

ECONOMIC COMMISSION FOR EUROPE

COMMITTEE ON ENVIRONMENTAL POLICY

Working Group on Environmental Monitoring and Assessment

REVISED GUIDELINES FOR THE APPLICATION OF ENVIRONMENTAL INDICATORS IN EASTERN EUROPE, CAUCASUS AND CENTRAL ASIA¹

INTRODUCTION

Environmental indicators are a key tool for environmental assessment and reporting. Appropriately chosen indicators based on sufficient time-series data can show key trends, help describe causes and effects of environmental conditions, and make it possible to track and evaluate policy implementation.

The countries of Eastern Europe, Caucasus and Central Asia (EECCA) currently use a wide variety of environmental indicators when publishing state-of-the-environment reports and environmental statistics compendiums. The involvement of the EECCA countries in the preparation of the Europe's environment: the third assessment report (*Kiev Assessment*) for the Fifth Ministerial Conference "Environment for Europe" (May 2003) triggered their interest in the development of an agreed set of indicators. Consequently, EECCA experts within the UNECE Working Group on Environmental Monitoring and Assessment, in close cooperation with the European Environment Agency (EEA), selected a core set of environmental indicators for application in EECCA.

To make the core set of EECCA environmental indicators operational, the Working Group agreed to prepare practical guidelines for their application. The resulting guidelines cover indicators that were classified by EECCA countries as top priority from the viewpoint of both national and international requirements, as understandable to the public and as supported, to the extent possible, by international methodological guidance. Presence on other international indicator lists was an important additional selection criterion. It relates to:

- (a) Sustainable development indicators of the United Nations Commission on Sustainable Development (CSD);
- (b) The indicators from the United Nations Statistics Division (UNSD)/United Nations Environment Programme (UNEP) Questionnaire on Environment Statistics;
- (c) The indicators for the second environmental performance reviews (EPR) under the UNECE review programme;
- (d) *Kiev Assessment* indicators and the EEA core set of indicators; and
- (e) World Health Organization (WHO)/Europe proposals for a core set of European environmental health indicators.

The list of guideline indicators presented in section I demonstrates the relevance of each

¹ Prepared by the secretariat with the assistance of its consultants on the basis of documents CEP/AC.10/2005/4, annex II and ECE/CEP/AC.10/2006/6 to /10 taking into account comments received and the discussions held at the sixth session of the Working Group on Environmental Monitoring and Assessment (12-14 June 2006, Geneva).

indicator to other international indicator sets. Depending on their role in the assessment of the issue, indicators are classified according to the DPSIR framework: Driving forces (D) – Pressures (P) – State (S) – Impact (I) – Responses (R).

The guidelines highlight the importance of the environmental issue for which the indicator has been designed, make reference to international targets that the indicator should concretize, specify requirements for measurements and data collection to support the indicator, and provide references to internationally agreed methodologies, monitoring standards, calculation methods, databases, useful literature and Internet sites.

It is expected that the guidelines will help (a) to improve environmental reporting in EECCA countries; (b) to make their national environmental assessments comparable among themselves and with those of countries covered by the networks of the EEA; and (c) to facilitate data gathering for future regional environmental reports.

The guidelines are intended for use primarily by officials (civil servants, planners, statisticians, etc.) in government agencies in the EECCA countries who have responsibility for environmental assessment, reporting and the publication of statistical compendiums or bulletins. They might also be of interest to other parties in the EECCA countries, such as business and industry, academics and non-governmental organizations (NGOs), as well as to other UNECE countries.

To assist EECCA Governments in adapting national systems of environmental monitoring and data collection to the requirements of the Guidelines on the Application of Environmental Indicators, the Working Group on Environmental Monitoring and Assessment prepared a set of recommendations (ECE/CEP/AC.10/2006/26annex). The recommendations address the legal and regulatory basis, institutional arrangements, training of experts, information management, data access and publication as well as international cooperation issues.

I. KEY ENVIRONMENTAL INDICATORS FOR EASTERN EUROPE, CAUCASUS AND CENTRAL ASIA

INDICATORS	DPSIR	EPR indicators	UNSD/UNEP environment statistics questionnaire	WHO/Europe environmental health indicators	CSD indicators	"Kiev" indicators	EEA core set of indicators
A. Air pollution and ozone depletion							
1. Emissions of pollutants into the atmospheric air	P	X	X	X		X	X ^{1/}
2. Air quality in urban areas	S/I	X	X ^{2/}	X ^{3/}	X		X ^{4/}
3. Consumption of ozone-depleting substances	P	X			X	X	X
B. Climate change ^{5/}							
4. Greenhouse gas emissions	P/R	X	X		X	X	X
C. Water ^{6/}							
5. Renewable freshwater resources	S	X	X				X
6. Freshwater abstraction	P	X	X ^{7/}		X ^{8/}	X	X
7. Household water use per capita	P	X					X
8. Water losses	R		X				
9. Reuse and recycling of freshwater in manufacturing industries	R		X				
10. Drinking-water quality	I			X			
11. BOD and concentration of ammonium in rivers	S	X	X		X	X	X
12. Nutrients in freshwater	S	X	X			X	X
13. Nutrients in coastal waters	S		X				X
14. Non-treated urban wastewater	R	X	X				
D. Land ^{9/}							
15. Land uptake	I	X ^{10/}	X ^{10/}		X ^{10/}		X ^{11/}
16. Area affected by soil erosion	S	X	X		X	X	
E. Biodiversity ^{12/}							
17. Protected areas	R	X			X	X	X
18. Forest and other wooded land	S	X	X ^{13/}		X		
19. Threatened and protected species	S/R	X					X
20. Trends in abundance and distribution of selected species	S/R				X		X ^{14/}
F. Agriculture ^{15/}							

^{1/} Subdivided into three indicators: emissions of acidifying substances, emissions of ozone precursors, and emissions of primary particulates and secondary particulate precursors.

^{2/} Annual mean concentrations of SO₂, NO₂ and PM₁₀ in ambient air in cities and at background sites.

^{3/} Population-weighted urban annual average concentration of NO₂, PM₁₀, PM_{2.5}, SO₂. Distribution of daily O₃.

^{4/} Supplemented by the indicator of exceedance of air quality limit values in rural areas.

^{5/} The EEA list also includes the following two indicators: atmospheric greenhouse gas concentrations; global and European temperature.

^{6/} The EEA list also includes the following indicators: bathing water quality; chlorophyll in transitional coastal and marine waters. Both the EEA and WHO/Europe lists include the indicator of percentage of national population connected to wastewater treatment.

^{7/} Also by surface and groundwater, separately.

^{8/} As percentage of renewable freshwater resources only.

^{9/} The EEA list also includes the indicator progress in management of contaminated sites.

^{10/} Land use.

^{11/} By transport infrastructure and urban development only.

^{12/} The EEA list also includes three indicators under Fisheries: status of marine fish stocks, aquaculture production and fishing fleet capacity.

^{13/} Total area only.

^{14/} Indicator of Species diversity focuses on selected common birds related to farmlands, woodlands and wetlands.

INDICATORS	DPSIR	EPR indicators	UNSD/UNEP environment statistics questionnaire	WHO/Europe environmental health indicators	CSD indicators	"Kiev" indicators	EEA core set of indicators
21. Fertilizer consumption	P	X			X	X	
22. Pesticide consumption	P	X			X	X	
G. Energy ^{16/}							
23. Final energy consumption	D	X			X		X
24. Total energy consumption	D	X				X	X
25. Total energy intensity	R	X			X	X	X
26. Renewable energy consumption	R				X	X	X
H. Transport ^{17/}							
27. Passenger transport demand	D/R	X		X	X	X	X
28. Freight transport demand	D	X		X		X	X
29. Composition of road motor vehicle fleet by fuel type	D	X				X	
30. Average age of road motor vehicle fleet	D			X			
31. Road traffic accidents, mortality and injury rate	I	X		X			
I. Waste							
32. Waste generation	D/P/R	X	X ^{18/}		X ^{19/}	X	X ^{20/}
33. Transboundary movements of hazardous wastes	D/R	X		X			
34. Waste recycling	R	X		X ^{21/}	X	X	X ^{22/}
35. Final waste disposal	P/R			X		X	

Note: DPSIR: Driving forces (D) - Pressure (P) - State (S) - Impact (I) – Response (R)

^{15/} EEA lists the following indicators: gross nutrient balance, area under organic farming.

^{16/} EEA also lists the indicator renewable electricity.

^{17/} EEA also lists the indicator use of cleaner and alternative fuels.

^{18/} Covers also waste from agriculture and forestry, and from other activities.

^{19/} Excluding total waste generation.

^{20/} Municipal and packaging waste only.

^{21/} Municipal and hazardous waste by volume.

^{22/} Recycling of packaging waste only.

II. DESCRIPTION OF INDICATORS

A. Air pollution and ozone depletion

1. *EMISSIONS OF POLLUTANTS INTO THE ATMOSPHERIC AIR*

General description

Brief definition: Emissions of sulphur dioxide (SO₂), nitrogen oxides (NO_x), ammonia (NH₃), particulate matter (PM₁₀, PM_{2.5} and total suspended particulates (TSP)), non-methane volatile organic compounds (NMVOCs), persistent organic pollutants (POPs including polychlorobiphenils (PCBs), dioxins/furans and polycyclic aromatic hydrocarbons (PAHs)) and heavy metals (cadmium, lead and mercury): total and by sectors; comparison of the present values with targets (if any) and with emission projections (if available).

Unit of measurement: Thousands of tons (Gg) of each pollutant a year. For cross-country comparisons, the indicator may be presented also in tons of emissions per km² of the country's territory or kilograms per capita. In the case of comparison with target, percentage is used.

Environmental policy relevance

Purpose: The indicator provides a measure of existing and expected pressure on the environment in terms of emissions of harmful substances into the atmospheric air and "distance to target" (if any).

Issue: The above-mentioned pollutants are known for their adverse effects on human health and ecosystems. Some of these pollutants are eroding technical infrastructures as well. Emissions of NO_x and NMVOC are mainly responsible for the formation of ground-level ozone, which has adverse effects on human health and plants. The indicator is important for the identification and the assessment of the atmospheric air pollution originating in the country and the input of particular sectors like energy, transport, industrial processes, agriculture and waste management. On the basis of this indicator, public authorities can adjust the national environmental policy by, for instance, revising emission standards and emission limit values, strengthening licensing and permitting of potentially polluting activities and improving the application of economic instruments, while the public should be informed in an understandable form of the status of the problem and the ways of settling it. Information on pollutant emissions is also necessary for the assessment of transboundary air pollution and for the international cooperation on this problem.

International agreements and targets: The UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP) commits its Parties to preventing, controlling, reducing and exchanging information on emissions of air pollutants. The Convention and its eight protocols together set targets for the reduction of specific emissions, prescribe stringent emission limit values for emission sources, propose concrete pollution reduction measures and establish requirements regarding the submission of data on emissions of the above-mentioned pollutants. The Executive Body for the Convention has invited Parties to report also on 6 additional heavy metals and 16 further POPs. The Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone sets emission reduction targets for SO_x, NO_x, NH₃ and NMVOCs to be

reached by 2010. The Stockholm Convention on Persistent Organic Pollutants sets relevant limits and reporting requirements at the global level. In the European Union (EU), Directive 2001/81/EC on national emissions ceilings for certain atmospheric pollutants requires the introduction of national emission ceilings for emissions of SO₂, NO_x, NMVOC and NH₃ in each member State to be complied with by 2010, as well as setting interim environmental objectives for reducing the exposure of ecosystems and human populations to acid pollutants and ozone.

Methodology and guidelines

Data collection and calculations: Two basic methods of emission inventory are generally applied: the first, detailed, one is based on direct measurements of emissions, and the second, simplified, one is based on the use of statistics on activities (e.g. production volumes and fuel and raw materials consumption in particular) and the relevant emission factors. National classifications of emission sources have to be harmonized with the international standards (see below). Among the individual pollutants, the reporting of emissions of heavy metals and POPs requires particular attention in EECCA countries. Modelling should be applied where data coverage is incomplete.

Internationally agreed methodologies and standards: The CLRTAP and its protocols, including the Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP), cover air emissions. Important internationally agreed standards are included in the Guidelines for Estimating and Reporting Emission Data under the CLRTAP and in the EMEP/CORINAIR Emission Inventory Guidebook. There is a correlation between the UNECE *nomenclature for reporting* (NFR) source classification system for air emission reporting, the *selected nomenclature for sources of air pollution* (SNAP97) developed by the EEA European Topic Centre on Air Emissions (ETC/AE) and reporting source categories in the *common reporting format* (CRF) of the Inter-governmental Panel on Climate Change (IPCC) and the United Nations Framework Convention on Climate Change (UNFCCC).

Data sources and reporting: In EECCA countries, national statistical agencies collect data on emissions into the air from stationary sources (using 2-TP form-Air). In many EECCA countries data collection is coordinated and shared with national and subnational environmental protection bodies. Data on emissions from mobile sources are frequently calculated on the basis of fuel consumption by vehicle fleet. Aggregated data are published in annual national environmental and statistical reports. Parties to the CLRTAP report emissions of the main air pollutants (e.g. SO_x, NO_x, NMVOC, PM, heavy metals and POPs) and projections. The emission database is managed by EMEP. EECCA countries report emission data to UNSD in response to the UNSD/UNEP questionnaire on environmental statistics.

References at the international level

- Guidelines for Estimating and Reporting Emission Data under the Convention on Long-range Transboundary Air Pollution. Air Pollution Studies No.15. United Nations, New York and Geneva, 2003. ECE/EB.AIR/80.
- EMEP/CORINAIR Emission Inventory Guidebook - 3rd edition. September 2004 . (EEA Technical report 30/2005; <http://reports.eea.eu.int/EMEPCORINAIR4/en>,

- Annual European Community CLRTAP Emission Inventory 1990-2003 (EEA Technical Report 6/2005).
- Eurostat (2001) «Environmental pressure indicators for the EU».
- EMEP Status Report 1/03 Part III "Transboundary acidification and eutrophication and ground-level ozone in Europe: Source-Receptor relationships".
- EMEP Report. "Transboundary acidification and eutrophication and ground-level ozone in Europe. EMEP Summary Report 2001". Joint CIAM & CCC & MSC-W report.
- EMEP Status Report 2/2003 "Heavy Metals: Transboundary Pollution of the Environment". I. Ilyin, O. Travnikov, W. Aas, H. Uggerud.
- EMEP Report. "Evaluation of transboundary transport of heavy metals in 1999. Trend analysis". Joint CCC & MSC-E report.
- EMEP Status Report 4/03 "Transboundary particular matter in Europe: Status Report 2003". Ed. by Michael Kahnert and Leonor Tarrasón. Joint CCC & MSC-W & CIAM report.
- EMEP Report. "Transboundary Particulate Matter in Europe: Status Report 2001". Joint CCC & MSC-W report.
- EMEP Status Report 1/03 Part III "Transboundary acidification and eutrophication and ground level ozone in Europe: Source-Receptor relationships".
- EMEP Report. "Transboundary acidification and eutrophication and ground-level ozone in Europe. EMEP Summary Report 2001". Joint CIAM & CCC & MSC-W report.
- EMEP Status Report 3/2003 "Persistent Organic Pollutants in the Environment" V. Shatalov, S. Dutchak, M. Fedyunin, E. Mantseva, B. Strukov, M. Varygina, N. Vulykh, W. Aas, S. Mano.
- EMEP Report. "Assessment of POP transport and accumulation in the environment". Joint CCC & MSC-E report.
- Air Emissions Inventory, Air Pollution Monitoring and Modelling in Kazakhstan. In: Environmental Monitoring and Assessment: Eastern Europe, the Caucasus and Central Asia. UNECE, 2003. CD-ROM.
- Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on National Emission Ceilings for Certain Atmospheric Pollutants.
- <http://www.unece.org/env/lrtap/welcome.html>
- <http://www.emep.int>
- <http://webdab.emep.int/>
- <http://www.ipcc-nggip.iges.or.jp/public/gl/invs4.htm>
- <http://unstats.un.org/unsd/environment/>
- <http://themes.eea.europa.eu/IMS/CSI>
- <http://europa.eu.int/comm/eurostat>

2. AIR QUALITY IN URBAN AREAS

General description

Brief definition: One possibility is the number or percentage of days during a certain period of time with an air pollution level exceeding the established limit values (maximum allowable annual and short term concentrations (MACs)) in urban areas with regular observations of air quality. It may also show the fraction of urban population in a country exposed to air pollution

above the established limit values. Population weighed annual mean concentration of air pollutants seems to be more robust indicator which is now being used in EU for the Structural Indicators on “Urban Air Quality (see Eurostat webpages).

Unit of measurement: Days or percentage of days during given period of time with exceeded annual or short-term limit values or percentage of population living in areas with exceeded limit values.

Environmental policy relevance

Purpose: The indicator provides a measure of the state of the environment in terms of air quality and the impact of air pollution on population and ecosystems.

Issue: Increased concentrations of pollutants in the low layer of the atmosphere can have various adverse impacts on human health, vegetation and materials. Exposure to particulate matter, measured as concentrations of PM₁₀ or PM_{2.5} (particulate matter which passes through a size-selective inlet with a 50 % efficiency cut-off at 10 µm or 2.5 µm aerodynamic diameter, respectively) in ambient air, represents, together with heavy metals and POPs, one of the largest human health risks from air pollution. Short-term inhalation of high concentrations of suspended particulates PM₁₀ and PM_{2.5} may cause increased symptoms for asthmatics, respiratory symptoms, reduced lung capacity and increased risk of serious diseases. There is considerable evidence of human environmental and occupational exposures to carbon monoxide (CO). SO₂, NO_x and ground-level ozone (O₃) ambient air can affect human health, and damage crops, vegetation and materials. Ozone is not emitted directly, but is formed in the lower atmosphere by photochemical reactions of NMVOCs, NO_x, CO and methane in the presence of sunlight.

- **International agreements and targets:** The CLRTAP and its protocols commit the Parties to reducing and preventing air pollution by SO_x, NH₃, NMVOC, O₃, particulate matter, lead, mercury, cadmium and POPs.

In the European Union, Council Directive 96/62/EC on Ambient Air Quality Assessment and Management (Air Quality Framework Directive) created a framework for the revision of previous limit values and setting additional ones, and established the overall system of air quality assessment and management (measurements, modelling, establishment of zones, preparation of plans etc.). The first “daughter directive” (1999/30/EC) sets the limit values for SO_x, NO₂, NO_x, PM₁₀ and lead. The second “daughter directive” (2000/69/EC) sets the limit values for benzene and CO. The third “daughter directive” (2002/3/EC) sets the target values for O₃ while the fourth “daughter directive” (2004/107/EC) sets target values for arsenic, cadmium, nickel and benzo(a)pyrene. All limit values and target values with the exception of O₃ and CO are set as annual average values. In some cases, shorter-term limit values are set as well. Limit values for the protection of human health for SO₂, PM₁₀, lead and CO were to be complied with by 2005 while those for NO_x and benzene by 2010. Target values for O₃ are to be complied with by 2010 and those for arsenic, nickel, cadmium and benzo(a)pyrene by 2012. The basic limit values for the protection of human health, as laid down by the above mentioned directives are as follows:

- PM₁₀ (annual average 40 µg/m³, 24 hours limit value 50 µg/m³ not to be exceeded more than 35 times a calendar year),

- SO₂ (hourly limit value 350 µg/m³ not to be exceeded more than 24 times a calendar year, 24 hours limit value 125 µg/m³ not to be exceeded more than 3 times a calendar year),
- NO₂ (annual average 40 µg/m³, hourly limit value 200 g/m³, not to be exceeded more than 18 times a calendar year),
- Lead (annual average 0.5 µg/m³),
- Benzene (annual average 5 µg/m³),
- CO (maximum daily 8-hour mean 10 mg/m³),
- O₃ (target value – maximum 8-hour mean – 120 µg/m³ not to be exceeded more than 25 days per calendar year over three years),
- Arsenic (target value – annual average – 6 ng/m³),
- Cadmium (target value – annual average – 5 ng/m³),
- Nickel (target value – annual average 20 ng/m³),
- Benzo(a)pyrene (target value – 1 ng/m³).

Methodology and guidelines

Data collection and calculations: An air quality-monitoring network may consist of fixed and/or mobile monitoring stations. The selection strategy for site locations should focus on areas with the highest concentration of emission sources (hot spots) for direct warnings or on urban background stations to get an overview over the general exposure of urban population in the country. No aggregation should be done for monitoring stations with different classifications (hot spots, urban background) because of very different concentration profiles. National calibration laboratories have to be established and quality assurance/quality control (QA/QC) procedures introduced. Urban population is a total number of people living in cities with at least 1 monitoring station. The indicator should be calculated for exceedance of limit values (MACs) for at least a limited number of priority pollutants such as SO₂, NO₂, PM₁₀ and O₃.

Internationally agreed methodology and standards: WHO Air Quality Guidelines for Europe covering 35 pollutants may be used in setting legally binding limit values (standards) for air pollutants. ISO standards 13.040, Air quality may be applied for monitoring purposes. In the EU, detailed rules for the establishment of monitoring networks are set in relevant “daughter directives”. The measurements in the EU are reported under the Community-wide procedure for the exchange of information and data on ambient air quality established by Council Decision 97/101/EC, as amended by Commission Decision 2001/752/EC (a guidance report is available). Annual reporting required by “daughter directives” follows the Commission Decision 2004/461/EC. Many references are available on the most appropriate and up-to-date air monitoring and analysis methods as well as proven models estimating ambient air concentrations of air pollutants.

Data sources and reporting: Data on ambient air pollution concentrations are often routinely collected in EECCA by sanitary and epidemiological monitoring networks, and meteorological services. General data on air quality in cities are published in annual environmental reports while actual data are being published at the municipal levels. The WHO Healthy Cities Network and the Air Quality and Health programme of the WHO Regional Office for Europe collect air quality data from participating national agencies. Eurostat, EEA and OECD collect air quality data from their member States.

References at the international level

- WHO (2000) Air Quality Guidelines for Europe (revision of Air Quality Guidelines for Europe 1987). WHO Regional Office for Europe, Bilthoven Division.
- WHO (2000) Human Exposure Assessment, Environmental Health Criteria Document 214, Programme of Chemical Safety.
- WHO (2000) Decision-Making in Environmental Health: From Evidence to Action, edited by C. Corvalan, D. Briggs and G. Zielhuis, E & FN Spon, London, New York.
- WHO (1999) Monitoring Ambient Air Quality for Health Impact Assessment, WHO Regional Publications, European Series, No. 85.2.
- WHO (1999) Environmental Health Indicators: Framework and Methodologies. Prepared by D. Briggs, Occupational and Environmental Health.
- Руководство по контролю загрязнения атмосферы. РД 52.04.186-89. М., Гидрометеиздат, 1991, 693 с.
- Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management (Air Quality Framework Directive).
- Council Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air.
- Directive 2000/69/EC of the European Parliament and of the Council of 16 November 2000 relating to limit values for benzene and carbon monoxide in ambient air.
- Directive 2002/3/EC of the European Parliament and of the Council of 12 February 2002 relating to ozone in ambient air.
- Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury and polycyclic aromatic hydrocarbons in ambient air.
- Council Decision 97/101/EC of 27 January 1997 establishing a reciprocal exchange of information and data from networks and individual stations measuring ambient air pollution within the Member States, as amended by Commission Decision 2001/752/EC.
- Commission Decision 2004/461/EC of 29 April 2004 laying down a questionnaire to be used for annual reporting on ambient air quality assessment under Council Directives 96/62/EC and 1999/30/EC and under Directives 2000/69/EC and 2002/3/EC of the European Parliament and of the Council.
- <http://www.unece.org/env/lrtap/welcome.html>
- http://www.euro.who.int/air/Activities/20020620_1
- <http://unstats.un.org/unsd/environment/>
- <http://themes.eea.europa.eu/IMS/CSI>
- <http://europa.eu.int/comm/environment/air/cafe/index.htm>
- <http://europa.eu.int/comm/eurostat/>
- <http://air-climate.eionet.eu.int>

3. CONSUMPTION OF OZONE-DEPLETING SUBSTANCES

General description

Brief definition: The indicator specifies total amount of ozone-depleting substances (ODS) that were produced, sold or consumed in a country.

Unit of measurement: Tons (Mg) of ODS weighted by their ozone-depletion potential (ODP).

Environmental policy relevance

Purpose: The indicator provides a measure of the pressure on the environment of substances that deplete the ozone layer.

Issue: The ozone layer in the stratosphere is an essential component of the Earth's atmosphere. It protects humans, animals and plants from damaging shortwave ultraviolet (UV) radiation. Ozone is destroyed (dissociated) by reactions with certain ODS in the presence of somewhat longer wavelength UV radiation. Compounds that cause significant ozone depletion include chlorofluorocarbons (CFCs), carbon tetrachloride, methyl chloroform, halons, hydrochlorofluorocarbons (HCFCs), hydrobromofluorocarbons (HBFCs) and methyl bromide. They are used as solvents, refrigerants, foam blowing agents, degreasing agents, aerosol propellants, fire extinguishers (halons) and agricultural pesticides (methyl bromide). The extent to which an ODS affects the ozone layer (its ODP) depends on its chemical characteristics. Certain ODS, e.g. CFCs and HCFCs are also potent greenhouse gases.

International agreements and targets: The Vienna Convention for the Protection of the Ozone Layer (1985), its Montreal Protocol on Substances that Deplete the Ozone Layer (1987) and the London, Copenhagen, Montreal and Beijing amendments to the Montreal Protocol. The Montreal Protocol sets a target to eliminate the production and use of ODS. The list of substances is set forth in the Protocol and the amendments thereto.

Methodology and guidelines

Data collection and calculations: Data collection should cover substances in annexes A to C or E of the Montreal Protocol, whether existing alone or in a mixture. It should include the isomers of any ODS, except as specified in the relevant annex, but exclude any controlled ODS or mixture which is in a manufactured product other than a container used for the transport or storage of that substance. Production means the amount of ODS produced, minus the amount destroyed by technologies to be approved by the Parties to the Montreal Protocol and minus the amount entirely used as feedstock in the manufacture of other chemicals. The amount recycled and reused is not to be considered as "production". Sale or consumption is the sum of production plus imports minus exports of ODS. Weighted tons of ODS for production is the sum of national annual production (in tons) of each ODS multiplied by its ODP. ODP is a relative index of the ability of a substance to cause ozone depletion. Data on sales or consumption are obtained through a similar calculation using national annual sale or consumption values (in tons).

Internationally agreed methodology and standards: The UNEP Ozone Secretariat has developed data reporting forms for reporting under the Montreal Protocol and pursuant to

decisions on requests for data by the Meeting of the Parties. These forms cover data reporting on imports, exports, production, amounts destroyed and on imports from and/or exports to non-Parties. The UNEP Handbook on Data Reporting under the Montreal Protocol assists the Parties to provide accurate, comprehensive and timely data.

Data sources and reporting: Data on production, imports and exports of ODS are generally collected annually by national statistical agencies and/or national focal points responsible for reporting under the Montreal Protocol. EECCA countries have national competent bodies, responsible for reporting under the Montreal Protocol and submit national ODS data to the UNEP Ozone Secretariat. EU members report data also to the European Commission in accordance with Council Regulation 2037/2000.

Reference at the international level

- Vienna Convention on the Protection of the Ozone Layer
- Montreal Protocol on Substances that Deplete the Ozone Layer and its amendments
- Ozone Secretariat, UNEP, Handbook for the International Treaties for the Protection of the Ozone Layer, pp.367, 2000. (ISBN: 92- 807-1867-3).
- Handbook on Data Reporting under the Montreal Protocol. UNEP and Multilateral Fund for the Implementation of the Montreal Protocol, United Nations, 1999 (ISBN 92-807-1735-9).
- Regulation (EC) No 2037/2000 of the European Parliament and of the Council on substances that deplete the ozone layer, as amended.
- <http://www.unep.org/ozone>
- <http://www.unep.ch/ozone>
- <http://www.unmfs.org>
- <http://www.uneptie.org/ozonaction>
- <http://themes.eea.europa.eu/IMS/CSI>.

B. Climate change

4. GREENHOUSE GAS EMISSIONS

General description

Brief definition:

- Total, by sector, per capita and per unit of GDP anthropogenic emissions of the greenhouse gases (GHG) included in Annex A to the Kyoto Protocol to the UNFCCC: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF₆);
- Current trends in anthropogenic GHG emissions in relation to the country targets. (“Distance to target” measurement unit helps to make EECCA countries comparable with countries covered by the networks of the EEA.);
- Projected trends in anthropogenic greenhouse gas emissions in a country.

Unit of measurement: Million tons of CO₂ equivalent for total and by sector source. For cross-country comparisons, the indicator may be presented in thousand tons per square km of the

country territory and in tons per capita and in tons per GDP unit (expressed in constant prices or purchasing power parity) in USD and national currency.

Relevance for environmental policy

Purpose: The indicator provides a measure of the existing and future pressure on the environment in terms of emissions of GHG into the atmosphere and shows extent to which countries have achieved their specified goals and response to the country policies for the achievement of the emissions target.

Issue: The main concern relates to the effects of increasing GHG concentrations on global temperature and the earth's climate, and to the potential consequences for ecosystems, human settlements, agriculture and other socio-economic activities. This is because CO₂ and other GHG emissions are still increasing in many countries, despite some progress in decoupling CO₂ emissions from economic growth. The main challenges are to limit emissions of CO₂ and other GHG and to stabilize the concentration of GHG in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. This implies achieving GHG emissions targets set by international agreements or national strategies and strengthening efforts to implement related national and international strategies and to further decouple GHG emissions from economic growth. Future GHG emissions will largely depend on development trends in the economy, on technologies and on social transformations. A country development scenario with a special focus on the priority sectors of the economy that are the major sources of emissions is a specific way to analyse consequences based on various assumptions about future trends and GHG reduction strategies.

International agreements and targets: The UNFCCC and its Kyoto Protocol. The UNFCCC binds the Parties to reduce their emissions, to ensure collection of the relevant information, and to develop strategies for adjusting to climate change and for cooperation in the areas of research and development of new technologies. Parties shall submit "national communications" (regularly for Annex 1 countries) to the Conference of the Parties. One of the main aims of this document is to review country policies and measures for achieving GHG emissions targets set by international agreements or national strategies. The national communications should describe the work conducted by a particular Party aimed at implementation of the Convention, including projection of GHG emissions for the next 10–20 years. The Kyoto Protocol stipulates that Annex 1 Parties (mainly industrialized countries) shall individually or jointly reduce their aggregate emissions of a "basket" of six GHGs to 5% below 1990 levels by the period 2008–2012. To be able to achieve this group target, each Party has to accomplish its own specific task in the area of emissions reduction. The Russian Federation and Ukraine, for instance, have to stabilize their emissions levels, whereas the EU-15 countries have to reduce their levels by 8% (see Council Decision 2002/358/EC). The World Summit on Sustainable Development (WSSD) held in Johannesburg in 2002 made commitments towards an urgent and substantial increase in the use of renewable (non-carbon) energy sources as well as the setting up of programmes leading to more sustainable consumption and production patterns, including a reduction in energy use.

Methodology and guidelines

Data collection and calculations: Each of the GHG makes its own contribution to the global warming process, depending on its ability to absorb heat and on its lifetime in the air. Three

GHGs – CO₂, CH₄ and N₂O – account for around 98% of the environmental pressure that leads to climate change. In order to aggregate the emissions of different GHGs and to present a single figure for the climate change issue,, these are presented in CO₂ equivalent based on the concept of its Global Warming Potential (GWP). The GWP is the estimated potential of a greenhouse gas contributing to global warming in the atmosphere, which is based on its effect over a 100-year time horizon. For example, the GWP of methane (CH₄) is 21, which means that the impact of 1 kilogram of methane on global warming is 21 times higher than that of 1 kilogram of carbon dioxide, while that of N₂O is 310 times higher than that of 1 kilogram of CO₂. The estimation of GHG emissions of the country can be based on statistics of human activities which affect the GHG concentration in the atmosphere (sources and sinks of GHGs). For instance, annual data on GHG emissions from fuel combustion activities can be estimated based on the annual consumption of fossil fuels. Annual data on methane in agriculture in relation to gastric fermentation can be evaluated based on the number of animals and on the species involved. Conversion (emission) factors connect emissions with statistics on human activities. A simplified description of the estimation technique is as follows::

$$GHG\ emissions = (data\ on\ human\ activities) \times emission\ factors$$

The methodology offers specific numerical values for each particular factor.

The GHG emissions values should be estimated for each year based on the assumption that the achievement of the projected emissions values by the year 2010 is a “linear” path, that is, the reduction or stabilization will take place evenly starting from the base year. The difference between the estimated line indicator and the actual indicator for a certain year may have both the “+” (advance) and the “-” (lagging behind) signs.

Internationally agreed methodologies and standards: Parties to the UNFCCC adopted reporting guidelines, including a set of tables for the common reporting format (CRF) which is in line with the IPCC Guidelines for National Greenhouse Gas Inventories. Signatories to the Kyoto Protocol adopted Guidelines for national systems for estimation of anthropogenic GHG emissions by sources and removals by sinks. ISO developed ISO 14064 standards for the quantification, reporting and verification of GHG emissions.

A large number of international models aimed at projecting both short-term and long-term GHG emissions evolution trends in various sectors of the economy are available. IPCC published three types of scenarios, namely “without measures”, “with measures” and with “additional measures”. Emissions scenarios at the national level are developed based on the state programmes for economic development, with special focus on the priority sectors of the economy that are the major sources of emissions.

Data sources and reporting

EECCA countries, which are the Parties to the UNFCCC submit national GHG inventories of anthropogenic emissions by sources and removals by sinks of GHGs not controlled by the Montreal Protocol on Substances That Deplete the Ozone Layer. As a part of their UNFCCC commitments, Annex 1 Parties are required to submit a national communication on a regular basis (every four to five years); other Parties have no obligation regarding regularity. EECCA countries, which are the Parties to the Kyoto Protocol, established national coordination centres which collect the data on emissions and sinks of GHGs, have available GHGs emission

projections and scenarios and prepare national communications to be submitted to the UNFCCC. EECCA countries report emissions data in response to the UNSD/UNEP Questionnaire on Environmental Statistics.

References at the international level

- UN Framework Convention on Climate Change. 1992.
- Kyoto Protocol to the UN Framework Convention on Climate Change, 1997.
- Revised Guidelines and Principles for National Inventories on GHG, 1996.
- IPCC good practice guidance and uncertainty management in national GHG inventories (IPCC, 2000).
- Good practice guidance for land-use, land-use change and forestry (IPCC 2003).
- IPCC Special Report, Emission Scenarios (SRES). Summary for the decision-makers. IPCC, 2000. ISBN 92-9169-313-8
- GHG indicator: UNEP Guidelines for Measuring GHG emissions for businesses and non-commercial organizations, UNEP, 2000
- Рассмотрение выполнения обязательств по конвенции и других ее положений. Национальные сообщения: кадастры выбросов парниковых газов сторон, включенных в приложение I к конвенции. Руководящие принципы РКИКООН для представления и рассмотрения докладов. FCCC/CP/2002/8, 28 March 2003.
- The GHG Indicator: UNEP Guidelines for Calculating Greenhouse Gas Emissions for Businesses and Non-Commercial Organizations (UNEP, 2000).
- UN FCCC guidelines on reporting and review (Document FCCC/CP/2002/8).
- Revised 1996 Intergovernmental Panel on Climate Change (IPCC) guidelines (IPCC 1997).
- National inventories of GHG.
- Annual European Community GHG inventory 1990-2003 and inventory report 2005 (EEA Technical Report No 4/2005).
- National communications concerning climate change.
- First review of information communicated by each Party included in Annex I to the Convention (A/AC.237/81 and Corr. 1).
- UNFCCC in-depth review reports on individual countries.
- Council Decision 2002/358/EC of 25 April 2002 concerning the approval, on behalf of the European Community, of the Kyoto Protocol to the UN FCCC and the joint fulfilment of commitments hereunder.
- Decision No 280/2004/EC of the European Parliament and of the Council of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and implementing the Kyoto Protocol.
- <http://www.unfccc.int>
- <http://www.ipcc.ch>
- <http://unstats.un.org/unsd/environment/>
- <http://www.globalreporting.org>
- <http://www.ghgprotocol.org>
- <http://cait.wri.org>
- <http://iso.org>
- <http://themes.eea.europa.eu/IMS/CSI>

C. Water

4. *RENEWABLE FRESHWATER RESOURCES*

General description

Brief definition: The total volume of river run-off and groundwater generated in natural conditions, exclusively by precipitation within the country, and the actual flow of rivers and groundwater coming from neighbouring countries.

Unit of measurement: Million cubic metres/year.

Relevance for environmental policy

Purpose: The development of this indicator in time provides a measure of the state of renewable freshwater resources in a country.

Issue: Renewable freshwater resources have major environmental and economic value. Their distribution varies widely among and within countries. Pressures on freshwater resources are exerted by overexploitation as well as by degradation of environmental quality. Relating resources abstraction to renewal of stocks is a central issue in sustainable freshwater resource management. If a significant share of a country's water comes from transboundary rivers, tensions between countries can arise, especially if water availability in the upstream country is smaller than in the downstream one. EECCA countries are quite interdependent with regard to water resources. Particularly in Central Asia, cooperation between countries sharing rivers such as the Syr Daria and the Amu Daria is crucial for life of population, economic well-being and political stability in the region. Azerbaijan's reliance on drinking water from the transboundary Kura River is another example.

International agreements and targets: The UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes is an important instrument for the protection freshwater resources and the development of transboundary water cooperation. There are no specific quantitative targets directly related to this indicator. In the European Union, the Water Framework Directive (2000/60/EC) requires the Member States to promote sustainable use based on long-term protection of available water resources and to ensure a balance between abstraction and recharge of groundwater, with the aim of achieving "good groundwater status" by 2015.

Methodology and guidelines

Data collection and calculations: Renewable freshwater (surface and groundwater) resources are replenished by precipitation (less evapotranspiration) falling on a country's territory that ends up as runoff to rivers and recharge to aquifers (internal flow), and by surface waters and groundwater flowing in from other countries (inflow). Climatic, ecological, economic and other limitations on the availability of these resources for abstraction are reflected in the variable "regular freshwater resources 95 per cent of the time". Data on renewable freshwater resources are usually collected at selected hydrological stations and calculated on the basis of long-term measurements of levels, flow-rates and inflows/outflows carried out on rivers and lakes as well

as in groundwater horizons and countrywide precipitation. The indicator is the major one used to define the water balance of a country.

Internationally agreed methodologies and standards: The UNSD/UNEP Questionnaire on Environment Statistics, coordinated with relevant Organisation for Economic Co-operation and Development (OECD) and Eurostat questionnaires.

Data sources and reporting

In many EECCA countries, information concerning renewable freshwater resources is collected by hydrological services both at the national level and at the levels of main river basins and is published in statistical yearbooks as well as in specialized collections dealing with environmental protection. The information is presented in a more comprehensive format in water cadastre materials. Statistical agencies report data to the UNSD International Environment Statistics Database.

References at the international level

- Convention on the Protection and Use of Transboundary Watercourses and International Lakes, 1992.
- Raskin, P., Gleick, P.H., Kirshen, P., Pontius, R. G. Jr. and Strzepek, K. . *Comprehensive Assessment of the Freshwater Resources of the World*. (Stockholm Environmental Institute, 1997) Document prepared for the fifth session of the UN Commission for Sustainable Development (1997).
- Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive).
- <http://www.unece.org/env/water/pdf/waterconr.pdf>
- <http://www.unece.org/env/documents/2000/wat/mp.wat.2000.1.r.pdf>
- <http://unstats.un.org/unsd/environment/>
- http://www.fao.org/ag/agl/aglw/aquastat/water_res/waterres_tab.htm
- <http://www.euro.who.int/ehindicators/>
- http://europa.eu.int/comm/environment/water/water-framework/index_en.html
- <http://europa.eu.int/comm/eurostat>
- <http://themes.eea.eu.int/IMS/CSI/>

6. FRESHWATER ABSTRACTION

General description

Brief definition: The total volume of surface and ground freshwater abstracted annually: total, by economic activity, per capita and as a percentage of renewable freshwater resources (water exploitation index, or WEI).

Unit of measurement: Million cubic metres/year for total and by economic activity, cubic metres/year for per capita and percentage for WEI.

Relevance for environmental policy

Purpose: The indicator provides, in relation to total resources available for abstraction, a measure of the pressure on the environment in terms of abstraction of freshwater resources. It can reflect the extent of water resource scarcity with increasing competition and conflict between different uses and users.

Issue: Freshwater resources are of major environmental and economic importance. Pressures on freshwater resources are exerted by overexploitation as well as by degradation of environmental quality. Since water quality is closely linked to water quantity, the relation of freshwater abstraction to renewal of stocks is a central issue in sustainable freshwater resource management. The indicator can show to what extent freshwater resources are already used and any need to adjust supply and demand management policy. Changes in the WEI help to analyze how changes in abstraction affect freshwater resources by increasing pressure on them or making them more sustainable. The WEI threshold that distinguishes non-stressed regions from stressed ones is around 20 per cent. Severe water stress can occur where the WEI exceeds 40 per cent, indicating strong competition for water but not necessarily enough extraction to trigger frequent water crises.

International agreements and targets: The Convention on the Protection and Use of Transboundary Watercourses and International Lakes is an important instrument for the protection and use of freshwater resources. There are no specific quantitative targets related to this indicator. In the European Union, the Water Framework Directive (2000/60/EC) requires the Member States to promote sustainable use based on long-term protection of available water resources and ensure a balance between abstraction and recharge of groundwater, with the aim of achieving “good groundwater status” by 2015. Targets are also established via international treaties between/among riparian countries.

Methodology and guidelines

Data collection and calculations: Public or private bodies whose main function is to provide water for various uses (the water supply industry) abstract water. It can also be directly abstracted from rivers, lakes, wells or springs by industries, farmers, households and others for their own use. The indicator incorporates data on abstraction of freshwater, broken down according to the main activity of the water abstractor as defined by the International Standard Industrial Classification of All Economic Activities (ISIC Rev. 3.1). The water abstraction indicator calculations are based on the data on quantity of abstracted water reported by water users to the relevant authorities. The quantity of water abstracted is either measured by water meters or calculated on the basis of energy consumption for pumps. In some cases it is necessary to apply a calculation method using models for some water users (household and agriculture).

The indicator is compiled based on reports submitted by the associations, enterprises and organizations abstracting water from surface and ground sources and having at their disposal technological processes (equipment) enabling measurement of water consumption. Reports are first processed at the regional level and then generalized at the national level. The WEI is the ratio of annual total water abstraction to long-term annual average renewable freshwater resources, expressed as a percentage. The WEI provides a good picture at the national level of the pressures on resources in an easily understandable format, and it shows trends over time.

Changes in the WEI help to analyze how changes in abstraction affect freshwater resources by increasing pressure on them or making them more sustainable.

Internationally agreed methodologies and standards: The UNSD/UNEP Questionnaire on Environment Statistics coordinated with relevant OECD and Eurostat questionnaires.

Data sources and reporting

Many EECCA countries have databases that provide fairly comprehensive time series regarding fresh water abstraction based on the reporting in standard form by enterprises and other relevant organisations. Data on fresh water abstraction are published in annual environmental reports and or in statistical yearbooks. More detailed information (including data at regional levels) is published in national state-of-the-environment reports in some countries. Statistical agencies report data to the UNSD International Environment Statistics Database.

References at the international level

- Convention on the Protection and Use of Transboundary Watercourses and International Lakes.
- OECD Environmental Data Compendiums.
- European Environment Agency. Europe's Environment: the third Assessment. 2003.
- International Standard Industrial Classification of All Economic Activities. United Nations, Series M No.4, Rev.3.
- Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive)
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://www.unece.org/env/water/pdf/waterconr.pdf>
- <http://www.unece.org/env/documents/2000/wat/mp.wat.2000.1.r.pdf>
- <http://www.fao.org>
- <http://unstats.un.org/unsd/environment/>
- <http://europa.eu.int/comm/eurostat>
- <http://themes.eea.eu.int/IMS/CSI/>
- <http://oecd.org/env/>

7. HOUSEHOLD WATER USE PER CAPITA

General description

Brief definition: The quantity of water used to cover the household and related utility needs of the population (including enterprise employees), calculated per capita.

Unit of measurement: Cubic metres/ year per capita (or litres/day per capita).

Relevance for environmental policy

Purpose: The indicator provides a measure of the pressure on the environment in terms of water abstraction from different water sources.

Issue: Adequate quantities of water for meeting basic human needs are a prerequisite for life, health and development. The indicator is one of the major ones defining the level of development of water economy services and the degree of water accessibility to cover all household needs of the population. This indicator helps to identify trends in rational water use in a particular location. The indicator of household water consumption differs by location and depends on many environmental and economic factors.

International agreements and targets: The Convention on the Protection and Use of Transboundary Watercourses and International Lakes.

Methodology and guidelines

Data collection and calculations: Household water use per capita can be calculated based on the measured volume supplied, local surveys or the total amount supplied to a community divided by the number of inhabitants. The indicator is an estimate based on territorial reports submitted by associations, enterprises and organizations supplying households with water. Reports submitted by the organizations and enterprises are first processed at the regional level and then generalized at the national level.

Internationally agreed methodologies and standards: Not available.

Data sources and reporting

Data are collected based on statistical reporting by countries. In EECCA countries, data collection on freshwater use is based on annual data reported to state statistical services. Data on household water use is still frequently collected within the statistical branch “Housing and Municipal Services” in an aggregated form which does not allow to report on actual water use by population. WHO has been collecting estimates of national average figures from governments as part of its water supply and sanitation monitoring activities.

References at the international level

- Convention on the Protection and Use of Transboundary Watercourses and International Lakes.
- Eurostat, *Environment statistics: Pocketbooks*.
- AQUASTAT – FAO global information system on water and agriculture.
- <http://www.unece.org/env/water/links/link.htm>
- <http://www.unece.org/env/water/pdf/waterconr.pdf>
- <http://europa.eu.int/comm/eurostat>
- <http://www.fao.org>
- <http://unstats.un.org/unsd/environment/questionnaire2004.htm/>
- <http://themes.eea.eu.int/IMS/CSI/>
- <http://www.euro.who.int/ehindicators/>

8. WATER LOSSES

General description

Brief definition: The quantity and percentage of freshwater lost during transport (due to leakage and evaporation) between a point of abstraction and a point of use, and between points of use and reuse.

Unit of measurement: Millions of cubic metres/year; percentage.

Relevance for environmental policy

Purpose: The indicator provides a measure of response to the efficiency of the water management system in a country.

Issue: Sustainable management of water resources has become a major concern in many countries. The efficiency of water use is a key in matching supply with demand. Reducing losses, using more efficient technologies and keeping water transportation systems in good condition are part of the solution. The amount of water lost during transport to users is an indicator of the efficiency of a water management system, including technical conditions affecting water supply pipelines, water pricing and public awareness in a country.

International agreements and targets: None.

Methodology and guidelines

Data collection and calculations: When working with this indicator the most important issue is to have data on the quantities of freshwater undersupplied to the users during transport by water supply industries (the companies collecting, purifying and distributing water through a permanent infrastructure). The indicator is estimated and defined as the absolute and relative difference between the amount of water abstracted by the water supply industry and the amount delivered to users (households; agriculture, forestry and fishing; manufacturing, the electricity industry and other economic activities). Total losses can be broken down into losses by evaporation and losses by leakage. Losses due to illegal tapping or other illegal use of water are excluded. Reports submitted by enterprises are processed first at the regional and then at the country level.

Internationally agreed methodologies and standards: None.

Data sources and reporting

Data are collected based on statistical reporting by countries. In many EECCA countries databases and data at the cadastre level of fairly comprehensive time series exist. Statistical agencies report data to the UNSD International Environment Statistics Database.

References at the international level

- International Standard Industrial Classification of All Economic Activities. United Nations, Series M No.4, Rev.3.
- AQUASTAT – FAO global information system on water and agriculture.
- <http://www.unece.org/env/water/links/link.htm>
- <http://www.unece.org/env/water/pdf/waterconr.pdf>
- <http://europa.eu.int/comm/eurostat>
- <http://unstats.un.org/unsd/environment/>
- <http://themes.eea.eu.int/IMS/CSI/>
- <http://www.euro.who.int/ehindicators/>

9. REUSE AND RECYCLING OF FRESHWATER IN MANUFACTURING INDUSTRIES

General description

Brief definition: The share of reused or recycled water in the total volume of water used to cover manufacturing industries production needs. The indicator defines the percentage of water saved by applying recycling and reused water supply systems.

Unit of measurement: Percentage.

Relevance for environmental policy

Purpose: The indicator provides a measure of response to the efficiency of water management systems in manufacturing industries.

Issue: Sustainable management of water resources has become a major concern in many countries. Efficient water use is a key concern. Reducing losses, using more efficient technologies, recycling and reuse are all part of the solution in manufacturing industry. This indicator allows observation of tendencies in the technological development of production in industries and regions. The indicator is an important one for public authorities and for the management of industrial enterprises so as to develop production facilities in a targeted manner that ensures efficient water consumption.

International agreements and targets: None.

Methodology and guidelines

Data collection and calculations: The water use indicator is a ratio of the amount of recycled and reused water to the sum of the quantities of such water and water used to cover production needs. The indicator can be presented using the following formula:

$$\%_{\text{rec./reused}} = \frac{(Q_{\text{recycled}} + Q_{\text{reused}}) \times 100}{(Q_{\text{recycled}} + Q_{\text{reused}}) + Q_{\text{production}}}$$

where

$\%_{\text{rec./reused}}$ is the share of recycled and reused water;

Q_{recycled} is the quantity of recycled water;

Q_{reused} is the quantity of reused water; and

$Q_{\text{production}}$ is the quantity of water used for production needs.

This indicator is a derivative of quantity ratios (quantity of water used for production needs, quantity of water used in recycled water supply systems, quantity of reused water) reflected in the special form of state statistical reporting. Data should cover production units defined as belonging to the manufacturing industry (ISIC 15-37) according to the International Standard Industrial Classification of All Economic Activities (ISIC Rev. 3.1).

Internationally agreed methodologies and standards: None.

Data sources and reporting

Data are collected according to state statistical reporting by enterprises and other organisations. Many EECCA countries have databases and data at the cadastre level that provide fairly comprehensive time series. Data on this indicator, related to particular sub-sectors of manufacturing industry are published in statistical yearbooks (both at the national and subnational levels) as well as in specialized collections dealing with environment issues. Statistical agencies report data to the UNSD International Environment Statistics Database.

References at the international level

- <http://www.unece.org/env/water/links/link.htm>
- <http://www.unece.org/env/water/pdf/waterconr.pdf>
- <http://unstats.un.org/unsd/environment/>
- <http://themes.eea.eu.int/IMS/CSI/>
- <http://www.euro.who.int/ehindicators/>

10. DRINKING WATER QUALITY

General description

Brief definition: Share of samples failing drinking water quality standards in the total number of drinking water samples.

Unit of measurement: Percent.

Relevance for environmental policy

Purpose: The indicator provides a measure of potential impact of drinking water quality on human health and shows the extent to which the drinking water supply conforms to sanitary requirements and standards.

Issue: Public health cannot advance without access to an adequate supply of clean drinking water. The quality of drinking water is still an area of concern throughout the EECCA countries, with significant microbiological contamination of supplies and the proportion of samples exceeding the faecal contamination standards ranging from 5 per cent to 30 per cent (WHO). The indicator is a measure of the extent to which drinking water is contaminated by chemical

contaminants and microbiological organisms, and thus it can serve as a mechanism for warning of situations that require further in-depth investigation and countermeasures.

International agreements and targets: The Protocol on Water and Health to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes. The Parties agreed to take all appropriate measures necessary to achieve:

- Adequate supplies of wholesome drinking water;
- Adequate sanitation of a standard that sufficiently protects human health and the environment;
- Effective protection of water resources used as sources of drinking water.

Methodology and guidelines

Data collection and calculations: The indicator is estimated from the available data on the compliance of drinking water with the parameters that are directly linked to human health. The microbiological quality of the drinking water should be expressed through *E. coli* and *Enterococci*. Countries may report other microbiological quality criteria, particularly *Pseudomonas aeruginosa*. A “core group” of 10 chemical quality parameters can be selected. The list of chemical parameters of the EU Drinking Water Directive (98/83/EC) Annex I Part B can serve as a reference. Turbidity could be included among the chemical parameters. For each parameter the mathematical expression would be the proportion of drinking water samples analyzed that fail to comply with the relevant standards. The data should be collected for a total number of regulatory analyses made by an official monitoring agency or undertaker within the defined spatial unit (a water supply zone or other regional entity defined for regulatory purposes in the country) over a given time period (e.g. one year) (T) and the number of non-compliant samples (E) found in the spatial unit. The “percentage compliance” indicator can be calculated as: $((T - E)/T) \times 100$. The number of sampling points in the system of both centralized and decentralized drinking water supply as well as the frequency of sampling should provide statistical authenticity regarding the number of samples failing the standards. Some EECCA countries might not have the necessary calculation capacity to provide national weighted data. In that case the reporting could be started as a non-weighted system, listing the performance of individual suppliers.

Internationally agreed methodologies and standards: WHO Guidelines for Drinking-water Quality (3rd ed.). The EC Drinking Water Directive (98/83/EC) sets standards for the most common 48 parameters, based on WHO guidelines.

Data sources and reporting

In EECCA countries sanitary and epidemiological service centres maintain departmental databases on drinking water quality since long ago. Some EECCA countries publish data on drinking water quality in annual environmental reports.

References at the international level

- WHO Guidelines for Drinking-water Quality (3rd ed.), WHO, 2004.
- Consultation on target setting and progress monitoring of water and wastewater services. Copenhagen, 9–10 May 2005. Report. (WHO/Europe).

- GEMS/WATER Operational Guide. 3rd ed. (WHO, 1992).
- EUROWATERNET. The Environment Agency's Monitoring and Information. Network for Inland Water Resources. Technical Guidelines for Implementation. Technical Report No. 7. (Copenhagen, 1998).
- Protocol on Water and Health to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes.
- Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption.
- <http://www.euro.who.int/document/wsn/protMtgMay05.pdf>
- <http://www.euro.who.int/ehindicators/>
- <http://unstats.un.org/unsd/environment/>
- <http://www.europa.eu.int/comm/eurostat/>
- <http://themes.eea.eu.int/IMS/CSI/>

11. BOD AND CONCENTRATION OF AMMONIUM IN RIVERS

General description

Brief definition: Oxygenation status of water bodies expressed in BOD (biochemical oxygen demand) which is the demand for oxygen resulting from organisms that consume oxidizable organic matter and concentrations of ammonium (NH₄) in rivers.

Unit of measurement: The annual average BOD after five or seven days' incubation (BOD₅/BOD₇) is expressed in milligrams of O₂/litre; the ammonium concentration is expressed in micrograms of N/litre.

Relevance for environmental policy

Purpose: The indicator provides a measure of the state of rivers in terms of biodegradable organic load and ammonium.

Issue: Large quantities of organic matter (microbes and decaying organic waste) can reduce the chemical and biological quality of river water and result in impaired biodiversity of aquatic communities and microbiological contamination that can affect the quality of drinking and bathing water. Sources of organic matter include discharges from wastewater treatment plants, industrial effluents and agricultural run-off. Organic pollution leads to higher rates of metabolic processes that demand oxygen. This could result in the lack of oxygen (anaerobic conditions). The transformation of nitrogen into reduced forms under anaerobic conditions in turn leads to increased concentrations of ammonium, which is toxic to aquatic life above certain concentrations, depending on water temperature, salinity and pH.

International agreements and targets: The Convention on the Protection and Use of Transboundary Watercourses and International Lakes and its Protocol on Water and Health. There is no international target for the oxygenation status of water bodies. In the European Union, the environmental quality of surface waters with respect to organic pollution and ammonium and the reduction of the loads and impacts of these pollutants are objectives of several directives, including the Surface Water for Drinking Directive (75/440/EEC), which sets

standards for the BOD and ammonium content of drinking water, the Nitrates Directive (91/676/EEC), aimed at reducing nitrate and organic matter pollution from agricultural land; the Urban Waste Water Treatment Directive (91/271/EEC); aimed at reducing pollution from sewage treatment works and certain industries; the Integrated Pollution Prevention and Control Directive (96/61/EEC), aimed at controlling and preventing the pollution of water by industry; and the Water Framework Directive (2000/60/EC), which requires the achievement of “good ecological status” or “good ecological potential” for rivers throughout the European Union by 2015.

Methodology and guidelines

Data collection and calculations: The key indicator for the oxygenation status of water bodies is the BOD which is the demand for oxygen resulting from organisms in water that consume oxidizable organic matter. The indicator illustrates the current situation and trends regarding BOD and concentrations of ammonium (NH₄) in rivers. The programme of monitoring BOD and concentrations of ammonium should be structured taking into account the spatial and temporal dynamics of the indicator. The number of surveillance points and their location should enable collection of information on BOD background values for the main morphological types of watercourses and values of this indicator in the areas subject to anthropogenic (predominantly household) load. Time parameters should correspond to hydrological phases, while the frequency of sampling should reflect the need for statistically authentic information. Efforts should be made to ensure methodological and metrological uniformity in surveillance and data processing; microbiological and chemical-analytical work should be conducted by accredited laboratories with measurement quality control systems.

Major difficulties in obtaining representative data on the value of BOD and ammonium in rivers are confined to low discretion of surveillance through monitoring networks in EECCA countries and to a lack of the financing required for optimization of the existing networks.

Internationally agreed methodologies and standards: The method of determining BOD in EECCA countries is in compliance with ISO 5815-1:2003 and ISO 5815-2:2003. The maximum permissible value of BOD₅ pursuant to Directive (78/659/EEC) on the quality of fresh waters needing protection or improvement in order to support fish life is 3mg/l of O₂ for salmonid waters and 6mg/l of O₂ for cyprinid waters.

Data sources and reporting

EECCA countries have departmental and, in some cases, national databases on the indicator. In some EECCA countries (e.g. in Belarus, the Russian Federation and Uzbekistan) databases include the results of analysis of BOD and ammonia concentrations in surface water bodies for several decades. Data in these countries are published in annual surface water quality reports. Statistical agencies report data to the UNSD International Environment Statistics Database.

References at the international level

- ISO Water Quality – determination of BOD after five days. ISO 5815. 1989.
- Fomin, G.S. *Water: Control of Chemical, Bacterial and Radiation Safety According to International Standards*. (Moscow: Protector, 1995).

- *Standard Methods for the Examination of Water and Wastewater*. 19th ed. (American Public Health Association, 1992).
- *GEMS/WATER Operational Guide*. 3rd ed. (WHO, 1992).
- Directive 2000/60/EC of the European Parliament and the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive).
- Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control.
- Council Directive 91/271/EEC of 21 May 1991 concerning urban wastewater treatment .
- Council Directive 75/440/EEC of 16 June 1975 concerning the quality required of surface water intended for the abstraction of drinking water in the Member States.
- Council Directive 78/659/EEC of 18 July 1978 on the quality of fresh waters needing protection or improvement in order to support fish life.
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://www.iso.org>
- <http://europa.eu.int/comm/eurostat/>
- <http://www.unece.org/env/water/welcome.html>
- <http://www.icpdr.org/pls/danubis/DANUBIS.navigator>
- <http://www.iksr.org/>
- <http://www.cciw.ca/gems/intro.html>
- <http://unstats.un.org/unsd/environment/>
- <http://themes.eea.eu.int/IMS/CSI/>
- <http://www.euro.who.int/ehindicators/>

12. NUTRIENTS IN FRESHWATER

General description

Brief definition: Concentrations of orthophosphate and nitrate in rivers, total phosphorus and nitrate in lakes and nitrate in groundwater.

Unit of measurement: Concentrations of nitrate are expressed as milligrams of NO₃/litre, and concentrations of phosphorus and orthophosphate as micrograms of P/litre.

Relevance for environmental policy

Purpose: The indicator provides a measure of the state of freshwater (rivers, lakes and groundwater) in terms of nutrient concentration.

Issue: Large inputs of nutrients to freshwater bodies from urban areas, industry and agricultural areas can lead to eutrophication of water bodies. This causes ecological changes that can result in a loss of plant and fish species (reduction in ecological status) and have negative impacts on the use of water for human consumption and other purposes. The indicator can be used to illustrate current geographical variations in nutrient concentrations and long-term trends.

International agreements and targets: The Convention on the Protection and Use of Transboundary Watercourses and International Lakes and its Protocol on Water and Health refer to reduction of emissions of biogenic substances by industrial, household and diffuse sources. The indicator is not directly related to a specific policy target. The environmental quality of surface waters with respect to eutrophication and nutrient concentrations is an objective of several EU directives:

- The Drinking Water Directive (98/83/EC) establishes a maximum allowable concentration for nitrate of 50 mg/l;
- The Surface Water for Drinking Directive (75/440/EEC) sets a guideline concentration for nitrate of 25 mg/l;
- The Nitrates Directive (91/676/EEC) requires the identification of groundwater sites/bodies where the annual average nitrate concentration exceeds or could exceed 50 mg NO₃/l;
- The Urban Waste Water Treatment Directive (91/71/EEC) aims to decrease organic pollution.
- An OECD report of 1980 defines lakes as eutrophic when annual lake P exceeds 35 mg P/l.

Methodology and guidelines

Data collection and calculations: The nitrate separation method is based on the reduction of nitrates to nitrites by the use of metallic cadmium, with subsequent photometric measurement of nitrites. The method of determining phosphates is based on their reaction with ammonium molybdate in an acid solution in the presence of antimony ions and subsequent photometric measurement of the recovered complex. Alternatively, more advanced analytical methods can be used (e.g. ion chromatography). A programme for monitoring nutrients in freshwater bodies should be structured taking into account the spatial and temporal dynamics of these ingredients. The number of surveillance points and their location should enable collection of information on the background content of nitrates and phosphates (conditioned by the natural process of decomposition of organic matter) for the main morphological types of watercourses and the values of this indicator in areas subject to anthropogenic load resulting from spot and diffuse sources. Time parameters should correspond to hydrological phases, while the frequency of sampling should reflect the need for statistically authentic information.

Efforts should be made to ensure methodological and metrological uniformity in surveillance and data processing; microbiological, and chemical-analytical work should be conducted by accredited laboratories with QA/QC systems. Major difficulties in obtaining representative data on the content of nutrients in rivers are confined to low discretion of surveillance through monitoring networks in EECCA countries and to a lack of the financing required for optimization of the existing networks.

Internationally agreed methodologies and standards: The concentration of nitrates is determined using the ISO 7890-3:1988 method, based on spectrometric measurement of the compound resulting from the reaction of nitrate with sulphosalicylic acid and its subsequent treatment with alkali. Phosphorus concentrations are determined using the ISO 6878:2004 method, which is in compliance with the corresponding method used by EECCA countries.

Data sources and reporting

EECCA countries have departmental and, in some cases, national databases on the indicator. In some EECCA countries (e.g. in Belarus, the Russian Federation and Uzbekistan) databases include the results of analysis of nutrients concentrations in surface water bodies for several decades. Data in these countries are published in annual surface water quality reports. Statistical agencies report data to the UNSD International Environment Statistics Database.

References at the international level

- Fomin, G.S. Water: Control of Chemical, Bacterial and Radiation Safety According to International Standards. (Moscow, Protector, 1995).
- Standard Methods for the Examination of Water and Wastewater. 19th ed. (American Public Health Association, 1992).
- GEMS/WATER Operational Guide. 3rd ed. (WHO, 1992).
- Directive 2000/60/EC of the European Parliament and the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive).
- Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption.
- Council Directive 75/440/EC of 16 June 1975 concerning the quality required of surface waters intended for the abstraction of drinking water in the Member States.
- Council Directive 91/271/EEC of 21 May 1991 concerning urban wastewater treatment.
- Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources.
- <http://europa.eu.int/comm/eurostat/>
- <http://unstats.un.org/unsd/environment/>
- <http://themes.eea.eu.int/IMS/CSI/>
- <http://www.euro.who.int/ehindicators/>
- <http://www.icpdr.org/pls/danubis/DANUBIS.navigator>
- <http://www.iksr.org/>

13. NUTRIENTS IN COASTAL WATERS

General description

Brief definition: The presence in the coastal waters of nutrients (biogenic substances) used by plants and autotrophic bacteria to maintain vital activity, and affecting the biological productivity and ecological condition of coastal waters.

Unit of measurement: Concentrations of major biogenic substances (nitrates and phosphates) are expressed in micrograms/litre.

Relevance for environmental policy

Purpose: The indicator provides a measure of the state of coastal waters in terms of nutrient concentrations.

Issue: Nitrogen and phosphorus enrichment can result in a chain of undesirable effects, starting with excessive growth of plankton algae, which increases the amount of organic matter settling to the bottom. This development may be enhanced by changes in the species composition and functioning of the pelagic food web (e.g. the growth of small flagellates rather than larger diatoms), which leads to lower grazing by copepods and increased sedimentation. The consequent increase in oxygen consumption can, in areas with stratified water masses, lead to oxygen depletion, changes in community structure and death of the benthic fauna. Eutrophication can also increase the risk of algal blooms, some of them consisting of harmful species that cause the death of benthic fauna and wild and caged fish or shellfish poisoning of humans. Increased growth and dominance of fast-growing filamentous macroalgae in shallow sheltered areas is another effect of nutrient overload which can change coastal ecosystems, increase the risk of local oxygen depletion and reduce biodiversity and the availability of nurseries for fish.

International agreements and targets: The Convention on the Protection and Use of Transboundary Watercourses and International Lakes; the Convention on the Protection of the Marine Environment of the Baltic Sea (HELCOM, Helsinki 1974) the Convention on the Protection of the Mediterranean Sea against Pollution (Barcelona, 1976); Convention on the Protection of the Black Sea against Pollution (Bucharest, 1992); the Environmental Programme for the Caspian Sea; the UNEP Global Program of Action for the Protection of the Marine Environment from Land-Based Activities.

International targets related to the EECCA countries for reducing the amount of nutrients in coastal and marine waters are:

- HELCOM/Baltic Sea: 50 per cent reduction in nutrient discharges from the mid-1980s level;
- Black Sea Commission/Black Sea: Return to the pollution status of 1960.
- Targets have also been set for the North Sea, the Mediterranean Sea and the North-East Atlantic Ocean.

In the European Union, the Water Framework Directive (2000/60/EC) gives a target of achieving “good ecological status” with regard to nutrient concentrations.

Methodology and guidelines

Data collection and calculations: The nitrate separation method is based on the breakdown of nitrates into nitrites by using metallic cadmium, with subsequent photometric measurement of nitrites. The method of defining phosphates is based on their reaction with ammonium molybdate in an acid solution in the presence of antimony ions and subsequent photometric measurement of the recovered complex. Major difficulties in obtaining representative data on the biogenic substances content of coastal waters are confined to low discretion of surveillance through monitoring networks in EECCA countries as well as to the lack of financing for

optimization of the existing networks. A basic monitoring programme should specify biogenic substances and a core list of measured indicators. The number of sampling points and their spatial location should enable the collection of information on the content of biogenic substances throughout the gradient of loads – from background water landing areas to coastal water areas exposed to substantive anthropogenic (predominantly agricultural and household) load. Time parameters should take into account the time mutability of the content of biogenic substances. Methodological and metrological uniformity of surveillance and data processing should be a goal; microbiological, and chemical-analytical activities should be conducted by accredited laboratories with measurement quality control systems.

Internationally agreed methodologies and standards: The concentration of nitrates is determined by using the ISO 7890-3:1988 method, based on spectrometric measurement of levels of the compound resulting from the reaction of nitrate with sulphosalicylic acid and its subsequent treatment with alkali. Phosphorus concentrations are determined using the ISO 6878:2004 method, which is in compliance with the corresponding method used by EECCA countries.

Data sources and reporting

EECCA countries have departmental and, in some cases, national databases on biogenic substances contained in coastal waters. Several EECCA coastal countries publish data on concentration of nutrients in seawater, including coastal waters, in annual reports on seawater quality.

References at the international level

- Fomin, G.S. Water: Control of Chemical, Bacterial and Radiation Safety According to International Standards. (Moscow: Protector, 1995).
- GEMS/WATER Operational Guide. 3rd ed. (WHO, 1992).
- Directive 2000/60/EC of the European Parliament and the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive), as amended by Decision 2455/2001/EC of the European Parliament and the Council establishing the list of priority substances in the field of water policy.
- <http://www.unep.org>
- <http://www.iso.org>
- <http://www.helcom.fi/>
- <http://www.blacksea-commission.net/>
- <http://www.grida.no/caspian/>
- <http://themes.eea.eu.int/IMS/CSI/>

14. NON-TREATED URBAN WASTEWATER

General description

Brief definition: The indicator defines the share of non-treated urban wastewater that was discharged into water bodies in the total generation of urban wastewater in the country in a calendar year.

Unit of measurement: Percent.

Relevance for environmental policy

Purpose: The indicator provides a measure of the response to the efficiency of the wastewater management system.

Issue: Wastewater from urban areas exerts significant pressure on the water environment because of loads of organic matter and nutrients as well as hazardous substances. The inability to ensure treatment of the total amount of wastewater delivered to urban aeration plants, due to their insufficient capacity or inefficient use, is one of the substantive factors of anthropogenic load onto aqueous ecosystems. The indicator defines the share of untreated urban waters discharged into water bodies with the goal of estimating the level and nature of the load on natural water, obtaining source information and developing nature conservation arrangements and monitoring their efficiency.

International agreements and targets: The Convention on the Protection and Use of Transboundary Watercourses and International Lakes and its Protocol on Water and Health. In the European Union, the Directive on urban wastewater treatment (91/271/EEC) aims to protect the environment from the adverse effects of urban wastewater discharges. It prescribes the level of treatment required before discharge and requires Member States to provide all agglomerations of more than 2,000 inhabitants with collecting systems. It also requires all wastewater collected to be appropriately treated. It has to be fully implemented in the EU-15 countries by 2005 and in the 10 new Member States by 2008–2015.

Methodology and guidelines

Data collection and calculations: Monitoring of discharges from urban wastewater treatment plants should provide for obtaining representative information on the quantity of wastewater not treated at the urban wastewater treatment plants. When conducting primary metering, the users should provide for the required frequency of sampling at water outlet points. When using instrumental measurements of wastewater discharges, it is necessary to use hydrometrical equipment certified and calibrated by the state standardization bodies. Environmental authorities should exercise well-established control over the quality and authenticity of primary measurements. Processing of source data and its inclusion in informational database should be done using updated information technologies. Major difficulties in obtaining representative data on the quantity of wastewater not treated by urban wastewater treatment plants are confined to low frequency of primary sampling and lack of sophisticated hydrometrical equipment to measure wastewater quantity.

Internationally agreed methodologies and standards: None.

Data sources and reporting

Companies and organizations in EECCA countries have to report on their water use (including waste-water discharges) to authorized State inspection authorities using the standard forms. EECCA countries have departmental and national databases concerning quantities of wastewater

not treated (or not sufficiently treated) at urban wastewater treatment plants. Information is entered into in the State water cadastre. Information on volumes of waste waters and on concentration of pollutants therein is published in annual environmental reports as well as in statistical yearbooks. Statistical agencies report data to the UNSD International Environment Statistics Database.

References at the international level

- Fomin, G.S. *Water: Control of Chemical, Bacterial and Radiation Safety According to International Standards*. (Moscow: Protector, 1995).
- *Standard Methods for the Examination of Water and Wastewater*. 19th ed. (American Public Human Health Association, 1992).
- *GEMS/WATER Operational Guide*. 3rd ed. (WHO, 1992).
- Directive 2000/60/EC of the European Parliament and the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive).
- Council Directive 91/271/EEC of 21 May 1991 concerning urban wastewater treatment.
- <http://www.unece.org/env/water/welcome.html>
- <http://www.unhabitat.org>
- <http://www.europa.eu.int/comm/eurostat/>
- <http://unstats.un.org/unsd/environment/>
- <http://www.euro.who.int/ehindicators/>

D. Land

15. LAND UPTAKE

General description

Brief definition: Land uptake by transport infrastructure and urban development and by landfills, waste dumps, tailing pits and refuse heaps in a country.

Unit of measurement: Square kilometres or hectares; percent of the total territory of the country, and the contributions of the various land-cover categories to land uptake as a percentage of the total territory.

Relevance for environmental policy

Purpose: The indicator provides a measure of the impact on the environment and shows trends in the encroachment of artificial land developments on natural and semi-natural land.

Issue: Land uptake by transport infrastructure and urban development and by landfills, waste dumps, tailing pits and refuse heaps has the highest impacts on the environment due to sealing of soil as well as disturbances resulting from transport, noise, resource use, waste dumping and pollution. Transport networks, which connect cities, add to the fragmentation and degradation of the natural landscape. The intensity and patterns of urban sprawl are the result of three main factors: economic development, demand for housing and extension of transport networks. A high

percentage of land used for waste dumps, landfills, tailing pits and refuse heaps for legal or illegal waste disposal is an indicator of unsustainable development. Reduction of this indicator signals improvement toward sustainable development.

International agreements and targets: None.

Methodology and guidelines

Data collection and calculations: Units of measurement are hectares or square kilometres. Results are presented as average change, percent of the total area of the country and percent of the various types of land cover used by transport infrastructure, urban development and landfills, waste dumps, tailing pits and refuse heaps in a country. Land use by urban and related infrastructures is generally calculated using statistical data. In a few EECCA countries these data are supplemented by satellite images. Difficulties often arise in accounting for land used illegally for waste dumps, landfills, tailing pits and refuse heaps. The period of reporting is 10 years.

Internationally agreed methodologies and standards: The United Nations Food and Agriculture Organization (FAO) is working on the harmonization of classification systems and databases to improve national and international land use information. This includes the development of definitions and protocols, a computerized land use database structure, and a broadly accepted structure of land use classifications.

Data sources and reporting

Data on land use in EECCA countries are generally available from government authorities responsible for cadastres and land use planning and environmental protection and from statistical agencies, local authorities and various reports. Data on land use are published in annual environmental reports and or in statistical yearbooks in a number of countries. Statistical agencies report data to the UNSD International Environment Statistics Database. FAO also collects data from its member countries.

References at the international level

- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://www.fao.org>
- http://themes.eea.eu.int/Environmental_issues/waste/indicators
- <http://themes.eea.eu.int/IMS/CSI>
- <http://unstats.un.org/unsd/environment/>
- http://epa.gov/ncea/ROE_Indicators/

16. AREA AFFECTED BY SOIL EROSION

General description

Brief definition: Total land area and share of agricultural land affected by degradation through wind and water erosion.

Measurement unit: Area (km²) and percentage of agricultural land area affected.

Relevance for environmental policy

Purpose: The indicator provides a measure of the state of land in terms of the degree to which it is affected by wind and water soil erosion.

Issue: Soil erosion can be caused by natural soil and landscape characteristics (steepness of hills, types of soil, amount of precipitation) which are difficult to change, as well as by land use, which can be easily mitigated by terracing, creation of wind barriers (including forest plantations) and changes in factors such as the variety, thickness and age of vegetation. Land erosion is a natural phenomenon, which, however, tends to be greatly accelerated by human activity. In most cases, erosion results from unsustainable agricultural land use, large-scale farming and over-grazing, and inappropriate irrigation and water management. Systems of agricultural management are a primary factor affecting the quality of soil. In turn, erosion is an exemplary indicator of negative effects caused by unacceptable agricultural practices, which lead to declines in soil fertility and often to irreversible soil damage. The soil erosion indicator estimates the total territory of eroded soil, the nature of erosion and erosion dynamics (where long time-series are available), and it enables the planning of counter-erosion activities.

International agreements and targets: United Nations Convention to Combat Desertification (New York, 1994). The soil erosion indicator reflects the progress achieved at the national level in fulfilling the requirements of Article 10 of the Convention. While no specific targets have been defined, the goal should be to reduce the area and percentage of land affected by erosion and/or reduce the severity of erosion.

Methodology and guidelines

Data collection and calculations: Data are collected separately for total land area (excluding area under inland or tidal water bodies) and agricultural land (including land under scattered farm buildings, yards and their annexes, and permanently uncultivated land, such as uncultivated patches, banks, footpaths, ditches, headlands and shoulders). Wind and water erosion (sheet, rill and gully) of soil can be measured as a net loss and applied to one of four categories: light, moderate, strong and extreme. Alternatively, erosion can be measured visually or derived on the basis of reduced productivity. These alternatives can also be applied to the same four categories, which are mutually exclusive. The four categories should add up to the total area affected. The soil erosion indicator does not take into account many important types of soil degradation, such as hardening, over-grazing, secondary salt pollution, and loss of fertility and biodiversity. It also does not take into account the effects of road construction and tourism. The soil erosion indicator should be assessed at least every five years.

Internationally agreed methodologies and standards: The UNECE adopted Standard International Statistical Classification for Land Use. The Global Assessment of Soil Degradation (GLASOD), developed by UNEP and FAO, provides definitions categorizing the extent of soil erosion. Wind and water erosion methodologies developed in the United States (Universal Soil Loss Equation) and some other countries may be also helpful. There is also a methodology for the creation of global and national soil databases (Soils and Terrain Digital Databases –

SOTER). The Committee on Science and Technology of the United Nations Convention to Combat Desertification is currently developing relevant international standards.

Data sources and reporting

At the national level in EECCA, data are collected by governmental bodies responsible for land cadastres, land-use planning and environmental protection as well as by statistical agencies. Data on land affected by erosion are published in annual state-of the-environment reports and/or in statistical yearbooks in some countries. Statistical agencies report data to the UNSD International Environment Statistics Database. FAO also collects data from its member countries.

References at the international level

- European Environmental Agency. *Assessment and Reporting on Soil Erosion*. Technical report N 94. (EEA, 2002).
- *Down to the Earth: Soil Degradation and Sustainable Development in Europe. A Challenge for Twenty-First Century*. Environmental Issues Series N16. (EEA/UNEP, 2000).
- Towards a strategy for soil protection. (EC, 2002).
- Assessment and reporting on soil erosion. (EEA, 2002).
- Grimm, M. et al. *Soil Erosion Risk in Europe*. (2002).
- United Nations Convention to Combat Desertification.
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://www.fao.org/gtos/tems/index.jsp>
- <http://www.unccd.ch>
- <http://unstats.un.org/unsd/environment/>

E. Biodiversity

17. PROTECTED AREAS

General description

Brief definition: The indicator shows the country-designated total area of land, inland water and marine ecosystems that is protected by national instruments and the ratio of this area to the total area of the country. It is also broken down to demonstrate the extent and the proportion of the designated areas by Protected Area Categories of the World Conservation Union (IUCN).

Unit of measurement: Total area in km² and as a percentage of the total country territory as well as by IUCN category.

Relevance for environmental policy

Purpose: The indicator provides a measure of the response to the degradation of ecosystems in a country. It demonstrates the extent to which areas important for conserving biodiversity, cultural heritage, scientific research (including baseline monitoring of processes in the ecosystems), recreation, natural resource maintenance and other values are protected from incompatible uses.

Issue: Sustainable development depends on a sound environment, which in turn depends on ecosystem diversity. Protected areas, especially the full range of IUCN Protected Area Categories, are essential for conserving biodiversity and also for contributing to sustainable development. According to the IUCN, territories intended for the protection and maintenance of biodiversity and natural resources, as well as historical-cultural resources related to them, should be governed by means of legal or other effective measures. In accordance with the main purpose of management, protected areas are divided into six categories of exposure to human interference, from complete non-interference to relatively strong interference.

International agreements and targets: The Convention on Biological Diversity (CBD) aims at the establishment and maintenance (by 2010 for terrestrial areas and by 2012 for marine areas) of comprehensive, effectively managed and ecologically representative national and regional systems of protected areas. Recommendation 16 of the Fourth World Congress on National Parks and Protected Areas (Caracas, 1992) establishes a target of 10 per cent protected areas for each biome (major ecosystem type). The European Environment Ministers in Kiev in 2003 called for the establishment of a pan-European ecological network by 2015. At the EU level, the target is to have a Natura 2000 ecological network of special protected areas completed on land by 2005, marine sites by 2008 and management objectives for all sites agreed and instigated by 2010. In the European Union, Council Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora lists habitat types to be protected in the Member States.

Methodology and guidelines

Data collection and calculations: It is necessary to have maps of designated areas and inventories of all protected areas of the country showing their location, size, date of establishment and protection regime in accordance with national legislation and relevant international requirements. For inter-country comparisons, protected areas should be also grouped by the IUCN categories. The monitoring is done on an annual basis.

Internationally agreed methodologies and standards: The IUCN defines six management categories of protected area in two groups. Totally protected areas are maintained in a natural state and are closed to extractive uses. They comprise Category I, Strict Nature Reserve/Wilderness Area; Category II, National Park; and Category III, National Monument. Partially protected areas are managed for specific uses (e.g. recreation) or to provide optimal conditions for certain species or communities. They comprise Category IV, Habitat/Species Management Area; Category V, Protected Landscape/Seascape; and Category VI, Managed Resource Protected Area. The methodology is increasingly used for land ecosystems, less so for marine ecosystems, and least for inland water ecosystems. Inland waters are usually lumped with land in a terrestrial classification. The methodology for this indicator has not been standardized.

Data sources and reporting

EECCA Ministries of Environment generally collect this data and submit it to statistical offices. Data on protected areas (total number, area, location and date of creation) by national categories are published in annual environmental reports and/or in statistical yearbooks in some countries. In cooperation with the United Nations Environment Programme - World Conservation Monitoring Centre (UNEP-WCMC), IUCN's World Commission on Protected Areas compiles

the United Nations List of Protected Areas, which provides the name, IUCN category, location, size, and year of establishment of all protected areas which meet the IUCN definition, regardless of size and whether or not they have been assigned an IUCN category for all countries. This information is also included in the World Database on Protected Areas. The European Nature Information System, managed by the European Topic Centre on Biological Diversity (ETC/BD in Paris) for the European Environment Agency (EEA) and the European Environmental Information Observation Network (EIONET), covers, in particular, data on habitats and sites compiled in the framework of Natura 2000 (the EU Habitats and Birds Directives).

References at the international level

- UN Convention on Biological Diversity;
- Guidelines for Protected Area Management Categories. CNPPA with the assistance of WCMC. International Union for the Conservation of Nature and Natural Resources (IUCN), Gland, Switzerland; Cambridge, UK, 1994. 261 p. ISBN 2-8317-0201-1;
- Parks for Life: report of the IVth World Congress on National Parks and Protected Areas. IUCN - The World Conservation Union, Gland, Switzerland. Dinerstein, Eric, David M. Olson, et al. 1995;
- 2003 United Nations List of Protected Areas. IUCN, Gland, Switzerland & Cambridge, UK & UNEPWCMC, Cambridge, UK. Chape, Blyth, Fish, Fox & Spalding (compilers) 2003;
- Ecosystems and Human Well-being: A framework for assessment. Millennium Ecosystem Assessment, 2003. 245 p. ISBN 1-55963-403-0;
- Benefits Beyond Boundaries: Proceedings of the Vth IUCN World Parks Congress. IUCN Gland, Switzerland & Cambridge, UK. 2005;
- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora,
- Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds.
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://www.biodiv.org/>
- www.wcmc.org.uk/parks/index.htm
- www.iucn.org/themes/wcpa/index.html
- www.wcmc.org.uk/protected_areas/data/un_97_list.html
- <http://eunis.eea.eu.int/sites.jsp>
- <http://www.world-national-parks.net/>
- <http://themes.eea.eu.int/IMS/CSI/>
- <http://nature.eionet.eu.int>

18. FORESTS AND OTHER WOODED LAND

General description

Brief definition: The indicator shows total area of forests and other wooded lands, ratio to total country area, and share of different categories of forests and other wooded lands by naturalness.

Unit of measurement: Square kilometres or thousand hectares for total, and percentage for share of forests and wooded land, and by category of designated use.

Relevance for environmental policy

Purpose: The indicator provides a measure of the state of forest and other wooded lands in a country and shows the trends in use for environmental purposes.

Issue: Forests are among the most diverse and widespread ecosystems on earth and have many functions: they provide timber and other products; deliver recreation benefits and ecosystem services, including regulation of soil, air and water; are reservoirs for biodiversity and act as carbon sinks. Overexploitation, fragmentation, degradation of environmental quality and conversion of other types of land uses threaten many forest resources. The impact of human activities on natural forest growth and regeneration raises concern. The indicator gives insights into quantitative and qualitative aspects of forest resources and presents averages that may conceal important variations among forest and other wooded lands.

International agreements and targets: Many other international agreements deal with forests within the context of natural resources and environment conservation, for example, the Convention on International Trade in Endangered Species (CITES), the Convention on the Conservation of Wetlands of International Importance (Ramsar Convention), the Convention on Biological Diversity, the Convention on Climate Change and the Convention to Combat Desertification. The United Nations Conference on Environment and Development adopted the Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests (the Forest Principles). There are no international targets. Several countries have set national targets for the extent of their forest area, either in absolute values or as a percentage of the total land area of the country.

Methodology and guidelines

Data collection and calculations: In data collection and calculations, relevant definitions established by FAO for its Global Forestry Resources Assessments and by the Ministerial Conference on the Protection of Forests in Europe (MCPFE) should be used. This relate to definitions of **forest** and **other wooded land** as well as definitions of forest and other wooded land whose primary function is designated as **protection of soil and water, conservation of biodiversity** and **social services** (recreation, tourism, education and/or conservation of cultural/spiritual sites). Other relevant definitions include **primary forest/other wooded land** (forest/other wooded land of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed), **protective plantation** (stands of introduced species established for provision of environmental services, such as soil and water protection, pest control and conservation of habitats of biological diversity; areas of native species characterized by few species, straight tree lines and even-aged stands) and **semi-natural forest/other wooded land** (areas under intensive management where native species are used and deliberate efforts are made to increase/optimize the proportion of desirable species, thus leading to changes in the structure and composition of the forest). The data are generally contained in national forest inventories and obtained by sampling ground surveys, cadastral surveys, remote sensing, or a combination of these. The frequency of evaluation is generally five years.

Internationally agreed methodology and standards: The UNECE/FAO Global Forestry Resource Assessment; The MCPFE guiding principles for use of the Pan-European Indicators for Sustainable Forest Management. The European Union has introduced detailed procedure for monitoring of forests (see Regulation No 21/52/2003).

Data sources and reporting

In EECCA countries, Forestry Ministries or Agencies collect the relevant data and submit it to the FAOSTAT global multilingual database and the electronic database of the Expert Committee on Temperate and Boreal Forest Resources (TBFRA-2000) of FAO/UNECE. Data on area of forests and their state are published in several EECCA countries in annual environmental reports, in statistical yearbooks or in specialized yearbooks (e.g. “Russian Forests” in the Russian Federation).

References at the international level

- Temperate and Boreal Forest Resources Assessment of 2000 UNECE/FAO. Terms and definitions. UN. New York and Geneva, July 1997.
- Forestry Resources of Europe, CIS, North America, Australia, Japan, and New Zealand (of industrialized countries of temperate/boreal zones). UNECE/FAO contribution to the Global Forest Resource Assessment of 2000. Keynote speech. UN. New York and Geneva, 2000. (ECE/TIM/SP/17).
- Global Forest Resource Assessment: Updated version, 2005. Technical description of national reporting tables in the framework of OJIP-2005. Forest Resource Assessment Program. Working paper No.81. FAO. Rome, 2004.
- MCPFE Liaison Unit VIENNA. Background information for improved Pan-European indicators for sustainable forest management - MCPFE expert level meeting 7 – 8 October 2002, Vienna, Austria;
- Sustainable Forest Management Systems. Application of the pan-European criteria for sustainable forest management (Portuguese Standard, NP4406 2003) MCPFE, 2003.
- International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (UNECE/ICP Forests);
- Regulation (EC) No 2152/2003 of the European Parliament and of the Council of 17 November 2003 concerning monitoring of forests and environmental interaction in the Community.
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://www.unece.org/trade/timber/fra/welcome.htm>
- <http://faostat.fao.org/faostat/collections?subset=forestry>
- <http://www.mcpfe.org/>
- <http://www.icp-forests.org/Index.htm>
- <http://www.iisd.ca/forestry/unff/unff5/>

19. *THREATENED AND PROTECTED SPECIES*

General description

Brief definition: This indicator uses estimates of population trends for species, in total and by species group that are threatened at the national and global levels and under protection in the country.

Unit of measurement: Number of species.

Relevance for environmental policy

Purpose: The indicator provides a measure of the state of the biodiversity in terms of number of threatened species and the relative effectiveness of national response measures to maintain the country's and global biodiversity.

Issue: It is recognized that biodiversity has intrinsic value and that biodiversity maintenance is essential for human life and sustainable development. Many species-level biological resources are currently at risk of modification, damage or loss. For many years, IUCN and other international organizations have been monitoring the extent and rate of biodiversity degradation by assigning species to categories of threat through detailed assessment of information against a set of objective, standard quantitative criteria. IUCN has developed a "red list" of globally threatened species. The 2004 edition lists a total of 15,589 species. Countries are developing red lists of species that are threatened at the national level and are establishing appropriate protection regimes for these species. Some of the globally threatened species present in EECCA may not be classified as threatened at the national level. Nevertheless, countries have a strong responsibility for the care of these species even though they are not yet threatened on their territories. To what extent national policies on nature and biodiversity reflect this responsibility is shown by the information that the indicator provides on the total number of globally threatened species that are present and protected in the country.

International agreements and targets: This indicator is relevant to the Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention), which lists species that must be protected. The Convention on Biodiversity aims to reduce the rate of biodiversity loss by the year 2010. The Ministers of Environment of the European States participating in the process of the Pan-European Biological and Landscape Diversity Strategy in 2003 reinforced their objective to halt the loss of biological diversity at all levels by the year 2010. The target implies not only that species extinction must be stopped but also that threatened species must be shifted to a better status. In the European Union, Council Directive 79/409/EEC on the conservation of wild birds and Council Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora list relevant species under legal protection.

Methodology and guidelines

Data collection and calculations: Lists of each group of threatened and protected species established in the country, and by IUCN for globally threatened species, serve as a basis for data collection. There may be differences between the number of threatened species and the number of species under protection, as the latter may include species protected under relevant multilateral environmental agreements or because of their presence on the *IUCN Red List of Threatened Species*. It is useful to have a break down for the latter species when presenting the resulting data. The number of species should be counted by species group (animals: invertebrates, freshwater fishes, reptiles, amphibians, birds and mammals; vascular plants). Taxonomic problems and the incomplete adequacy of the IUCN may list hinder proper maintenance of general accounting for invertebrates. Estimates for each species group should be done at least every five years.

Internationally agreed methodologies and standards: The *IUCN Red List* is the world's most comprehensive inventory of the global conservation status of plant and animal species. Classification into the categories for species threatened with extinction (Vulnerable, Endangered, and Critically Endangered) is done using a set of five quantitative criteria that form the heart of the system.

Data sources and reporting

At the national level in EECCA, data are available from ministries of environment, agencies dealing with protected areas and statistical agencies. In the majority of EECCA countries, information on threatened species is collected in Red Books, which include data on abundance, state and conservation measures of rare and or protected species of wild fauna and flora. Red Books should be published at least once per 10 years. Besides, subnational Red Books are being published in several EECCA countries. The Species Database of UNEP-WCMC provides detailed information on species of conservation importance. UNEP-WCMC maintains the CITES Trade Database. The European Nature Information System managed by ETC/BD covers data on species compiled in the framework of Natura 2000 and other relevant instruments.

References at the international level

- 2004 IUCN Red List of Threatened Species: A Global Species Assessment. Edited by Jonathan
- E.M. Baillie, Craig Hilton-Taylor and Simon N. Stuart. ISBN: 2-8317-0826-5;
- Categories and criteria of the World Red Book of the International Union for Conservation of Nature and Natural Resources (IUCN) (version 3.1);
- Global Biodiversity: Status of Earth's Living Resources. Compiled by World Conservation Monitoring Centre in collaboration with The Natural History Museum, London, and in association with IUCN, UNEP, WWF, and WRI. Chapman & Hall, London, 1992 - 585 p.;
- World Atlas of Biodiversity. UNEP-WCMC; Publisher University of California Press, 2002. - 340 p. ISBN: 0-520-23668-8;
- European Red List of Globally Threatened Animals and Plants, 1991 (E/ECE/1249 - ECE/ENVWA/20) (Sales No. 91.II.E.34);

- Code of Practice for the Conservation of Threatened Animals and Plants and Other Species of International Significance, 1992 (ECE/ENVWA/25-Sales No.92.II.E.16);
- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora,
- Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds
- <http://www.redlist.org/>
- <http://www.iucn.org/themes/ssc/>
- <http://www.unep-wcmc.org/>
- <http://themes.eea.eu.int/IMS/CSI/>
- <http://www.cms.int/>
- <http://www.cites.org/>
- <http://themes.eea.europa.eu/IMS/CSI>

20. *TRENDS IN ABUNDANCE AND DISTRIBUTION OF SELECTED SPECIES*

General description

Brief definition: Changes in the number of various selected species within a given area (country, region or designated area).

Unit of measurement: Number of mature individuals or other relevant indicator of abundance within a given area, and percentage for trends.

Relevance for environmental policy

Purpose: The indicator provides a measure of the state of selected species and response measures to maintain biodiversity.

Issue: Many multilateral environmental agreements recognize that biodiversity has an intrinsic value and that biodiversity maintenance is essential for human life and sustainable development. Because of high economic interest, many biological resources at the gene, species and ecosystem level are currently at risk of modification, damage or loss. The indicator shows the situation for populations of representatives of fauna and flora that belong to groups of species that are of major resource relevance and are important from the point of view of biodiversity conservation (“selected species”). The indicator will help decision makers to balance economic interests with biodiversity protection (especially when issuing hunting and forest harvest licenses), and to maintain balance within ecosystems.

International agreements and targets: This indicator is relevant to the Convention on Biodiversity, the Bonn Convention, CITES and the Berne Convention. The Convention on Biodiversity aims to reduce the rate of biodiversity loss by the year 2010. The Ministers of Environment of the European States participating in the process of Pan-European Biological and Landscape Diversity Strategy in 2003 reinforced their objective to halt the loss of biological diversity at all levels by the year 2010. In the European Union, Council Directive 79/409/EEC on the conservation of wild birds and Council Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora are also relevant.

Methodology and guidelines

Data collection and calculations: The following categories of species might be considered as “selected species” when developing a monitoring programme:

(a) **Keystone species:** Taxons whose impact on the ecosystem or community studied is disproportionately large relative to its abundance. The loss of these species will significantly affect the population sizes of other species in the ecosystem, potentially leading to further species loss (“cascade effect”).

(b) **Species of international significance:** Examples are species for which a country accounts for a significant proportion of the global or European range or population.

(c) **“Flagship” species:** These are taxons of particular intrinsic (cultural and historical) appeal to the citizens of the country as a whole or its regions.

(d) **Endemic species:** Any area contributes to global biodiversity by the overall number of different species within it and by the proportion of species that do not occur anywhere else (are endemic to the area). Conservation of endemic species, particularly those sharing a discrete geographic area, can be an effective way to maintain global biodiversity levels.

Information on species abundance should be collected through the consistent long-term application of an appropriate survey technique that is widely accepted by the scientific community. Retrospective population data can be obtained through review of published literature, including previous field study reports, to find material that is appropriate for comparison with the methodologies currently in use. While it is usually impossible to count every individual within a population or area, knowledge of habitat requirements and species population density in sample areas, coupled with data on climate, altitude, soil type and/or vegetation cover can be used to estimate population size in the area of interest. In many countries, a geographic information system (GIS) is commonly used to analyse the spatial data. It is important to verify population size predictions through fieldwork.

Quantity trends are predominantly determined based on the aggregate of cyclic fluctuations. They show the aggregate of habitat conditions, protection and efficient use of biological resources.

The indicator is calculated separately for every type. For species for which the aggregate absolute quantity is calculated, the following formula can be used to calculate the quantity trend indicator ($IN_{sp.}$) in percent:

$$IN_{sp.} = \ln(N_y) \times 100 / \ln(N_{max})$$

where N_y is the absolute quantity in a given year and N_{max} is the maximum known absolute quantity that serves as a reference point.

For species for which in the country there are only assessments of absolute or relative quantities in observation territorial units, the reference point for each observation territorial unit is the assessment of the quantity in the year the monitoring was introduced. Calculation of a sub indicator ($SIN_{sp.}$) for a certain species is done for each observation territorial unit using the same formula. Then the geometric average of available assessments $SIN_{sp.}$ calculated for each year becomes the indicator.

Internationally agreed methodologies and standards: No universally agreed methodology currently exists. EEA is currently considering abundance variation trends over years for farmland, woodland, park and garden birds as well as distribution variation trends over 20–25 years for butterflies. WCMC/UNEP and World Wide Fund for Nature (WWF) have designed and implemented a system to generate indicators on biodiversity change over time, principally at the global or continental level.

Data sources and reporting

In EECCA, data are in relatively short supply. Some data that may be suitable as a basis for this indicator are collected by central environmental institutions, state statistics bodies, academic institutions and nature conservation associations. At the international level, BirdLife International maintains a database on farmland birds and on trends involving woodland, park and garden birds, and Dutch Butterfly Conservation maintains a database on trends involving butterflies.

References at the international level

- Code of Practice for the Conservation of Threatened Animals and Plants and Other Species of International Significance, 1992 (ECE/ENVWA/25-Sales No.92.II.E.16);
- Birds in Europe: Population Estimates, Trends and Conservation Status. BirdLife International. BirdLife International. BirdLife Conservation Series No 12. London, 2004;
- The EBCC Atlas of European Breeding Birds: their distribution and abundance.
- Hagemeyer, EJM and Blair MJ (eds), 1997. T and AD Poyser, London;
- Habitat use and trends of European butterflies. Methodology for calculation of trends in European butterflies: van Swaay, C., Warren, M. & Loïs G. Habitat use and trends of European butterflies. Journal of Insect Conservation, Habitat Special Issue. 2005;
- Delbaere, B. An inventory of Biodiversity Indicators in Europe 2002. EEA Technical Report. 2003.
- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora,
- Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://www.unep-wcmc.org/>
- <http://www.cms.int/>
- <http://www.cites.org/>
- <http://themes.eea.eu.int/IMS/CSI/>
- <http://www.iucn.org/themes/ssc/>
- <http://www.birdlife.net/>
- <http://www.ebcc.info/>
- <http://www.rspb.org.uk/>
- <http://www.environment.detr.gov.uk/sustainable/>
- <http://www.vlinderstichting.nl/>

F. Agriculture

21. FERTILIZER CONSUMPTION

General description

Brief description: Total amount of fertilizers used per unit of agricultural land.

Measurement unit: Kilogram per hectare.

Relevance for environmental policy

Purpose: The indicator provides a measure of the pressure on the environment in terms of intensity of fertilizer consumption.

Issue: The use of mineral fertilizers in agriculture to increase cropping power simultaneously increases environmental hazards, such as water and soil pollution, and has toxic effects on other environmental components, interfering with the natural balance of soil microflora. High levels of nitrate and nitrite in drinking water are a hazard to human health. The actual environmental effects will depend on pollution abatement practices, soil and plant types, and meteorological conditions. The indicator makes it possible to assess the fertilizer load on the environment (the accumulation of nutrients in the soil, the resulting pollution of surface and groundwater, and the movement of nutrients through trophic chains and other parts of the environment). Time series analysis of mineral fertilizers consumption allow monitoring of its effect on the environment, which is influenced by geography and other local conditions, including the types of crops cultivated but also the use of organic fertilizers.

International agreements and targets: In the EU Directive 91/676/EEC was adopted which concerns water pollution by nitrates, establishes requirements covering the use of nitrogen and phosphate while placing on the market of fertilizers is regulated by regulation 2003/2003. HELCOM (the Helsinki Commission) has developed recommendations for its Parties in this regard.

Methodology and guidelines

Data collection and calculations: It is necessary to collect data on mineral fertilizer sales and fertilizers' basic characteristics. The indicator is assessed annually. Data on the quantities of fertilizers used (sales to the final consumer) are converted into the three basic nutrient components (N, K₂O, P₂O₅) and aggregated. Basic data on fertilizer nutrient content can be obtained directly from producers or through chemical analysis (it must be indicated clearly on labels and in all commercial documents). Agricultural land is defined according to cadastre information. The technical parameters of fertilizer application, such as the amount used, the climate zone, the season and broadcast method and the type of crop and soil, determine its effect on the environment. These factors, with the exception of the type of crop, are difficult to evaluate. No information is collected on organic fertilizers such as compost, manure and bone meal. Likewise, no information is collected on the use of fertilizers outside of agriculture.

Internationally agreed methodologies and standards: ISO standards (17020 for sampling and 17025 for testing).

Data sources and reporting

In EECCA, data are collected by the ministries dealing with agriculture and the environment, and by statistical agencies. In several EECCA countries, national statistical agencies and their subnational departments have long-term databases on the use of fertilizers at the national and subnational levels, accordingly. Data on national consumption of mineral and organic fertilizers are published in annual statistical yearbooks in several countries. FAO Member States report data to the FAOSTAT database.

References at the international level

- Fertilizer use by crop, 3. International Fertilizer Industry Association, Paris, France/International Fertilizer Development Centre, Muscle Shoals AL, USA/FAO, Rome, Italy. Statistics Division, FAO, 1996. 49 p.
- Environmental Indicators for Agriculture. Vol. 3. Methods and Results. (OECD, 2001).
- Wascher, D.W. (ed.). Agri-Environmental Indicators for Sustainable Agriculture in Europe. ECNC Technical Reports series. (European Centre for Nature Conservation, 2000).
- *Towards Sustainable Agriculture – A Pilot Set of Indicators*. Research Report. (MAFF, 2000).
- FAO, FAOSTAT database, annual updates (Rome).
- Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources.
- Regulation (EC) No 2003/2003 of the European Parliament and of the Council of 13 October 2003 relating to fertilizers.
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://faostat.fao.org>
- <http://europa.eu.int/comm/eurostat/>
- <http://www.fertilizer.org/>

22. PESTICIDE CONSUMPTION

General description

Brief description: Use of pesticides per unit of agricultural land.

Measurement unit: Kilogram per hectare.

Relevance for environmental policy

Purpose: The indicator provides a measure of the pressure on the environment in terms of intensity of pesticide consumption.

Issue: The use of pesticides (herbicides, fungicides, insecticides, etc.) mainly for crop protection increases environmental hazards (soil pollution and toxic effects on other parts of the environment). Pesticides can be persistent, mobile and toxic in soil, water and air, and they can affect humans and wildlife either directly when using them or indirectly through the food chain. Some pesticides can accumulate in the soil and in biota, and their residues may reach surface

water and groundwater through leaching. Only detailed information on the use of pesticides makes it possible to assess the resulting environmental hazards for various regions, separate territories and crops, which are influenced by geography and other local conditions, including the types of crops cultivated, the timing of application, the material used, etc. Strategies can then be devised to offset negative effects.

International agreements and targets: The 2001 Convention on Persistent Organic Pollutants (POPs) and the POPs Protocol to the 1979 Convention on Long-range Transboundary Air Pollution control the use of pesticides. Some pesticides are banned by international trade agreements. Since 1993 the European Union has been implementing a programme to establish harmonized maximum residue levels (MRLs), which restrict the levels of pesticide residues in foodstuffs sold in the European Union. The placing on the market of plant protection products is regulated by directive 91/414/EEC.

Methodology and guidelines

Data collection and calculations: Data calculation is based on the amount of pesticide sales (sales volume). Data are continuously fed into national databases on pesticide consumption. Pesticide consumption is assessed annually. At the national level, government authorities aggregate pesticide consumption data by pesticide groups: insecticides, herbicides, fungicides and so on. Ideally, pesticide databases should describe pesticide characteristics, such as active components, to be able to relate to their toxicity and environmental behaviour. An analysis of pesticides' effect on the environment that is based solely on the amount of active components present cannot be considered complete. It is important to take into account factors such as broadcast methods, the climate, the season, and the types of soil and cultivated crop.

Internationally agreed methodologies and standards: The Organisation for Economic Co-operation and Development (OECD) collects data on the amount of active component, while European Union is preparing a regulation to collect detailed information on pesticide use in the Member States.

Data sources and reporting

In EECCA, Ministries of Agriculture and State statistical agencies collect data on pesticide consumption. FAO Member States report some data on total national pesticide consumption to FAOSTAT database. Eurostat maintains a database of member countries' data. Pesticide Action Network North America (PANNA) has a database as well.

References at the international level

- FAO, FAOSTAT database, annual updates. (Rome).
- Council Directive 76/895/EEC of 23 November 1976 relating to the fixing of maximum levels for pesticide residues in and on fruits and vegetables.
- Council Directive 86/362/EEC of 24 July 1986 on the fixing of maximum levels for pesticide residues in and on cereals products.
- Council Directive 86/363/EEC of 24 July 1986 on the fixing of maximum levels for pesticide residues in and on foodstuffs of animal origin.
- Council Directive 90/642/EEC of 29 November 1990 on the fixing of maximum levels for pesticide residues in and on products of plant origin, including fruits and vegetables.

- Council Directive 91/414/EEC of 15 July 1991 concerning the placing of plant protection products on the market.
- Regulation (EC) No. 396/2005 of the European Parliament and of the Council of 23 February 2005 on MRLs of pesticides in or on food and feed of plant and animal origin.
- *Environmental Indicators for Agriculture*. Vol. 3. *Methods and Results*. (OECD, 2001).
- Wascher, D.W. (ed.). *Agri-Environmental Indicators for Sustainable Agriculture in Europe*. ECNC Technical Reports series. (European Centre for Nature Conservation, 2000).
- U.S. Department of Agriculture, Agricultural Marketing Service. Pesticide Data Program.
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://www.fao.org/>
- <http://europa.eu.int/comm/eurostat/>
- <http://www.pops.int/>
- <http://www.pesticideinfo.org/Index.html>
- <http://www.epa.gov/tri/>

G. Energy

23. FINAL ENERGY CONSUMPTION

General description

Brief definition: Energy consumption, represented by energy supplied to the final consumer's door for all energy uses – both the total and the amount used by major users (transport, industry, services, agriculture and households).

Unit of measurement: Thousand tons of oil equivalent (ktoe).

Relevance for environmental policy

Purpose: Final energy consumption (total and by user) represents a driving forces indicator and shows trends in final energy consumption.

Issue: The trend in final energy consumption (total and by user) provides a broad indication of progress made in reducing energy consumption and associated environmental impacts by the different end users (transport, industry, services and households). It can be used to help monitor and assess the success of key policies that attempt to influence energy consumption and energy efficiency. The policy objective is to work out and implement particular measures in certain sectors of the economy aimed at increasing the efficiency of energy consumption (or at reducing energy intensity), and hence at reducing negative environmental impacts. Thus, for instance, industry-related strategies include reasonable efficiency standards, financial incentives and liberalization of energy prices. Activities in the household sector focus mainly on the application of energy efficiency standards to construction of new housing, energy pricing reform and public awareness campaigns.

International agreements and targets: UNFCCC and its Kyoto Protocol call for curbing total GHG emissions, the major share of which is CO₂ emissions caused by burning of fossil fuels. The Kyoto Protocol establishes limits on total GHG emissions for industrially developed countries and for economies in transition. The EU Directive on energy end-use efficiency and energy services (2006/32/EC) aims at boosting the cost-effective and efficient use of energy in

the European Union. According to this Directive, each Member State should each year save 1 per cent more energy than in the previous year through increased energy efficiency, which, it is hoped, will lead to annual energy savings of around 6 per cent by 2012.

Methodology and guidelines

Data collection and calculations: Final energy consumption is calculated as the sum of final energy consumption from all sectors. These are disaggregated into the categories of industry, transport, households, services and agriculture using the International Standard Industrial Classification of All Economic Activities (ISIC Rev. 3.1). Final energy consumption includes consumption of transformed energy (electric power, public heating, petroleum products, coke, etc.) and primary fuels such as natural gas and renewable energy sources (solar energy, biomass, etc.). Final energy consumption in industry includes consumption in all industrial sectors except the “energy sector”. Final energy consumption in transport includes consumption in all types of transportation (rail, road, pipeline and air transport and inland and maritime navigation). Final energy consumption in households includes quantities consumed by households, excluding the consumption of motor fuels for personal transport. Household consumption includes all use of electricity and use of fuels for space and water heating. Final energy consumption in services includes consumption by public administration and private services. The service sector in this context includes agriculture, fisheries and other sectors. Final energy consumption in agriculture consists of quantities consumed by agriculture, including engines used for agricultural transportation. Final energy consumption in fisheries consists of quantities consumed by the fishing industry, excluding fishing on the high seas. The relative contribution of a specific sector can be measured by the ratio of final energy consumption from that specific sector to the total final energy consumption calculated for a calendar year.

Internationally agreed methodologies and standards: IAEA, in cooperation with the United Nations Department of Economic and Social Affairs (UNDESA), IEA, Eurostat and the EEA published Energy Indicators for Sustainable Development (EISD) with corresponding methodologies and guidelines in 2005.

Data sources and reporting

In the majority of EECCA countries, national energy balances are being prepared by the governmental bodies responsible for economic affairs. Data on energy consumption in total and by sectors are published in statistical yearbooks. UNSD collects energy statistics from more than 190 countries and updates and maintains an Energy Statistics Database, as well as a National Accounts Statistics Database, which includes GDP. The International Financial Statistics database of the International Monetary Fund (IMF) provides nominal and real GDP for most countries. The International Energy Agency (IEA) supports the most comprehensive databases on energy balances and assessments, which are primarily based on national data or on data collected by reliable regional agencies.

References at the international level

- United Nations, *Energy Statistics – Definitions, Units of Measure and Conversion Factors*. Series F, No. 44.

- United Nations, Commission of the European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development and World Bank. System of National Accounts 1993 (SNA 1993). Series F, No. 2, Rev. 4.
- United Nations. *Handbook of the International Comparison Programme*. Studies in Methods, Series F, No. 62.
- World Bank, *World Development Indicators* (issued annually).
- Organisation for Economic Co-operation and Development/International Energy Agency, *Energy Statistics of OECD Countries and Energy Statistics of Non-OECD Countries* (issued annually) Part I. Methodology.
- IAEA, UNDESA, IEA, Eurostat and EEA. *Energy Indicators for Sustainable Development: Guidelines and Methodologies*. IAEA, Vienna, 2005.
- IEA, *Key World Energy Statistics* (2003).
- Eurostat: Energy balances.
- Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC.
- <http://www.un.org/esa/sustdev/natlinfo/indicators/indisd/indisd-mg2001.pdf/>
- <http://www-pub.iaea.org/>
- <http://unstats.un.org/>
- <http://www.worldbank.org>
- http://europa.eu.int/estatref/info/sdds/en/sirene/energy_base.htm
- <http://forum.europa.eu.int/irc/dsis/coded/info/data/coded/en/Theme9.htm>
- <http://themes.eea.eu.int/IMS/CSI/>
- <http://www.iea.org>

24. TOTAL ENERGY CONSUMPTION

General description

Brief definition: Energy resources, total and by fuel (solid, oil, gas, nuclear and renewable sources, including hydro power), consumed annually in a country.

Unit of measurement: Thousand tons of oil equivalent (ktoe) for total and by fuel, and per cent for shares of different types of fuel.

Relevance for environmental policy

Purpose: Total energy consumption, total and by fuel, is a driving forces indicator describing the development of the energy sector and the corresponding levels of consumption.

Issue: Energy is a key factor in industrial development and the provision of essential services. Traditionally, energy has been considered a key element of economic progress. However, current energy production and consumption practices are having major negative impacts on the environment. These impacts are fuel-specific: for instance, the use of coal as a fuel has a major impact due to extremely high levels of pollutants emissions, whereas natural gas is one of the most environmentally appropriate fossil fuels. However, production and transportation of natural gas appear to be a huge source of GHG emissions (methane). Renewable energy sources have less negative environmental impact. Long-term objectives include continuous increases in energy

efficiency that are higher than increases in energy consumption, as well as switching to consumption of environmentally appropriate renewable energy resources. The indicator reflects primary energy supply or gross domestic energy consumption and serves as a unit of measurement for power inputs in the economy. It is widely used to measure the use of various fuels.

International agreements and targets: The UNFCCC and its Kyoto Protocol call for curbing total GHG emissions, the major share of which is CO₂ emissions caused by burning of fossil fuels. The Kyoto Protocol establishes limits and targets for total GHG emissions for countries included in Annex 1.

Methodology and guidelines

Data collection and calculations: Total energy consumption is a key element of energy balances and relates to “revealed” consumption. Measuring it requires the use of data on revealed rather than actual consumption, and it is calculated based on a formula taking into account production, exports, imports, storage bins and changes in fuel stocks. Production (or primary production) means production of solid fuels (coal, lignite and derivatives), oil (crude oil and petroleum products), gas (natural and derived), nuclear energy and renewable sources (solar energy, energy from biomass and waste, and geothermal, hydropower and wind energy). International trade in energy products is based on the “general trade” system, in which all goods delivered into the country or shipped out of it are registered as export or import goods. Data on changes in stocks mean data on changes in stocks with producers, importers and/or industrial consumers as of the beginning and end of the year. Bins are usually related to the fuel delivered to vessels and aircrafts for international sea and air shipping, irrespective of whether or not they belong to the state. Data on exports, imports, bins and changes in stocks of resources include data on both primary and secondary products (fuel products, such as petrol and lubricants produced from primary fuels). Balance calculation based on the data on total consumption of fuels is carried out according to the following scheme:

For each fuel type it is necessary to measure consumption volume using the following formula:

$$\textit{primary production} + \textit{import} - \textit{export} - \textit{bin} \pm \textit{changes in stocks}$$

Then, using the conversion multiplier factor for each fuel type the obtained volume values are converted into common energy units. Adding up all consumption values for each fuel type results in the total energy consumption (gross domestic energy consumption).

The relative contribution of a specific fuel is measured by the ratio between energy consumption originating from that fuel and the total gross inland energy consumption calculated for a calendar year.

Internationally agreed methodologies and standards: IAEA, in cooperation with the United Nations Department of Economic and Social Affairs (UNDESA), IEA, Eurostat and the EEA published Energy Indicators for Sustainable Development (EISD) with corresponding methodologies and guidelines in 2005.

Data sources and reporting

In EECCA countries, governmental bodies responsible for economic affairs prepare national energy balances by fuel types and the data on consumption of various fuels are available from national statistical agencies; some of the data are also available in national statistical yearbooks. UNSD and IEA publish energy statistics based on reports by various countries including from EECCA. For the European Union, data have been traditionally compiled by Eurostat through the annual Joint Questionnaires of Eurostat and IEA.

References at the international level

- United Nations, *Energy Statistics – Definitions, Units of Measure and Conversion Factors*. Series F, No. 44.
- United Nations, Commission of the European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development and World Bank. *System of National Accounts 1993 (SNA 1993)*. Series F, No. 2, Rev. 4.
- United Nations. *Handbook of the International Comparison Programme*. Studies in Methods, Series F, No. 62.
- World Bank, *World Development Indicators* (issued annually).
- Organisation for Economic Co-operation and Development/International Energy Agency, *Energy Statistics of OECD Countries and Energy Statistics of Non-OECD Countries* (issued annually) Part I. Methodology.
- IAEA, UNDESA, IEA, Eurostat and EEA. *Energy Indicators for Sustainable Development: Guidelines and Methodologies*. IAEA, Vienna, 2005.
- IEA, *Key World Energy Statistics*.
- Eurostat: Energy balances.
- <http://www.un.org/esa/sustdev/natlinfo/indicators/indisd/indisd-mg2001.pdf/>
- <http://www-pub.iaea.org/>
- <http://unstats.un.org/>
- <http://www.worldbank.org>
- http://europa.eu.int/estatref/info/sdds/en/sirene/energy_base.htm
- <http://forum.europa.eu.int/irc/dsis/coded/info/data/coded/en/Theme9.htm>
- <http://themes.eea.eu.int/IMS/CSI/>
- <http://www.iea.org>

25. TOTAL ENERGY INTENSITY

General description

Brief definition: Ratio between the gross inland consumption of energy (or total energy consumption) and the GDP calculated for a calendar year at constant prices.

Unit of measurement: Thousand tons of oil equivalent (ktoe) per unit of GDP in US dollars. For internal use, the GDP should be expressed in the national currency.

Relevance for environmental policy

Purpose: The indicator provides a measure of the response to the efficiency of energy consumption in a country.

Issue: Energy is a key factor in economic progress. However, current energy production and consumption practices are having major negative impacts on the environment. Total energy intensity indicates the general correlation between energy consumption and economic development and provides a basis for approximate assessment of energy consumption and its environmental impact as a result of economic growth. Total energy intensity depends both on the structure of the economy (high- and low-energy-consuming sectors) and on geographical factors (countries in cold climate zones may consume 20 per cent more energy per capita than other countries for heating purposes, whereas countries in hot climates may consume some 5 per cent extra energy per capita for air conditioning). The policy objective is to improve energy efficiency and weaken the correlation between economic growth and energy consumption (decoupling economic growth from energy consumption), particularly the consumption of fossil fuels.

International agreements and targets: There are no particular targets for energy intensity. The UNFCCC and its Kyoto Protocol call for curbing total GHG emissions, the major share of which is CO₂ emissions caused by burning of fossil fuels. The Kyoto Protocol establishes limits and targets for total GHG emissions for countries included in Annex 1. The indicative target for final energy consumption intensity in the European Union, set in the 1998 by Council Resolution on Energy Efficiency, is a 1 per cent annual improvement in the intensity of final energy consumption from 1998 “over and above that which would otherwise be attained”. The EU Directive on energy end-use efficiency and energy services (2006/32/EC) aims at boosting the cost-effective and efficient use of energy in the European Union. According to this Directive, each Member State should each year save 1 per cent more energy than in the previous year through increased energy efficiency, which is hoped to lead to annual energy savings of around 6 per cent by 2012

Methodology and calculations

Data collection and calculations: The gross inland consumption of energy is calculated as the sum of the gross inland consumption of the five types of energy: solid fuels, oil, gas, nuclear energy and energy from renewable sources. In addition, each of these is calculated as an aggregation of various data on the production, storage, trade (imports/exports) and consumption/use of energy. Total energy consumption is calculated using national energy balances. The GDP figures are taken at constant prices to avoid the impact of inflation and are presented with an indication of the base year. GDP is measured in US dollars, converted from real local currency at purchasing power parity for the base year to which local currency was deflated.

Internationally agreed methodologies and standards: IAEA, in cooperation with the United Nations Department of Economic and Social Affairs (UNDESA), IEA, Eurostat and the EEA published Energy Indicators for Sustainable Development (EISD) with corresponding methodologies and guidelines in 2005.

Data sources and reporting

In some EECCA countries, the data on energy intensity per unit of GDP are available in governmental bodies responsible for economic affairs. In addition, in many EECCA countries separate data on energy consumption and on GDP are published annually, hence the calculation of this indicator does not present any problem. UNSD collects energy statistics from more than

190 countries, including from EECCA, and updates and maintains an Energy Statistics Database, as well as a National Accounts Statistics Database, which includes GDP. The International Financial Statistics database of the IMF provides nominal and real GDP for most countries. IEA supports the most comprehensive databases on energy balances and assessments, which are primarily based on national data or on data collected by reliable regional agencies.

References at the international level

- United Nations, *Energy Statistics – Definitions, Units of Measure and Conversion Factors*. Series F, No. 44.
- United Nations, Commission of the European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development and World Bank. *System of National Accounts 1993 (SNA 1993)*. Series F, No. 2, Rev. 4.
- United Nations. *Handbook of the International Comparison Programme*. Studies in Methods, Series F, No. 62.
- World Bank, *World Development Indicators* (issued annually).
- Organisation for Economic Co-operation and Development/International Energy Agency, *Energy Statistics of OECD Countries and Energy Statistics of Non-OECD Countries* (issued annually) Part I. Methodology.
- IAEA, UNDESA, IEA, Eurostat and EEA. *Energy Indicators for Sustainable Development: Guidelines and Methodologies*. IAEA, Vienna, 2005.
- IEA, *Key World Energy Statistics* (2003).
- Eurostat: Energy balances.
- Council Resolution of 7 December 1998 on energy efficiency in the European Community.
- Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC.
- <http://www.un.org/esa/sustdev/natlinfo/indicators/indisd/indisd-mg2001.pdf/>
- <http://www-pub.iaea.org/>
- <http://unstats.un.org/>
- <http://www.worldbank.org>
- http://europa.eu.int/estatref/info/sdds/en/sirene/energy_base.htm
- <http://forum.europa.eu.int/irc/dsis/coded/info/data/coded/en/Theme9.htm>
- <http://themes.eea.eu.int/IMS/CSI/>
- <http://www.iea.org>.

26. RENEWABLE ENERGY CONSUMPTION

General description

27. **Brief definition:** The share of renewable energy consumption in a country's total energy consumption for a calendar year.

28. **Unit of measurement:** Percent.

Relevance for environmental policy

Purpose: The indicator provides a measure of the response to reduce the environmental impact of energy consumption.

Issue: The dependence of the economy on non-renewable energy resources (fossil fuels) cannot be viewed as steady in the long run, since natural fossil fuel resources are limited, whereas renewable resources can ensure a continuous energy supply. Renewable energy sources can be viewed as the best option for reducing the negative environmental impacts of energy production and consumption. The related policy objective is to achieve a safe energy supply by gradual replacement of fossil fuels with renewable energy sources. Renewable energy is the energy obtained from the energy streams of the environment. It includes energy produced from renewable non-fossil energy sources: wind, solar, geothermal, wave, tidal, hydropower, biomass, landfill gas, sewage treatment plant gas and biogas energy. The indicator measures the contribution of renewable energy sources to the total consumption of energy.

International agreements and targets: Chapter 4 of Agenda 21 calls for improving efficiency in the use of energy sources and for a transition towards the environmentally friendly use of renewable resources. In the European Union, the European Commission's White Paper "Energy for the Future: Renewable Sources of Energy" (COM(97)599) as well as the 1998 Council Resolution on renewable energy provide a framework for Member States' actions to develop renewable energy and sets an indicative target of increasing the share of renewable energy in EU-15 total energy consumption to 12 per cent by 2010.

Methodology and guidelines

Data collection and calculations: Measuring renewable energy consumption relates to "revealed" consumption which is calculated based on a formula taking into account production, exports, imports, and changes in fuel stocks. Both data on consumption of energy produced from renewable energy sources and data on gross energy consumption are required. Both types of data may be available in national energy balances, as well as from various international information sources on energy. Both renewable energy and total energy consumption are measured in ktoe. Therefore, the amount of renewable energy is measured as an absolute value but presented as a percentage. Due to the huge variety of forms and uses of renewable energy resources, data collection may create problems. The comparability of national data is limited by the absence of standard methodologies.

Internationally agreed methodologies and standards: IAEA, in cooperation with the United Nations Department of Economic and Social Affairs (UNDESA), IEA, Eurostat and the EEA published Energy Indicators for Sustainable Development (EISD) with corresponding methodologies and guidelines in 2005.

Data sources and reporting

National data and assessments on renewable energy resources are collected by governmental bodies responsible for economic affairs and or by statistical agencies and published in the national statistical yearbooks of some EECCA countries. UNSD and IEA collect data and assessments based on information from national and international sources.

References at the international level

- United Nations, Energy Statistics – Definitions, Units of Measure and Conversion Factors. Series F, No. 44.
- Organisation for Economic Co-operation and Development/International Energy Agency. Energy Statistics of OECD Countries and Energy Statistics of non-OECD countries. (issued annually) Part I: Methodology.
- IAEA, UNDESA, IEA, Eurostat and EEA. *Energy Indicators for Sustainable Development: Guidelines and Methodologies*. IAEA, Vienna, 2005.
- IEA, *Key World Energy Statistics*.
- Energy for the future: Renewable sources of energy. White Paper for a Community strategy and action plan (COM(97) 599 final).
- Council Resolution of 7 June 1998 on renewable sources of energy
- Eurostat: Energy balances.
- <http://www.un.org/esa/sustdev/natlinfo/indicators/indisd/indisd-mg2001.pdf/>
- <http://www-pub.iaea.org/>
- <http://unstats.un.org/>
- <http://www.worldbank.org>
- http://europa.eu.int/estateref/info/sdds/en/sirene/energy_base.htm
- <http://forum.europa.eu.int/irc/dsis/coded/info/data/coded/en/Theme9.htm>
- <http://themes.eea.eu.int/IMS/CSI/>
- <http://www.iea.org>

H. Transport

27. PASSENGER TRANSPORT DEMAND

Brief definition: The number of kilometres travelled per person in a given year by different modes of transport (passenger cars, buses, trolleybuses, trams, underground, trains, ships and airplanes) and the volume of passenger transport relative to GDP at constant prices.

Unit of measurement: Thousand passenger-kilometres (pkm), total and per unit of GDP, in US dollars. For internal use, GDP should be expressed in the national currency.

Relevance for environmental policy

Purpose: Passenger transport demand is a driving force indicator. It is of prime importance in regulating passenger turnover and developing various types of transport. By measuring the decoupling of passenger transport demand from economic growth, it also helps assess the effectiveness of response measures.

Issue: Travel is an essential part of the economic and social life of a country. The relevance of the modal split policy for the environmental impact of passenger transport arises from difference in the environmental performance (resource consumption, emissions, noise, accidents, etc.) of different modes of transport. Non-motorized travel has low environmental impact, and, due to the level of physical exertion involved, offers health benefits. Motorized travel has greater environmental and social impacts, such as air and noise pollution, global warming and accidents. Sustainability implies using the most appropriate mode of transport for the journey in question and decoupling transport from economic development. Policies are needed which support a shift

towards less environmentally damaging means and reduce the need for travel. Relative decoupling occurs when demand for passenger transport grows more slowly than GDP. Absolute decoupling occurs when demand for passenger transport falls while GDP rises or remains constant.

International agreements and targets: None. In the European Union, the European Commission's white paper "European Transport Policy for 2010: Time to Decide" (COM(2001) 370) proposes an Action Plan aimed at bringing about substantial improvements in the quality and efficiency of transport in Europe.

Methodology and guidelines

Data collection and calculations: Current statistics should make it possible to calculate at least the performance of travel via passenger car, bus and coach, rail, ship and airplane. Contributors to compilations of generalized data on passenger carriage include enterprises, agencies and private individuals involved in the transport business. The reporting time in passenger carriage depends on the type of transport: one can use the time when the ticket is acquired (rail, car, municipal electrically driven transport) or the time of departure (maritime, fluvial and air transport). The time of arrival in passenger carriage statistics is, practically speaking, used only for air transport. Passenger turnover is assessed by adding up the number of passengers by each carriage position by distance of carriage; this is done separately for each mode of transport. All data should be based on movements on national territory, regardless of the nationality of the vehicle. To calculate decoupling trends, demand for passenger transport and real GDP should be shown as an index (e.g. 1995 = 100). The ratio of the former to the latter should be indexed on the previous year (i.e. annual decoupling/intensity changes) in order to be able to observe changes in the annual intensity of passenger transport demand relative to economic growth.

Internationally agreed methodologies and standards: Eurostat/the European Conference of Ministers of Transport (ECMT)/UNECE Common Questionnaire on Transport Statistics (passenger transport performance).

Data sources and reporting

In several EECCA countries, data on passenger transport demand by particular modes (railway, bus etc.) and by types of transportation (intra-city, urban etc.) are published regularly in statistical yearbooks. The Russian Federation publishes more detailed information on transport in *Transport in Russia* yearbooks. Some EECCA countries are reporting relevant data via the Common Questionnaire on Transport Statistics circulated by Eurostat, UNECE and ECMT. In a number of EECCA countries, transport data as well as data on GDP are published regularly in statistical yearbooks.

References at the international level

- United Nations, Commission of the European Communities, International Monetary Fund, Organisation for Economic Cooperation and Development and World Bank. System of National Accounts 1993 (SNA 1993). Series F, No. 2, Rev. 4 (United Nations publication Sales No. E.94.XVII.4).
- UNECE, *Annual Bulletin of Transport Statistics for Europe and North America*.

- United Nations, *Indicators of Sustainable Development: Guidelines and Methodologies* (2001).
- “EU transport in figures”, Statistical Pocketbook, EC.
- “Transport and Environment – Statistics for the Transport and Environment Reporting Mechanism (TERM) for the European Union”.
- EEA, “Are we moving in the right direction? Indicators on transport and the environment integration in the EU” (2000).
- Eurostat, “Panorama of transport - Statistical overview of transport in the EU - Data 1970-2001” (2004).
- European Commission, *European Transport Policy for 2010: Time to Decide*. White paper (COM (2001) 370).
- Eurostat, Pocketbook “Energy, transport and environment indicators”, 2005.
- <http://www.unece.org/trans/main/wp6/wp6.html>
- <http://www.unece.org/trans/main/wp6/transstatpub.html#trans>
- <http://europa.eu.int/comm/eurostat>
- <http://themes.eea.eu.int/IMS/CSI/>
- <http://www.cemt.org/>

28. *FREIGHT TRANSPORT DEMAND*

Brief definition: The indicator will be presented in two different ways:

- (a) Decoupling of freight demand from economic growth: volume of freight transport relative to GDP;
- (b) Modal split share of freight transport: This indicator is defined as the share of particular modes of transport in total inland freight transport.

Unit of measurement: For (a), thousand ton-kilometres (tkm) and per unit of GDP in US dollars. (For internal use, GDP should be expressed in the national currency.) For (b), percentage.

Relevance for environmental policy

Purpose: Freight transport demand by mode is a driving force indicator and shows the volume of cargo conveyance in a country.

Issue: Transport is an important source of GHG and also generates significant air pollution, which can seriously damage human health and ecosystems. Reducing the demand would reduce freight transport's environmental burden. Relative decoupling occurs when the demand for freight transport grows more slowly than demand for GDP. Absolute decoupling of freight transport demand from economic growth occurs when the demand falls and GDP continues to rise or remains constant. If demand and GDP both fall, they remain coupled. The relevance of the modal split policy for the environmental impact of freight transport stems from differences in the environmental performance (with regard to resource consumption, GHG, pollutant and noise emissions, land uptake, accidents, etc.) of different transport modes. Shifting freight from road to water and rail is an important strategic element in future transport policy.

International agreements and targets: None. In the European Union, the European Commission's white paper "European Transport Policy for 2010: Time to Decide" (COM(2001) 370) proposes an Action Plan aimed at bringing about substantial improvements in the quality and efficiency of freight transport in Europe.

Methodology and guidelines

Data collection and calculations: Total inland transport should include transport by road, rail and inland waterways. Calculations relating to transport by rail and inland waterways should be based on movements on national territory, regardless of the nationality of the vehicle or vessel. Calculations relating to road transport should be based on all movements of vehicles registered in the reporting country. The unit of surveillance in freight conveyance statistics is the shipment (a batch delivered on the basis of a freight conveyance contract). Participants in the compilation of summary data on freight conveyances include enterprises, agencies and private individuals involved in the transportation business. Freight turnover is defined as the sum of the products of the mass of freight conveyed in tons multiplied by the distance of conveyance in kilometres. To measure the decoupling of freight demand from economic growth, the volume of freight transport relative to GDP should be calculated, including separate trends for its two components. Both freight demand and real GDP growth should be indexed on 1995. The decoupling indicator is defined as the ratio between ton-kilometres (inland modes) and GDP in constant 1995 prices (in both the national currency and the US dollar equivalent). It should be indexed to reflect changes in the annual intensity of freight transport demand relative to economic growth (i.e. annual decoupling/intensity changes). The indicator should also be presented as the share of road transport in total inland transport (i.e. the modal split share for freight transport).

Internationally agreed methodologies and standards: The Eurostat/ECMT/UNECE Common Questionnaire on Transport Statistics (passenger transport performance).

Data sources and reporting

In a number of EECCA countries, data on freight transport demand by particular modes (rail, road etc.) and by types of load (e.g. coal, ores) are published regularly in statistical yearbooks. As the data on GDP are published in the same yearbooks, the calculation of this indicator does not seem to be difficult. The Russian Federation publishes more detailed information on transport in *Transport in Russia* yearbooks. Some EECCA countries are reporting relevant data via the Eurostat/ECMT/UNECE Common Questionnaire on Transport Statistics. GDP is published in the UNSD National Accounts Statistics Database. The IMF's International Financial Statistics database provides nominal and real GDP for most countries.

References at the international level

- United Nations, Commission of the European Communities, International Monetary Fund, Organisation for Economic Cooperation and Development and World Bank. System of National Accounts 1993 (SNA 1993). Series F, No. 2, Rev. 4 (United Nations publication Sales No. E.94.XVII.4).
- UNECE, *Annual Bulletin of Transport Statistics for Europe and North America*.
- United Nations, *Indicators of Sustainable Development: Guidelines and Methodologies* (2001)

- “EU transport in figures”, Statistical Pocketbook, EC.
- “Transport and Environment – Statistics for the Transport and Environment Reporting Mechanism (TERM) for the European Union” (2000).
- EEA, “Are we moving in the right direction? Indicators on transport and the environment integration in the EU” (2000).
- Eurostat, “Panorama of transport - Statistical overview of transport in the EU - Data 1970-2001” (2004).
- European Commission, *European Transport Policy for 2010: Time to Decide*. White paper (COM (2001) 370).
- Eurostat, Pocketbook “Energy, transport and environment indicators”, 2005.
- <http://www.unece.org/trans/main/wp6/wp6.html>
- <http://www.unece.org/trans/main/wp6/transstatpub.html#trans>
- <http://europa.eu.int/comm/eurostat>
- <http://themes.eea.eu.int/IMS/CSI/>
- <http://www.cemt.org/>

29. *COMPOSITION OF THE ROAD MOTOR VEHICLE FLEET BY FUEL TYPE*

Brief definition: The indicator defines the breakdown of the road motor vehicle fleet by fuel type.

Unit of measurement: The number of motor vehicles by fuel type and share in each category in the total road motor vehicle fleet.

Relevance for environmental policy

Purpose: This is a driving force indicator which shows tendencies in the transport sector’s development and is also an indirect indicator of fuel consumption.

Issue: The current transport system poses significant and growing threats to the environment and human health. Combustion of petrol and diesel fuel by motor vehicles leads to considerable GHGs emissions and air pollution and jeopardizes human health. Transport policies increasingly recognize the need to improve the shares of transport modes that use environmental friendly fuels, primarily electric and biofuel vehicles. The promotion of low- and zero-sulphur fuels will enable further decreases in pollutant emissions from road vehicles, while the promotion of biofuels is essential for reducing GHG, especially CO₂. The indicator helps to understand developments in the composition of the road motor vehicle fleet by fuel type, which in turn explains observed trends in transport’s impact on the environment.

International agreements and targets: None. In the European Union, current legislation requires the reduction of the sulphur content of fuels to 50 mg/kg (low-sulphur fuels) by 2005 and its further reduction below 10 mg/kg (zero-sulphur fuels) by 2009 (Directive 98/70/EC). The legislation also requires that by 2005 and 2010 biofuels constitute 2 per cent and 5.75 per cent share respectively of EU fuel consumption (Directive 2003/17/EC).

Methodology and guidelines

Data collection and calculations: Data should cover the stock of road motor vehicles, namely, all road vehicles registered in a country on a given date and licensed to use roads open to public traffic. Data should be collected separately for each category of road motor vehicles: passenger cars, motor coaches, buses and trolleybuses, and trucks. For each of these categories, vehicles may be classified according to the type of energy used by the motor. The main types are gasoline (petrol), diesel, gas-powered (liquefied petroleum gases and natural gas), electricity, biofuel (e.g. biodiesel) and other sources (such as alcohols, mixtures of alcohols with other fuels or hydrogen). The electricity and biofuel groups should be also presented as percentages of the total for each vehicle category. The shares may be compared with a baseline year demonstrating trends in fleet composition.

Internationally agreed methodologies and standards: The methodology developed jointly by UNECE, ECMT and Eurostat for the Common Questionnaire on Transport Statistics.

Data sources and reporting

In a number of EECCA countries, data on number of vehicles of different categories, including passenger cars, trucks and busses, as well as well as respective fuel consumption (mainly petrol and diesel fuel) are published regularly in statistical yearbooks. Ministries of Transport in a few EECCA countries collect and report data to UNECE annually.

References at the international level

- UNECE, *Annual Bulletin of Transport Statistics for Europe and North America*.
- United Nations, *Glossary for Transport Statistics* (3rd ed.) (2003).
- Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EC., as amended.
- Directive 2003/17/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport.
- <http://www.unece.org/trans/main/wp6/wp6.html>
- <http://europa.eu.int/comm/eurostat>

30. AVERAGE AGE OF ROAD MOTOR VEHICLE FLEET

Brief definition: The indicator defines the average age of the road motor vehicle fleet.

Unit of measurement: The number of motor vehicles by age and percentage of each age group in each category of road vehicle fleet.

Relevance for environmental policy

Purpose: The average age of the vehicle fleet is a driving force indicator and shows the technical status of the fleet through its age.

Issue: Transport is an important source of GHG emissions and also produces significant air pollution, which can seriously damage human health and ecosystems. These effects increase with vehicle age. Outdated vehicle equipment is another problem, particularly in EECCA countries. A

key priority of state policy for the development of transport systems in EECCA countries should be to improve vehicle fleet composition by replacing older, more polluting vehicles with newer, cleaner ones.

International agreements and targets: None. The “younger” categories of cars comply with the UNECE/EURO standards which means limited emissions of pollutants into the air. In the European Union, Directive 2000/53/EC on end-of-life vehicles provides that vehicles sold after 2005 should be at least 85 per cent reusable and/or recyclable and at least 95 per cent reusable and/or recoverable (both percentages in terms of vehicle weight).

Methodology and guidelines

Data collection and calculations: Data should cover the stock of road motor vehicles, namely, all road vehicles registered on a given date in a country and licensed to use roads open to public traffic. A road vehicle’s age is the length of time after the first registration of the vehicle, irrespective of the registering country. Data should be presented for each of the five categories of road motor vehicles: passenger cars, motor coaches, buses and trolleys, trucks and road tractors. For each of these categories, the number of vehicles should be broken down by age as follows: ≤ 2 years, ≥ 5 years, ≥ 10 years and > 10 years. Each individual age group may be also presented as a percentage of the total by each vehicle category. The shares may be compared with a baseline year demonstrating trends in the fleet composition.

Internationally agreed methodologies and standards: The methodology developed jointly by UNECE, ECMT and Eurostat for the Common Questionnaire on Transport Statistics.

Data sources and reporting

Data on average age of vehicles are available, but “scattered” among plenty different specialized sources. Ministries of Transport in a few EECCA countries collect and report data to UNECE annually.

References at the international level

- UNECE, *Annual Bulletin of Transport Statistics for Europe and North America*.
- United Nations, *Glossary for Transport Statistics* (3rd ed.) (2003).
- Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of-life vehicles.
- <http://www.unece.org/trans/main/wp6/wp6.html>
- http://www.unece.org/trans/main/Vehicle_Regulations
- <http://europa.eu.int/comm/eurostat>

31. ROAD TRAFFIC ACCIDENT, MORTALITY AND INJURY RATES

Brief definition: The indicator defines rates of road traffic accidents, mortalities and injuries due to road traffic accidents.

Unit of measurement: The number of accidents, deaths and injuries per 10,000 inhabitants.

Relevance for environmental policy

Purpose: The indicator provides a measure of impact on human health and is of prime importance for the development of transport safety policy and regulations.

Issue: The indicator serves to demonstrate the level of accidents occurring in different mode of transport and their consequences for people. It also helps to define transport injury trends and to assess the impact of preventive measures.

International agreements and targets: Agreement on the Adoption of Uniform Conditions for Periodical Technical Inspections of Wheeled Vehicles and the Reciprocal Recognition of Such Inspections (1997); Agreement on the Establishing of Global Technical Regulations for Wheeled Vehicles, Equipment and Parts Which Can Be Fitted and/or Be Used on Wheeled Vehicles (1998); European Charter on Transport, Environment and Health (1999). The European Union has a Road Safety Action Programme.

Methodology and guidelines

Data collection and calculations: Rates are calculated by dividing the number of accidents, the number of deaths and the number of injuries, respectively, by 10,000 inhabitants. Additional rates may be calculated by dividing the number of accidents, the number of deaths and the number of injuries, respectively, by other indicators of exposure, such as the number of passenger-kilometres or the number of vehicles. According to international agreements, deaths are considered transport-related if they occur within 30 days from the date of the accident.

Availability of internationally agreed methodology: Methodologies developed by WHO and UNECE.

Data sources and reporting

In a number of EECCA countries, data on road traffic accidents (both by deaths and injuries, and by transport modes involved) are published in statistical yearbooks. Data on the number of accidents and injuries in relation to the number of wheeled vehicles are maintained by traffic safety authorities. In addition, Ministries of Interior and/or Ministries of Communication/Statistics usually publish statistical yearbooks which include mortality statistics reported through death certificates. In some countries the Ministry of Health publishes statistics on mortality and morbidity from various causes, including road traffic injuries, as recorded by the health system.

Data at the international level are available from the WHO Mortality Database. In a number of EECCA countries, data on the number of transport casualties appear regularly in statistical yearbooks published by government authorities. Development of this indicator makes it possible to create a long-term database and obtain rather comprehensive time series.

References at the international level

- UNECE, *Statistics of Road Traffic Accidents in Europe and North America* (published annually).

- European Conference of Ministers of Transport (ECMT), *Recent Trends in Road Accidents and Policy Issues* (2002).
- <http://www.unece.org/trans/main/wp6/wp6.html>
- <http://www.euro.who.int/hfadb>
- http://www.euro.who.int/eprise/main/WHO/InformationSources/Data/20011017_1
- <http://europa.eu.int/comm/eurostat>
- <http://www.cemt.org/stat/conjonct/index.htm>

I. Waste

32. WASTE GENERATION

General description

Brief definition: The amount of generated waste in a country – total, per unit of GDP, and by category (industrial, municipal (solid) and hazardous).

Measurement unit: Million metric tons per year. Total waste intensity should be presented in kilograms per unit of GDP at constant prices (in both US\$ and the national currency), and municipal waste intensity should be expressed in kilograms per capita or in cubic meters per capita.

Relevance for environmental policy

Purpose: The main purpose is to provide a measure of the pressure on the environment of the total amount of generated waste and waste by category (hazardous, industrial and municipal solid waste). The waste intensity represents a driving force indicator and shows response to raise the eco-efficiency of human activities. Waste generated per unit of GDP (total waste intensity) will show if there has been any decoupling of waste generation from economic growth. Municipal waste generation per capita allows comparisons of countries. For each indicator, the two time series should be shown together to get the full benefit of the indicator.

Issue: Sound and efficient use of natural resources is an important part of sustainable development. Waste represents a considerable loss of resources in the form of both materials and energy. The treatment and disposal of the generated waste may cause environmental pollution and expose humans to harmful substances and infectious organisms. Waste generation is intimately linked to the level of economic activity in a country and reflects society's production and consumption patterns. A reduction in the volume of waste generated is an indication of development towards less material-intensive production and consumption patterns, particularly as an economy moves from a heavy industry base to a more service-oriented base.

International agreements and targets: Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal agreed to take all practicable steps to ensure minimization of the generation of hazardous and other waste. Agenda 21, chapter 20 on general objectives includes the target of "preventing or minimizing the generation of hazardous wastes as part of an overall integrated cleaner production approach" (20.7). Some countries have set national targets for the reduction of waste within a specified time frame. In the EU, waste framework directive (2006/12/EC) provides for increased efforts in the

fields of prevention and reduction of waste generation, recovery of wastes and development of new techniques for final disposal of waste.

Methodology and guidelines

Data collection and calculations: The precise definition of what constitutes waste varies. According to Basel Convention, wastes are substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law. Principally waste can be considered materials that are not primary products (products produced for the market), for which the generator has no further use related to production, transformation or consumption, and which the generator discards, or intends to or is required to discard. It excludes residuals directly recycled or reused on the site of generation and pollutants that are directly discharged into ambient water or air as wastewater or air emission.

Waste statistics should group waste according to main economic activities and should use the ISIC Rev. 3. Industrial waste covers waste generated primarily by mining and quarrying, by manufacturing industries and by energy production and construction. Waste from industrial activities that is removed by municipal waste collection should be reported under the respective sector of generation. Municipal (solid) waste includes all municipal waste collected plus the estimated amount of municipal waste from areas not served by a municipal waste collection service. In general it covers waste originating from households as well as similar waste from commerce and trade, small businesses, office buildings and institutions (schools, hospitals, government buildings). Data on municipal waste generation are usually gathered through surveys of municipalities, which are responsible for waste collection and disposal, or from transport companies that collect waste, or from landfill or incineration sites. Waste collection companies and landfills should apply coefficients or factors for recalculations from m³ to tons.

The amount reported under “total waste generation” should be equal to the sum of the waste amounts reported as industrial waste, waste generated by other economic activities (e.g. agriculture and forestry) and municipal waste. Hazardous waste should cover the categories of waste to be controlled according to the Basel Convention (Article 1 and Annex I).

Internationally agreed methodologies and standards: The UNSD/UNEP Questionnaire on Environment Statistics, provides a methodology for calculating waste generation by sector. The Basel Convention has established an internationally agreed methodology for calculating the amount of hazardous waste generated. In the EU, waste statistics including both waste generation and waste disposal (final disposal and recovery) is dealt with by a specialized regulation (2150/2002).

Data sources and reporting

In the EECCA countries, data on the generation of industrial waste are usually collected by ministries responsible for the environment or statistical agencies (statistical form 2TP-Waste) while data on municipal waste generation are collected by national statistical agencies. Data on waste generation are published in national state-of-the-environment reports in some EECCA countries. EECCA countries report data on internationally agreed types of hazardous waste to the

Basel Convention and waste generation data to UNSD in response to the UNSD/UNEP Questionnaire on Environment Statistics.

References at the international level

- UNSD/UNEP 2006 Questionnaire on Environment Statistics (waste section).
- Basel Convention for the Control of Transboundary Movement of Hazardous Wastes and Their Disposal.
- United Nations. *International Standard Industrial Classification of All Economic Activities*. Series M No.4, Rev.3.
- European Environment Agency. *Europe's Environment: The Third Assessment*. (EEA, 2003) (Kiev Assessment).
- Regulation (EC) No 2150/2002 of the European Parliament and of the Council of 25 November 2005 on waste statistics.
- Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste.
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://unstats.un.org/unsd/environment/>
- <http://www.basel.int/>
- <http://themes.eea.eu.int/IMS/CSI>
- <http://waste.eionet.eu.int/>
- <http://www.etc-waste.int/>
- <http://europa.eu.int/comm/eurostat/>

33. TRANSBOUNDARY MOVEMENTS OF HAZARDOUS WASTES

General description

Brief definition: The total amount of hazardous waste, as defined by the Basel Convention (Article 2), exported and imported by a country.

Unit of measurement: Metric tons per year.

Relevance for environmental policy

Purpose: The transboundary movement of hazardous waste represents a driving force indicator. Trends in a country's export of hazardous waste show its response to the need to minimize the generation of hazardous waste and recycle it domestically.

Issue: Toxic, explosive, oxidizing, corrosive, flammable, irritant, teratogenic, mutagenic, carcinogenic ecotoxic, and infectious waste are recognized as hazardous waste. The uncontrolled movement and dumping of this waste can cause severe health problems and can poison water and land for decades. Recycling of hazardous waste reduces the need for its transboundary movement and prevents risks to human health and the environment. In some instances transboundary movement is required for environmentally sound waste recovery and disposal. Transboundary hazardous waste movement may also be justified when waste is going to be used as secondary raw material or for energy generation. Complete data on the export and import of hazardous waste help to control its safe movement and disposal.

International agreements and targets: Transboundary movement of hazardous waste is regulated by the Basel Convention by the way of prior notifications and consents (Article 6). The Conference of the Parties to the Basel Convention, at its second meeting, banned transboundary movement of hazardous waste from Annex VII countries (EU, OECD and Liechtenstein) to non-Annex VII countries (resolution II/12). The third meeting of the Conference of the Parties amended the above resolution (resolution III/1). The Basel Convention does not provide any internationally agreed targets for the containment and reduction of transboundary movement of hazardous waste.

Methodology and guidelines

Data collection and calculations: The amount of exported and imported hazardous waste is regulated through prior notification at the side export and written consent at the side of import as required by Article 6 of the Basel Convention. Data should be recorded on the amount, category and nature of each type of waste (whether hazardous or other waste according to Annex II to the Convention) subject to transboundary movement. Data should be available on a continuous basis through the application at the national level of notification and monitoring procedures for transboundary waste movement. The difficulty of establishing whether a particular waste is hazardous leads to problems in using waste information as an indicator of sustainable development. A special technical working group created under the Basel Convention was entrusted with determining which types of waste should be considered hazardous under the convention (Decision III/1 of the third meeting of the Conference of the Parties). The same working group categorized waste into types, which should be considered as waste under all and any circumstances, and other types which are not subject to the Convention (Annexes VIII and IX to the Convention). Data scarcity, imprecision and lack of systematic categorization are other limitations of this indicator. Illegal trade of hazardous waste poses additional problems.

Internationally agreed methodology and standards: Article 5 of the Basel Convention requires that Parties establish competent bodies, responsible for the administration of notifications and issuing consents as well as for the establishment of focal points which collect all relevant information on any transboundary movement of hazardous or other wastes (amount, properties, origin, methods of disposal etc.). The seventh meeting of the Conference of the Parties to the Basel Convention adopted a decision on harmonization of lists of wastes and related procedures. In the EU, waste statistics including both waste generation and waste disposal is dealt with by a specialized regulation (2150/2002).

Data sources and reporting

Data on transboundary movement of hazardous wastes are collected by respective customs offices as well as by environmental protection authorities in frontier areas. The best information can be found at the Basel Convention focal points or competent authorities, which are responsible for reporting to the Convention secretariat. This information is reviewed and compiled by the secretariat and is presented in an annual report, which includes statistical tables and graphic representations of the data.

References at the international level

- Manual: Questionnaire on "Transmission of Information". (Basel Convention for the Control of Transboundary Movement of Hazardous Wastes and Their Disposal).

- Regulation (EC) No 2150/2002 of the European Parliament and of the Council of 25 November 2005 on waste statistics.
- <http://www.basel.int/>
- <http://unstats.un.org/unsd/environment/>
- <http://waste.eionet.eu.int/>
- http://themes.eea.eu.int/Environmental_issues/waste/indicators
- <http://www.oecd.org/env/>
- <http://reports.eea.eu.int>
- <http://europa.eu.int/comm/eurostat/>
- <http://www.environmentalindicators.com>

34. WASTE RECYCLING

General description

Brief definition: Waste recycled as a share of the total waste in a country, or of the specific category of waste (industrial, municipal or hazardous).

Unit of measurement: Percentage.

Relevance for environmental policy

Purpose: Waste recycling represents a response type indicator and shows the proportion of total waste, or of the specific category of waste, that is recycled.

Issue: In general, waste recycling is an important component of sustainable use of resources. Waste recycling is an important component of sustainable solid waste management. As the population continues to grow, the amount of land available for waste disposal is reduced and waste has to be transported longer distances. When waste recycling is stimulated, landfill capacity is conserved and solid waste management expenditures are reduced. Increased recycling leads to a reduction in the environmental impacts of waste final disposal, such as methane and carbon dioxide gas emissions from landfill sites, and preserves natural resources. Recycling also tends to increase the population's income through employment in waste recycling sector.

1. **International agreements and targets:** No international agreement or targets exist. In the EU, Directive 94/62/EC on packaging and packaging waste requires member countries to recycle a minimum of 55% and a maximum of 80% of packaging waste by 2008. Waste framework directive (2006/12/EC) provides for increased efforts in the fields of prevention and reduction of waste generation, recovery of wastes and development of new techniques for final disposal of waste. EU targets for recycling (and re-use) cover also end-of-life vehicles (Directive 2000/53/EC) and waste electrical and electronic equipment (Directive 2002/96/EC).

Methodology and guidelines

Data collection and calculations: Recycling is defined as any reprocessing of waste material in a production process that diverts it from the waste stream, except reuse as fuel (energy recovery). Reprocessing both into the same type of product and for different purposes should be included. Recycling in industrial plants (i.e. at the place of generation) should be excluded. Assessment of

recycled waste requires precise assessment of total waste and the specific category of waste (industrial, municipal or hazardous). The indicator of waste recycling is derived by dividing the quantity of total and specific-category waste recycled by the total quantity of waste and specific-category waste generated and expressing the result as a percentage. In addition, for municipal waste the proportion of recycled waste may be presented as a percentage of recycled components, such as metals, plastic, paper, glass, textiles or organic materials.

Internationally agreed methodology and standards: The UNSD/UNEP Questionnaire on Environment Statistics provides a methodology for calculation of waste recycling. In the EU, waste statistics including both waste generation and waste disposal is dealt with by a specialized regulation (2150/2002).

Data sources and reporting

2. In EECCA, data sources include ministries responsible for urban affairs and the environment and statistical agencies.

References at the international level

- European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste
- Regulation (EC) No 2150/2002 of the European Parliament and of the Council of 25 November 2005 on waste statistics.
- Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste.
- Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles.
- Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE).
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://unstats.un.org/unsd/environment/datacollect.htm>
- <http://europa.eu.int/comm/eurostat/>
- <http://waste.eionet.eu.int/>
- http://themes.eea.eu.int/Environmental_issues/waste/indicators

35. FINAL WASTE DISPOSAL

General description

Brief definition: The share of the total amount of waste generated (the latter also broken down by category – industrial, municipal and hazardous) that is finally disposed of by (a) incineration (without energy recovery, not used as a fuel) or (b) landfilling on a controlled site.

Measurement unit: Percentage.

Relevance for environmental policy

Purpose: The indicator provides a measure of the pressure on the environment and the response to the efficiency of the waste management system.

Issue: The way a country manages its waste has significant long-term implications for public health, the economy and the natural environment. Therefore it is essential to promote an environmentally sound waste treatment and disposal programme. Generally, adequate waste management indicates that the authorities are aware of the health and environmental risks and that they support or impose suitable measures to prevent or reduce waste. Reducing the amount of waste that needs to be disposed of reduces the demand for raw materials, leading to a reduction in resource extraction. For waste that is not suitable for recycling, incineration is often considered the next-best option (provided that the incineration plants comply with legislation for emission standards and that energy from waste incineration is recovered), as it reduces the overall volume of waste. If recycling or incineration is excluded, waste should be landfilled on a controlled site, with suitable technical control in line with national legislation. Controlled landfilling requires adherence to a permit system and technical control procedures in compliance with the national legislation in force. Other final disposal methods may include permanent storage.

International agreements and targets: None. In the EU, there are 2 basic directives on final disposal of waste: Directive on the landfill of waste (1999/31/EC) and Directive on the incineration of waste (2000/76/EC). In general, waste statistics including both waste generation and waste disposal (including recovery and final disposal) is dealt with a specialized regulation (2150/2002). Waste framework directive (2006/12/EC) provides for increased efforts in the fields of prevention and reduction of waste generation, recovery of wastes and development of new techniques for final disposal of waste.

Methodology and guidelines

Data collection and calculations: To measure the proportion of waste disposed of by different methods, a combination of several methods can be used. It is important to be aware of where in the waste flow the data are collected to avoid double counting. Municipalities or industries should have data available on waste they manage. Also, waste management and disposal facilities such as incineration plants and landfills should be aware of the amounts they are processing. Waste collection companies are another potential source of data. However, data can be scattered, and its collection and compilation for indicator purposes can be time-consuming. For practical reasons, calculation of the waste incineration rate should consider only waste incinerated through the registered waste management system. Households or industries incinerating their own waste should not be included. Calculation of the landfill rate usually does not consider waste disposed of at illegal dumps.

Internationally agreed methodologies and standards: The UNSD/UNEP Questionnaire on Environment Statistics provides a methodology for calculation of final disposal.

Data sources and reporting

In EECCA countries, data sources include ministries responsible for urban affairs and environment and statistical agencies. Data on the generation and disposal of industrial waste are usually collected by the ministries, responsible for the environment (form 2TP-waste applied) while the data on municipal waste generation and disposal are being collected by national

statistical agencies. Data on waste generation and disposal are published in national state-of-the-environment reports in some countries.

References at the international level

- UNSD/UNEP 2006 Questionnaire on Environment Statistics (waste section).
- United Nations. *International Standard Industrial Classification of All Economic Activities*. Series M No.4, Rev.3.
- European Environment Agency. *Europe's Environment: The Third Assessment* (EEA, 2003) (Kiev Assessment)
- Regulation (EC) No 2150/2002 of the European Parliament and of the Council of 25 November 2005 on waste statistics.
- Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste.
- Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste.
- Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste.
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://unstats.un.org/unsd/environment/questionnaire2006.htm>
- <http://www.basel.int/>
- http://themes.eea.eu.int/Environmental_issues/waste/indicators
- <http://themes.eea.eu.int/IMS/CSI>
- <http://waste.eionet.eu.int/>
- <http://www.etc-waste.int/>
- <http://europa.eu.int/comm/eurostat/>.