end-use prices)	M	1	1	S
	23. Water pricing and cost recovery (tbd)	M	1	2	S/M
	To be complemented with indicators on:				
	• *Environmentally related subsidies (tbd)*		1	3	M/L
	• *Environmental expenditure: level and structure (pollution abatement and control, biodiversity, natural resource use and management)*		2	1	L
Regulations and management approaches	*Indicators to be development*		...	...	...
Training and skill development	*Indicators to be development*		...	...	...

Definitions of the indicators

1.1 CO_2 and greenhouse gas emissions and productivity
Index, 1990 =100

CO_2 productivity = GDP (price-adjusted) / CO_2 emissions

Greenhouse gas productivity = GDP (price-adjusted) / greenhouse gas emissions.

According to the Kyoto Protocol, the following six substances are included as greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide = laughing gas (N_2O), partly halogenated hydrofluorocarbons (HFCs), perfluorocarbons (PFC) and sulphur hexafluoride (SF_6).

Emissions are calculated in accordance with the territorial principle (emissions on German territory, in other words including foreign companies located in Germany and excluding emissions from German companies located abroad). Emissions from land use, land use change and forestry (LULUCF) are not taken into consideration nor are emissions from the use of biomass for energy.

Source for emissions: Federal Environment Agency, ZSE database, source GDP: Federal Statistical Office

For comparison OECD definition (2011a).[1]

Production based CO_2 productivity – GDP generated per unit of CO_2 emitted – and CO_2 intensities per capita for the period 1990 to 2008. The emissions presented here are gross direct emissions, emitted within the national territory and excluding bunkers, sinks and indirect effects. The CO_2 productivity of production informs about the relative decoupling between domestic production and carbon inputs. It also reflects other environmental issues, in particular emissions of greenhouse gases and air pollution that are correlated with the carbon intensity of economic production.

1.2 Energy-related CO_2 emissions depending on supply and use
Million tonnes

In order to calculate the indicator, CO_2 emissions that occur through the use of fossil fuels and motor fuels are used (including the memo-items in the IPCC Inventory / NIR Inventory: Emissions from bunkering from domiciliaries in international shipping and air transport, emissions from biomass (e.g. burning wood or straw); also emissions by German nationals filling up with fuel abroad for travel on the roads). There are methodological differences compared with the calculation method used by the OECD (there e.g. without emissions from bunkering and “fugitive emissions from fuel extraction“. Methodological differences in the allocation of import volumes for exports are also assumed). Energy-related CO_2 emissions are considered to be representative for the (slightly higher) total greenhouse gas emissions (including methane CH_4, laughing gas N_2O, H-FKW / HCF, FKW / PFC and SF_6).

The occurrence of energy-related CO_2 arises from manufacturing in Germany (production-related) and from the production of imports abroad. The calculation of the occurrence of CO_2 for imports is based on specific emission factors for production abroad (that may differ from those used by the OECD; emission factors are currently available for Germany only up to 2007).

The calculations applied here take account of the emissions produced by German companies located abroad but not by foreign companies located in Germany.

1 OECD (2011a), Towards Green Growth: Monitoring Progress; OECD Indicators, p. 54.

For private households direct and indirect consumption are analysed. Emissions occur directly through the use of fuel at home (heating) and when driving private vehicles, indirectly through the use of consumer goods where CO_2 occurred during production (in Germany and abroad, in other words including imports). The calculation gives a total for CO_2 emissions for consumer goods arising from direct use by households and those from abroad (imports) as well as in Germany (domestic production). The per capita calculation of this value can be used as a "CO_2 footprint". (An alternative would for example be to discuss the allocation of a proportion of public consumption, in other words state consumption for individual consumption).

Sources: Federal Statistical Office, Federal Environment Agency

For comparison OECD definition (2011a):[2]

The estimates of CO_2 emissions embodied in final domestic demand are calculated by the OECD using a combination of input-output tables, bilateral trade data and production based CO_2 emissions. The approach uses the bilateral trade data in conjunction with national input-output tables for 47 countries – responsible for 95 % of global GDP and over 85 % of global CO_2 emissions (with an input-output table modelled for the Rest of the World) – to create a global input-output table that shows trade flows in goods and services between countries. This provides a framework that can be used to allocate the flows of CO_2 emitted in producing a product to the final purchaser of that product; irrespective of how many intermediate processes and countries the product passes through before arriving with its final purchaser. Emissions from bunkers and fugitive emissions from fuel extraction are excluded.

1.3 Energy productivity of primary energy consumption
Index, 1990 = 100

Energy productivity = gross domestic product / domestic primary energy consumption. Energy productivity expresses how much gross domestic product (in euros adjusted for price) is generated per unit of primary energy used (in petajoules).

Domestic primary energy consumption is calculated from the sum of all primary energy sources generated domestically and all imported energy sources less energy exports (and excluding offshore bunkering). In terms of use, this is equivalent to total energy used for energy purposes (final energy consumption and own consumption by energy sectors) and for non-energy purposes (e.g. in the chemical industry), losses incurred through domestic energy conversion, flare and line losses, as well as statistical differences reported in energy balance sheets.

1.4 Energy intensity by homogeneous branches
Index, 2000 = 100

Energy intensity = primary energy consumption / gross value added of homogeneous branches (price-adjusted)

In contrast to energy productivity, energy intensity shows how much primary energy had to be used per unit of gross value added. The indicator does not refer to the economy as a whole, but is related to individual production sectors. The energy efficiency of the individual production sectors becomes evident.

For comparison OECD definition (2011a):[3]

Energy productivity (I2.1) and energy intensity (I2.2) by sector (manufacturing, freight transport, passenger transport). Energy productivity, expressed as GDP per unit of total

2 OECD (2011a), loc. cit., p. 58.
3 OECD (2011a), loc. cit., p. 59.

primary energy supply (TPES), and intensities per capita, may reflect, at least partly, efforts to improve energy efficiency and to reduce carbon and other atmospheric emissions. They also reflect structural and climatic factors (see "Interpretation" below). The structure of energy supply is given as a complement.

1.5.1 Share of renewable energies in final consumption
in %

Share of renewable energies in total final energy consumption. Renewable energies include, among others, hydropower, wind power, photovoltaic, solar energy, geothermal energy, as well as biomass and biodegradable portions of domestic refuse. Final energy is generated subject to energy loss through conversion from primary energy and is directly available to the consumer.

1.5.2 Share of renewable energies in electricity consumption
in %

Share of electricity from renewable energy sources (see Indicator 3a of the 2012 Indicator Report on Sustainable Development in Germany) in (gross) electricity consumption (comprising net electricity supply of the country, exchange balance with other countries, own electricity consumption of power plants and grid losses).

For comparison OECD definition (2011a):[4]

Total primary energy supply and productivity Total primary energy supply (TPES) equals production plus imports minus exports minus international marine and aviation bunkers plus or minus stock changes. The world total, international marine and aviation bunkers are not subtracted from TPES. Energy productivity is calculated as the amount of revenue (GDP here) generated per unit of energy used (TPES here).

Energy use by sector and end-use. These indicators, developed from an updated and expanded IEA database, describe energy use across three main end-use sectors in IEA countries: manufacturing (in megajoule per USD of value added), passenger transport (in megajoule per passenger-km) and freight transport (in megajoule per tonne-km). These indicators make it possible to examine how changes in energy efficiency, economic structure, income, prices and fuel mix have affected recent trends in energy use and CO_2 emissions. Share of renewable energy sources in TPES and in electricity generation.

Renewables include hydro, geothermal, solar, wind, tide/wave/ocean energy, as well as combustible renewables and waste.

Geothermal is the energy available as heat emitted from within the earth's crust, usually in the form of hot water or steam. It can be used directly as heat for district heating, agriculture, etc., or to produce electricity. Unless the actual efficiency of the geothermal process is known, the quantity of geothermal energy entering electricity generation is inferred from the electricity production at geothermal plants assuming an average thermal efficiency of 10 %.

Solar includes solar thermal and solar photovoltaic (PV). The quantities of solar PV entering electricity generation are equal to the electrical energy generated. Direct use of solar thermal heat is also included.

Tide, wave and ocean represents the mechanical energy deriving from tidal movement, wave motion or ocean current and exploited for electricity generation. The quantities entering electricity generation are equal to the electrical energy generated.

4 OECD (2011a), loc. cit.

Wind represents the kinetic energy of wind exploited for electricity generation in wind turbines. The quantities entering electricity generation are equal to the electrical energy generated.

Combustible renewables and waste comprises solid biomass, liquid biomass, biogas, industrial waste and municipal waste. Biomass is defined as any plant matter used directly as fuel or converted into fuels (e.g. charcoal) or electricity and/or heat. Included here are wood, vegetal waste (including wood waste and crops used for energy production), ethanol, animal materials and/or wastes, and sulfite lyes (i.e. black liquor). Municipal waste comprises wastes produced by the residential and commercial and public service sectors (which are collected by local authorities for disposal in a central location for the production of heat and/or power).

N. B. The methodology used to calculate the TPES correspondent to a given amount of final energy has important implications on the respective share of each contributing energy source. This is particularly true for calculation of the shares of renewable energy sources. The IEA Secretariat uses the "physical energy content" methodology to calculate TPES. For combustibles, TPES is based on the net calorific value of the fuels. For other sources, the IEA assumes an efficiency of 10 % for geothermal electricity, 33 % for nuclear, 50 % for geothermal heat and 100 % for hydro, wind and solar PV. As a result, for the same amount of electricity produced, the TPES calculated for combustible renewables will be several times higher than the TPES for hydro, wind or solar PV.

1.6 Material productivity
Index, 1994 = 100

Material productivity sets gross domestic product in relation to non-energy domestic material consumption. The domestic extraction of resources and of the imported goods (resources, semi-finished and finished products) minus the exported goods is included. In order to avoid any overlaps with energy productivity (cf. Indicator 1.3 – 1.5), the energy sources as well as semi-finished and finished products from energy sources remain excluded. The indicator presented here has several differences from that used in the German sustainability strategy, which is based on abiotic direct material input. The latter includes the extraction and import of abiotic raw materials and goods and therefore also includes energy raw materials, but no biotic materials; in addition exports are not offset. It should be noted that in the calculation of productivities the total income from economic activity is related exclusively to the relevant production factor, although the product arises from the interaction of all the production factors.

1.7 Waste generation (municipal waste) per capita
kg per inhabitant

The waste balance sheet summarises the results of various waste statistics using a mathematical model (in accordance with Sections 3 (1), 4 no. 2, 5 (1) of the German Environmental Statistics Act – UStatG). The waste balance sheet uses the following arithmetic:

Municipal waste
\+ Waste from extraction and processing of natural resources
\+ Construction and demolition waste
\+ Other waste
= *Net generation*
\+ Waste from waste processing plants (secondary waste)
= Total waste generation

Source: Federal Statistical Office: Erläuterungen zur Abfallbilanz, April 2012

1.8 Nitrogen surplus, herbal biomass and value added in agriculture
Index, 1991 = 100

Nitrogen surplus in kilogram per hectare of land used for agriculture, calculated from nitrogen input (from fertilisers, atmospheric deposition, biological nitrogen fixation, seed and plant material, feedstuff from domestic production and from imports) minus nitrogen output (through crop and animal market products leaving the agricultural sector). The overall balance is calculated on the basis of the "farm-gate model". Nitrogen flows in the domestic cycle – with the exception of domestic feed production – are not shown.

The moving three-year average is calculated from the total balance of the given year, the previous year and the following year.

1.9 Water intensity by homogeneous branches
Index, 2000 = 100

Water intensity = water use / gross value added of homogeneous branches (price-adjusted).

Water use in the production sectors is set in relation to their economic output. The indicator does not refer to the economy as a whole, but is related to individual production sectors. The energy efficiency of the individual production sectors becomes evident.

2.1 Water use by homogeneous branches
Index, 2000 = 100

Irrespective of its economic significance, the water use of the production sectors and private households and their change becomes evident.

2.2 Forest resources: percentage of total land area, area per capita, volume of standing timber

The term 'forest area' (in hectares) is defined in the German Federal Forest Inventory (BWI) and/or in Section of the German Federal Forests Act (BWaldG) and its substantiation in the Implementation Regulation for the Federal Forest Inventory (VwV-BWI II). Data collection is based not on the actual land use but the canopy cover (international approach). The area category includes all areas stocked with forest trees with a minimum canopy cover of the ground area of 10 %, a minimum height at maturity of 5 m and a minimum area of 0.5 ha (including special cases such as young trees, openings resulting from human intervention and natural disasters, forest roads, forest aisles etc.). Forests in national parks and other protected areas are also included. Areas with largely agricultural use, including Christmas tree cultivation or rapid growth plantations, are excluded. The forest area category includes the categories of "timber floor" (at least 50 % stocked with trees) and „non-timber floor" (without forest trees, but directly associated with forestry use, e.g. forest paths wider than 5 m, timber yard and building areas amongst other things).

For methodological reasons the figures used for the forest area for this indicator are not identical to those of the official area statistics (that were used for Indicator 2.4).

Sources: Julius Kühn Institute and Federal Statistical Office (Land survey; Forest Economic Accounting)

For comparison OECD definition (2011a):[5]

Forest area refers to land spanning more than 0.5 hectare and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. This excludes woodlands or forest predominantly under agricultural or urban land use and used only for recreation purposes.

The total forest stock (in million m^3 over bark, solid cubic metres) generally refers to the forest areas (cf. Indicator 2.2.1; only for "wood extraction" can the area category in addition to forest also be "other land"). In Germany information on standing timber is traditionally shown in the unit "solid cubic metres merchantable wood over/with bark" (Vfm m.R.), whereby "merchantable wood" describes the total biomass above ground as of a diameter (at chest level as well as at the "weak end") of 7 cm with bark.

Sources: Julius Kühn Institute and Federal Statistical Office (Forest Economic Accounting)

For comparison OECD definition (2011a):[6]

Growing stock: Volume over bark of all living trees more than X cm in diameter at breast height (or above buttress if these are higher). Includes the stem from ground level or stump height up to a top diameter of Y cm, and may also include branches to a minimum diameter of W cm.

2.3 Fish resources: supply, domestic use and per-capita consumption of seawater and freshwater animals

1 000 tonnes (catch weight)

The figures include domestic fish (from rivers, lakes, ponds, aquaculture) and marine animals (fish, crabs, mussels from offshore and coastal fishing).

The volume in the German industry includes landings in Germany and abroad and imports. The figures for landings do not include by-catches (that is thrown back overboard immediately). Landings abroad should be considered to be exports for trade reasons. However, they are an expression of the pressure stemming from the German fishing fleet on stocks. Foreign landings are deducted from the stock in order to determine domestic consumption.

Source: Statistical Yearbook of the Federal Ministry of Food, Agriculture and Consumer Protection, several years.

For comparison OECD definition (2011a):[7]

Fish stocks within safe biological limits: The proportion of fish stocks exploited within their level of maximum biological productivity, i.e. stocks that are underexploited, moderately exploited, and fully exploited. Safe biological limits are the precautionary thresholds advocated by the International Council for the Exploration of the Sea (ICES). The stocks assessed are classified on the basis of various phases of fishery development: underexploited, moderately exploited, fully exploited, overexploited, depleted and recovering.

Fish catches and production in aquaculture: Fish catches are expressed as % of world captures and changes in total catches since 1979-81. To capture fisheries in inland and marine waters, including freshwater fish, diadromous fish, marine fish, crustaceans, molluscs and miscellaneous aquatic animals; excludes aquaculture.

5 OECD (2011a), loc. cit.
6 OECD (2011a), loc. cit.
7 OECD (2011a), loc. cit.

The data cover capture fisheries and aquaculture in fresh, brackish and marine waters.

2.4 Land resources: land use changes (housing and transport area, agricultural land, forests, water surface

Index, 1992 = 100

The housing and transport area is composed of the following types of use: building and adjacent open area, operating area (excluding exploitation area), recreation area, cemetery.

Average daily increase in land use for housing and transport: Determination by the division of the increase in land use for housing and transport (in hectares) in a defined period of time (one year or four years) by the number of days (365/366 or 1,461). The moving four-year average is determined in each case by the development of land use for housing and transport in the relevant year and the preceding three years. The data for one year is currently influenced by external effects (the public land survey registers are being reorganised), so that the moving four-year average gives a better picture.

Source: Federal Statistical Office, Fachserie 3, Reihe 5.1, (2011), "Bodenfläche nach Art der tatsächlichen Nutzung"

For comparison OECD definition (2011a):[8]

Land use: Arable and permanent crop land refers to (i) all land generally under rotation, whether for temporary crops or meadows, or left fallow (less than five years), and (ii) land under permanent crops, i.e. crops that occupy land for a long period and do not have to be planted for several years after each harvest. Pastures refer to permanent grassland, i.e. land used for five years or more for herbaceous forage, either cultivated or growing wild.

Forest land refers to land spanning more than 0.5 hectare and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. This excludes woodland or forest predominantly under agricultural or urban land use and used only for recreation purposes.

Other land includes built-up and related land, wet open land, and dry open land, with or without vegetation cover. Areas under inland water bodies (rivers and lakes) are excluded.

Land use change: This indicator relates to the change over time of the distribution of land uses within a country. Land use is characterised by the arrangements, activities and inputs that people undertake in a specific land cover type to produce, change or maintain it. Unit of observation is proportion of each category of land use changed to another land use over a given period of time. Land use defined in this way establishes a direct link between land cover and the actions of people in their environment.
A given land use may take place on one, or more than one, piece of land and several land uses may occur on the same piece of land. By this definition, land use provides a basis for analysis of social, economic and environmental characteristics and allows distinctions between land uses, where required.

Land cover change and soil sealing: Land cover change presents information on distribution of land-cover types across the total terrestrial area, agricultural and natural. Soil sealing relates to covering the soil surface by impervious materials and changing the nature of the soil into an impermeable medium.

8 OECD (2011a), loc. cit.

2.5 Diversity of species using breeding bird species as an example
Index, 2015 = 100

The indicator is determined based upon the development of the stocks of 59 bird species which represent different types of landscape and habitat in Germany (farmland, forest, settlements, inland waters, coasts and seas and the Alps). This indicator also indirectly reflects the development of a number of other species in the landscape and sustainability of land use, since there are also other species besides birds that rely on a richly structured landscape with intact, sustainably used habitats. A body of experts has determined target population values for 2015 for each individual species, which could be reached if the European and national legal provisions relating to nature conservation and the guidelines on sustainable development are implemented quickly. Every year a value for the overall indicator is calculated based on the degree to which the goals for all 59 bird species have been achieved.

For comparison OECD definition (2011a):[9]

Threatened species: “Threatened” refers to the “endangered”, “critically endangered” and “vulnerable” species, i.e. species in danger of extinction and species soon likely to be in danger of extinction. Data cover mammals, birds, fish, reptiles, amphibians and vascular plants. Other major groups (e.g. invertebrates, fungi) are not covered at the present time.

Protected areas: Protected areas, i.e. areas under management categories I to VI of the World Conservation Union (IUCN) classification that refer to different levels of protection, and protected areas without a specific IUCN category assignment. Categories I and II (wilderness areas, strict nature reserves and national parks) reflect the highest protection level.

Global wild bird index (under development): The global wild bird index (WBI) is an average trend in a group of species suited to track trends in the condition of habitats. A decrease in the WBI means that the balance of species’ population trends is negative, representing biodiversity loss. If it is constant, there is no overall change. An increase in the WBI means that the balance of species’ trends is positive, implying that biodiversity loss has halted. However, an increasing WBI may, or may not, always equate to an improving situation in the environment. It could in extreme cases be the result of expansion of some species at the cost of others, or reflect habitat degradation. In all cases, detailed analysis must be conducted to interpret accurately the indicator trends. The composite trend can hide important trend patterns for individual species.

3.1 Hazard to human health posed by ozone
Number of days threshold values are exceeded

The indicator states on how many days of the year the 8-hour average of 120 µg/m³ was exceeded. The measurements are taken in four different types of area (rural, background; suburban, background; urban, background; urban, traffic-oriented). In order to take account of the meteorological variability of individual years during a long-term review, the figure is given over a period of 3 years.

The threshold serves to protect human health. For 2010 the ozone concentration should not exceeded the threshold value more often than 25 times per calendar year (as a three-year average) and then until 2020 not at all on any day. The concentration of near-ground ozone was monitored in 2010 in Germany at 253 measuring stations by the Federal Government and the German Laender.

Source: Federal Environment Agency, Core Indicator System (KIS) Environment

9 OECD (2011a), loc. cit.

For comparison OECD definition (2011a):[10]

Population exposure to pollution by ozone (Europe): Population weighted yearly sum of maximum daily 8-hour mean ozone concentrations above a threshold (70 microgram Ozone per m^3) at urban background stations in agglomerations. Based on calculations by the European Environment Agency.

3.2 Hazard to human health posed by fine particulate matter

Number of days threshold values are exceeded

Source: Federal Environment Agency, Core Indicator System (KIS) Environment

For comparison OECD definition (2011a):[11]

Population exposure to pollution by fine particulates (Europe): Population weighted annual mean concentration of fine particulate matter (PM10, i.e. particulates whose diameter is less than 10 micrometers) at urban background stations in agglomerations. Based on calculations by the European Environment Agency.

3.3.1 Sewage: residents connected to the public sewage system and municipal or private sewage treatment plants

in %

The public sewage system is said to mean the pipelines that are exclusively to collect and channel away waste water (drain water and/or rainwater). Drain water and rainwater are channelled away together in a combined waste water sewer.

In waste water treatment a distinction is primarily made between mechanical and biological processes. In mechanical waste water treatment plants (without biological treatment) undissolved material from waste water is removed using mechanical processes. In biological plants the removal of undissolved contaminants, colloides and particulate matter from waste water takes place through aerobic and/or anaerobic decomposition, the construction of new cell substances and absorption of bacterial flakes or biological lawns, e.g. in aeration and percolating filter plants. There may subsequently be more extensive processes to purify waste water, e.g. phosphate reduction, nitrification, denitrification.

Drain, infiltration and precipitation water together provide the annual waste water volume.

For comparison OECD definition (2011a):[12]

Population connected to waste water treatment plants: "Connected" means actually connected to a waste water treatment plant through a public sewage network. Individual private treatment facilities such as septic tanks are not covered. Primary treatment refers to a physical and/or chemical process involving settlement of suspended solids, or other process in which the BOD5 of the incoming wastewater is reduced by at least 20 % before discharge and the total suspended solids of the incoming wastewater are reduced by at least 50 %. Secondary treatment refers to a process generally involving biological treatment with a secondary settlement or other process, resulting in a BOD removal of at least 70 % and a COD removal of at least 75 %. Tertiary treatment refers to treatment of nitrogen and/or phosphorous and/or any other pollutant affecting the quality or a specific use of water: microbiological pollution, colour etc. The optimal connection rate is not necessarily 100 per cent; it may vary among countries and depends on geographical features and on the spatial distribution of habitats.

10 OECD (2011a), loc. cit.
11 OECD (2011a), loc. cit.
12 OECD (2011a), loc. cit.

Population using an improved sanitation facility: Population with access to facilities that hygienically separate human excreta from human waste. Improved facilities include flush/pour flush toilets or latrines connected to a sewer, -septic tank, or -pit, ventilated improved pit latrines, pit latrines with a slab or platform of any material which covers the pit entirely, except for the drop hole and composting toilets/latrines. Definitions and a detailed description of these facilities can be found at the website of the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation at *www.wssinfo.org*

3.3.2 Drinking water: proportion of the population with public water delivery and per capita water usage

in %

The indicator takes account of the water supplied to end-users. End-users are private households (including tradesmen and small businesses), commercial companies (manufacturing industry, trade, transport, services) and other consumers (e.g. hospitals and schools, public authorities and municipal facilities, German Federal Armed Forces, agricultural enterprises and for public purposes), for which the public water supply companies charge for the volume of water supplied directly or indirectly.

Surface water means natural or artificial bodies of water above ground (river, lake and dam water) as well as enriched ground water.

Source: Federal Statistical Office, FS 19 R 2.1 Öffentliche Wasserversorgung und Abwasserbeseitigung 2007, (cf. also Federal Statistical Office, press release No. 377 of 2 September 2009)

For comparison OECD definition (2011a):[13]

Population using an improved drinking water source: Population using any of the following types of water supply for drinking: piped water into dwelling, plot or yard; public tap/standpipe; borehole/tube well; protected dug well; protected spring; rainwater collection and bottled water (if a secondary available source is also improved). It does not include unprotected well, unprotected spring, water provided by carts with small tanks/drums, tanker truck-provided water and bottled water (if the secondary source is not an improved source) or surface water taken directly from rivers, ponds, streams, lakes, dams, or irrigation channels. Definitions and a detailed description of these facilities can be found at *www.wssinfo.org*

4.1 Government expenditure on research and development in the fields of environment and energy

EUR million

This includes all expenditure from the public budgets of the Federal Government and the German federal states, both for institutions (e.g. institutional support for research establishments) or project support programmes (e.g. research contracts to companies, institutions of higher education, research establishments), insofar as it is used for research in the fields of the environment or energy. It also includes funds spent abroad.

For more detailed comments, please refer to*: http://epp.eurostat.ec.europa.eu*

4.2 Patent applications in selected areas of renewable energy

Number

The indicator covers patent applications in selected areas of renewable energy from German applicants with the German Patent and Trade Mark Office and the European

13 OECD (2011a), loc. cit.

Patent Office without double counting. Renewable energy includes the following: Photovoltaic, wind power generating units, hydropower/wave/tidal, geothermal, biogas, other sources of energy.

4.3 Turnover of goods, construction work and services for environmental protection
EUR billion

Turnover of goods, construction work and services for environmental protection. Environmental protection includes the sectors of climate protection, the waste industry, protection for bodies of water, noise control, nature conservation and preservation of the countryside, air purity, soil decontamination (Source: Federal Statistical Office, FS 19, R. 3.3, 2009, p. 6).

In more detail the companies and organisations in the following economic sectors are included:

- mining and the extraction of stone and earth;
- manufacturing;
- energy supply;
- water supply; waste water and waste disposal and removal of environmental pollution;
- construction industry;
- architectural and engineering offices;
- institutions and establishments undertaking technical, physical and chemical investigations, consultancy;
- reports and project management;
- other services. (Source: as above, page 5).

4.4 CO_2 emission certificates
Million Tonnes

CO_2 emission certificates issued are compared (and therefore the ceiling) with the actual emissions from plants that are obliged to be involved in emissions trading. The emission certificates are partly allocated free of charge and partly auctioned. An emission certificate entitles the holder to the emission of one tonne of CO_2 emissions. If the volume of emission authorisations required for the emission is higher for a plant/operator than the available number of certificates, authorisations must be purchased additionally. Conversely the certificates can be sold. Settlement must take place by 30 April of the following year.

Aircraft operators are obliged to participate in emissions trading only as of 2012 and then for flights that land or take off within the European Economic Area. However, they must already report their emissions for 2010 and 2011. This information is not included in the indicator/chart.

Emission authorisations can also be carried over from one period to another under certain conditions. Cf. “Position“ of the Federal Environment Agency of 29 February 2012 “Wahl zwischen Stillstand oder Aufbrauch – warum die EU ihr Klimaziel 2020 jetzt erhöhen muss” (*Choice between standstill or exhaustion – why the EU must now increase its 2020 climate target*), page 5:

“... According to the regulations in the EU 2009 Climate and Energy Package (cf. above) these surplus emission authorisations can be transferred from the EU-ETS during the period 2008-2012 into the third EU emission trading period. In addition companies in the EU-ETS can to a limited extent transfer credits from climate protection projects (Joint Implementation – JI), as well as mechanisms for environmentally acceptable development (Clean Development Mechanism – CDM) into the third trading period. In accordance with the Emission Trading Directive, the precise level of the expanded opportunities for use depends partly on the actual emissions and partly on the EU legislative enactment procedure still envisaged in the Emission Trading Directive. ...“

4.5 Environmentally related taxation
in % of total taxes

Environmentally related taxation refers to a physical unit (or a proxy of it), with a specific negative impact on the environment – regardless of the named purpose of the tax or the use of the revenue. For Germany the energy tax (the former mineral oil tax), the electricity tax and the motor vehicle tax are included in environmentally related taxation. Since 2011 nuclear fuel tax and aviation tax are also included. The truck toll is not included in the environmentally related taxation.

4.6 Development of petrol price and petrol taxation
Index, 1995 = 100

The development of the petrol price and petrol taxation is shown for example as the annual average price and tax rate per litre of super grade petrol.

Sources: Federal Ministry of Finance, Federal Ministry of Economics and Technology

4.7 Water pricing
Index, 2005 = 100

4.8 Environmental protection expenditure
EUR billion

Environmental protection expenditure is composed of investment in plants for the protection of the environment as well as current expenditure for their operation, insofar as they are operated by manufacturing industry, as part of public budgets, or by privatised public enterprises. This includes the areas of waste disposal, water protection, noise control and protection of ambient air. The sectors of nature conservation, soil decontamination, climate protection as well as reactor safety and radiation protection are not included in the calculations. Data are shown in current prices.

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