List of well-being indicators

Working Paper no 2

Authors: Claudia Kettner (WIFO), Angela Köppl (WIFO), Sigrid Stagl (WU)

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Authors: Claudia Kettner (WIFO), Angela Köppl (WIFO), Sigrid Stagl (WU)

Contributions by: Kurt Kratena (WIFO), Jeroen van den Bergh (UAB)

Reviewed by: John Gowdy (Rensselaer Polytechnic Institute)

List of well-being indicators

Work Package 202

Milestone 30 "List of well-being indicators suitable for inclusion in socio-ecologically extended macroeconomic models"

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List of well-being indicators

Claudia Kettner (WIFO), Angela Köppl (WIFO), Sigrid Stagl (WU)

Abstract

This milestone presents a pool of available indicators and indicator systems which go beyond the narrow concepts of national economic accounts as well as a structuring of the indicators and indices according to central areas of well-being. The milestone builds the basis for Task 202.2, where a subset of indicators will be selected based on different theoretical frameworks, e.g. services / functionings, needs. Some of the indicators will be included in the macro-economic models in order to account for key dimensions of sustainability.

Contribution to the Project

The list aims to identify a set of well-being indicators suitable for inclusion in macroeconomic models and useful for policy advice.

The concept of sustainable development goes beyond well-being, but is related to it. Due to the multidimensionality of both concepts they show a high complexity. Sets of indicators are considered an appropriate tool to reduce this complexity and to account for the interaction between society, economy and the biophysical environment. Systems of indicators for sustainable development were developed by a number of international institutions including the EU and the UN.

On the basis of our assessment carried out in task 202.1, WU, WIFO and UAB jointly examined candidate indicators of well-being suitable to augment or replace GDP. For this purpose we reviewed journal papers as well as project reports on suitable dimensions of well-being and sustainability. Another step that follows during the modelling process is to explore how best to expand macroeconomic analyses as to account for key dimensions of sustainability.

Keywords: Beyond GDP; biophysical constraints; indicators; social-ecological transition; welfare state; well-being

Jel codes: D63, E01, I32, O44

List of well-being indicators

The concept of sustainable development includes wellbeing but goes beyond it. Both are multidimensional concepts as they aim to capture the complexity of socio-ecological systems. Sets of indicators are considered an appropriate tool to reduce this complexity and to account for the interaction between society, economy and the biophysical environment. Systems of indicators for sustainable development were developed by a number of international institutions including the EU and the UN.

The following list presents areas of well-being and a corresponding pool of available indicators and indicator systems which go beyond the narrow concepts of national economic accounts.[1] The specific indicators listed here have in common that data are available for one or more EU countries. For the full list see the Appendix. The indicator list will be a contribution to a wider review within the project on suitable dimensions of well-being and sustainability and expand their analyses. A selection of indicators will be based on an assessment in the light of different theoretical frameworks, e.g. services and functionings, needs (Task 202.1).

The service / functionings-based approach can be illustrated by the energy system. Here the focus lies on energy service indicators instead of energy flows as it is not the quantity of energy used by households and companies that is relevant to welfare, but rather the energy services delivered. In buildings, for example, the energy required to deliver a "well-tempered living space" depends on the thermal quality of the building (thermal transmittance of walls, windows, rooftops, etc.) and the heating system. In this framework indicators reflect services, stocks and flows. Where appropriate, indicators differentiated by men and women will be developed.

Pool of indicators and indicator systems

- Indicator Systems
  - EU Sustainable Development Indicators (EU SDIs)
  - UN Indicators for Sustainable Development (UN ISDs)
  - OECD Better Life Indicators (BLIs)
  - IEA / IAEA Indicators for Sustainable Energy Development (ISEDs)
  - Indicators of the Environmental Performance Index (EPIs)
  - Millennium Assessment Ecosystem Service Indicators (ESIs)
  - PASHMINA Indicators[2]
- Composite Indices
  - Genuine Progress Indicator (GPI) / Index of Sustainable Economic Welfare (ISEW)

[1] It has to be noted that the three categories (indicator systems, composite indicators, Material follows) exhibit some overlaps (the EPI framework and MFA e.g. do also provide composite indices).

[2] Indicators compiled within the FP7 project PASHMINA. A short description of the indicator system is provided in the Appendix.

- Genuine Savings (GS)
- Human Development Index (HDI)

- NAMEA and Material flow accounts
  - National Accounting Matrix including Environmental Accounts (NAMEA)
  - Material flow accounts (MFA)

Table 1. Areas of well-being and corresponding indicators / indicator systems

Area	Considered in
Energy and Emissions	
Total	EU SDIs, UN ISDs, BLIs, ISEDs, NAMEA, MFA, PASHMIMA, GP / ISEW
Housing	EU SDIs, UN ISDs, BLIs, ISEDs, NAMEA, PASHMINA
Transport	EU SDIs, UN ISDs, ISEDs, PASHMINA
Industry and Services	EU SDIs, ISEDs, NAMEA, PASHMINA
Energy supply	EU SDIs, ISEDs, NAMEA, PASHMINA
Environment and Resources	
Material consumption, waste and recycling	EU SDIs, EPIs, ISEDs, NAMEA, MFA, GP / ISEW, GS,
Land use	EU SDIs, UN ISDs, ISEDs, ESSIs, EPIs, PASHMINA, GP / ISEW
Water	EU SDIs, UN ISDs, ESSIs, EPIs, GP / ISEW
Lifestock and biodiversity	EU SDIs, UN ISDs, BLIs, ESSIs, EPIs,
Equity	
Income, social security, poverty	EU SDIs, UN ISDs, BLIs, ISEDs,
Work	EU SDIs, BLIs,
Energy	ISEDs
Water	EU SDIs, UN ISDs,
Health	EU SDIs, UN ISDs,
Health	
Health status	EU SDIs, UN ISDs, BLIs, HDI
Influencing factors (e.g. nutritional status, (indoor) air pollution)	EU SDIs, UN ISDs, EPIs
Work, Income and Consumption	
Income and Consumption	BLIs, EU SDIs, GP / ISEW
Work	EU SDIs, UN ISDs, BLIs,

Table 1. Areas of well-being and corresponding indicators / indicator systems (continued)

Area	Considered in
Production	
Economic structure	EU SDIs, UN ISDs, NAMEA, ISEDs, PASHMINA
Innovation	EU SDIs, UN ISDs,
Security	
Physical security	UN ISDs, BLIs
Education	
Education	EU SDIs, UN ISDs, ISEW, GPI / ISEW, Genuine Savings, HDI
Governance and Civic Engagement	
Good governance	EU SDIs, UN ISDs
Civic engagement	EU SDIs, BLIs
Life Satisfaction	BLIs

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Annex

A. Indicator Systems

B. Composite Indices

C. NAMEA and Material flow accounts

D. References

A.1 EU SUSTAINABLE DEVELOPMENT INDICATORS

Headline Indicator	Level II Indicator	Level III Indicator
SDI-Theme: Socioeconomic Development		
Real GDP per capita, growth rate and totals		
Sub-theme: Economic development		
	Investment by institutional sectors (total, government, household, business)	
		Dispersion of regional GDP per inhabitant
		Net national income
		Household saving rate
Sub-theme: Innovation, competitiveness and eco-efficiency		
	Growth rate of labour productivity per hour worked	
		Total R&D expenditure
		Real effective exchange rate
		Turnover from innovation
		Energy intensity of the economy
Sub-theme: Employment		
	Total employment rate	
		Employment rate, by gender
		Employment rate, by highest level of education attained
		Dispersion of regional employment rates, by gender
		Unemployment rate, by gender
		Unemployment rate, by age group
Indicators to be developed		
Genuine savings		
Eco-innovations		

A.1. EU SUSTAINABLE DEVELOPMENT INDICATORS (continued)

Headline Indicator	Level II Indicator	Level III Indicator
SDI-Theme: Sustainable Consumption and Production		
Resource productivity		
Sub-theme: Resource use and waste		
	Municipal waste generated	
		Components of domestic material consumption
		Domestic material consumption by material
		Municipal waste treatment, by type of treatment method
		Generation of hazardous waste, by economic activity
		Emissions of acidifying substances by source sector
		Emissions of ozone precursors by source sector
		Emissions of particulate matter by source sector
Sub-theme: Consumption patterns		
	Electricity consumption of households	
		Final energy consumption, by sector
		Consumption of certain foodstuffs per inhabitant
		Motorisation rate
Sub-theme: Production patterns		
	Organisations and sites with EMAS registration	
		Eco-label awards
		Area under agri-environmental commitment
		Area under organic farming
		Livestock density index
Contextual indicators		
Number of households (for sub-theme Consumption patterns)		
Household expenditure per inhabitant, by category (for sub-theme Consumption patterns)		
Indicators to be developed		
Total material consumption		
Green public procurement		
Share of consumption of products with an ecolabel / Awareness of ecolabels		
Nitrogen balance		
Ethical financing		
Share of industrial production from enterprises with a formal environmental management system		
Share of production of products with an ecolabel		
Energy and material use per unit of output, by industrial sector		

A.1. EU SUSTAINABLE DEVELOPMENT INDICATORS (continued)

Headline Indicator	Level II Indicator	Level III Indicator
SDI-Theme: Social Inclusion		
At-risk-of-poverty rate, by gender		
Sub-theme: Monetary poverty and living conditions		
	At-persistent-risk-of-poverty rate	
		At-risk-of-poverty rate, by age group
		At-risk-of-poverty rate, by household type
		Relative at-risk-of-poverty gap
		Inequality of income distribution
Sub-theme: Access to labour market		
	People living in jobless households, by age group	
		In-work poverty
		Total long-term unemployment rate
		Unadjusted gender pay gap
Sub-theme: Education		
	Early school-leavers	
		At-risk-of-poverty rate, by highest level of education attained
		Persons with low educational attainment, by age group
		Life-long learning
		Low reading literacy performance of pupils
		Individuals' level of computer skills
		Individuals' level of internet skills
Contextual indicator		
Public expenditure on education (for sub-theme Education)		
Indicators to be developed		
Child well-being		
Material deprivation		
Adequacy of housing conditions		

A.1. EU SUSTAINABLE DEVELOPMENT INDICATORS (continued)

Headline Indicator	Level II Indicator	Level III Indicator
SDI-Theme: Demographic Changes		
Employment rate of older workers		
Sub-theme: Demography		
	Life expectancy at age 65, by gender	
		Total fertility rate
		Crude rate of net migration
Sub-theme: Old-age income adequacy		
	Aggregate replacement ratio	
		At-risk-of-poverty rate of elderly people
Sub-theme: Public finance sustainability		
	General government debt	
		Average exit age from the labour market
Contextual indicators		
Old-age-dependency ratio (for sub-theme Demographic changes)		
Projected old-age dependency ratio (for sub-theme Demographic changes)		
Projected evolution of EU-27 age-related public spending – baseline scenario (for sub-theme Public finance sustainability)		
Projected evolution of theoretical income replacement ratios (for sub-theme Public finance sustainability)		
Expenditure on care for the elderly (for sub-theme Public finance sustainability)		
Indicators to be developed		
Health expenditure on old age		

A.1. EU SUSTAINABLE DEVELOPMENT INDICATORS (continued)

Headline Indicator	Level II Indicator	Level III Indicator
SDI-Theme: Public Health		
Healthy life years and life expectancy at birth, by gender		
Sub-theme: Health and health inequalities		
	Death rate due to chronic diseases, by gender	
		Healthy life years and life expectancy at age 65, by gender
		Suicide death rate, by age group
		Suicide death rate, males by age group
		Suicide death rate, females by age group
		Self reported unmet need for medical examination or treatment,
		Dispersion of regional death rates
Sub-theme: Determinants of health		
	Index of production of toxic chemicals, by toxicity class	
		Population exposure to air pollution by particulate matter
		Population exposure to air pollution by ozone
		Population living in households considering that they suffer from noise
		Serious accident at work
Indicators to be developed		
Incidence of chronic diseases		
Childhood health/diseases		
Deaths due to infectious food-borne diseases		
Index of apparent consumption of chemicals by toxicity class		
Dioxins and PCBs in food and feed		
Pesticide residues in food		
Overweight people, by age group		
Present smokers, by gender and by age group		
Work with a high level of job strain/stress		
Monetary damage of air pollution as % of GDP		

A.1. EU SUSTAINABLE DEVELOPMENT INDICATORS (continued)

Headline Indicator	Level II Indicator	Level III Indicator
SDI-Theme: Climate Change and Energy		
Greenhouse gas emissions (CO_2e)		
Share of renewables in gross inland energy consumption		
Sub-theme: Climate change		
	Greenhouse gas emissions by sector	
		Greenhouse gas emissions intensity of energy consumption
		Projections of greenhouse gas emissions
		Global surface average temperature
Sub-theme: Energy		
	Energy dependency	
		Gross inland energy consumption, by fuel
		Electricity generated from renewable sources
		Share of biofuels in fuel consumption of transport
		Combined heat and power generation
		Implicit tax rate on energy
Indicators to be developed		
Radioactive waste		
External costs of energy use		

A.1. EU SUSTAINABLE DEVELOPMENT INDICATORS (continued)

Headline Indicator	Level II Indicator	Level III Indicator
SDI-Theme: Sustainable Transport		
Energy consumption of transport		
Sub-theme: Transport and mobility		
	Modal split of passenger transport	
	Modal split of freight transport	
		Volume of freight transport
		Volume of passenger transport
		Energy consumption by transport mode
		Modal share of investment in transport infrastructure
Sub-theme: Transport impacts		
	Greenhouse gas emissions by transport mode	
	People killed in road accidents	
		Emissions of ozone precursors from transport
		Emissions of particulate matter from transport
		Average CO_2 emissions per km from new passenger cars
Contextual indicator		
Price indices for transport (for sub-theme Transport and mobility)		
Indicators to be developed		
Vehicle-km by road		
Use of public transport		
External costs of transport activities		
Fragmentation of natural and semi-natural areas (to appear either in this theme or in Natural resources, depending on the type of indicator that is developed)		

A.1. EU SUSTAINABLE DEVELOPMENT INDICATORS (continued)

Headline Indicator	Level II Indicator	Level III Indicator
SDI-Theme: Natural Resources		
Common bird index		
Fish catches taken from stocks outside safe biological limits		
Sub-theme: Biodiversity		
	Sufficiency of sites designated under the EU Habitats Directive	
		Deadwood on forest land
Sub-theme: Freshwater resources		
	Surface and groundwater abstraction as a share of available resources	
		Population connected to urban wastewater treatment
		Biochemical oxygen demand in rivers
Sub-theme: Marine ecosystems		
	Concentration of mercury in fish and shellfish	
		Size of fishing fleet
Sub-theme: Land use		
	Built-up areas	
	Forest increment and fellings	
		Forest trees damaged by defoliation
		Percentage of total land area at risk of soil erosion
Indicators to be developed		
Biodiversity Index		
Abundance and distribution of selected species		
Change in status of species of European interest		
Red List Index for European species		
Index of toxic chemical risk to aquatic environment /		
Concentration of organic matter as chemical oxygen demand of rivers		
Effective fishing capacity and quotas		
Structural support to fisheries and % allocated to promote environmentally friendly fishing practices		
Sea grasses		
Critical load exceedance for nitrogen		

A.1. EU SUSTAINABLE DEVELOPMENT INDICATORS (continued)

Headline Indicator	Level II Indicator	Level III Indicator
SDI-Theme: Global Partnership		
Official development assistance as share of gross national income		
Sub-theme: Globalisation of trade		
	EU Imports from developing countries, by income group	
		EU Imports from developing countries, by group of products
		EU Imports from least-developed countries, by group of products
		Aggregated measurement of support for agriculture
Sub-theme: Financing for sustainable development		
	Total EU financing for developing countries, by type	
		Foreign direct investment in developing countries, by income group
		Official development assistance, by income group
		Untied official development assistance
		Bilateral official development assistance dedicated to debt
		Bilateral official development assistance dedicated to social services
		Bilateral official development assistance dedicated to
Sub-theme: Global resources management		
	CO_2 emissions per inhabitant in the EU and in developing countries	
Contextual indicators		
Population living on less than 1USD a day (for sub-theme Financing for sustainable development)		
Official development assistance per capita in donor and recipient countries (for sub-theme Financing for SD)		
Population with sustainable access to an improved water source (for sub-theme global resource management)		
Indicators to be developed		
Sales of selected fair-trade-labelled products		
Share of global greenhouse gas emissions from countries having agreed limits on their emissions		
Contribution of the Clean Development Mechanism to greenhouse gas emission reductions in developing countries		
Global footprint		

A.1. EU SUSTAINABLE DEVELOPMENT INDICATORS (continued)

Headline Indicator	Level II Indicator	Level III Indicator
SDI-Theme: Good Governance		
Sub-theme: Policy coherence and effectiveness		
	New infringement cases, by policy area	
		Transposition of Community law by policy area
Sub-theme: Openness and participation		
	Voter turnout in national and EU parliamentary elections	
		E-government on-line availability
		E-government usage by individuals
Sub-theme: Economic instruments		
	Shares of environmental and labour taxes in total tax revenues	
Contextual indicator		
Level of citizens' confidence in EU institutions (for sub-theme Policy coherence and effectiveness)		
Indicators to be developed		
Administrative cost imposed by legislation		
Impact assessment		
Openness and participation		
Level of involvement of consumer groups and companies		
Public consultations		
Proportion of environmentally harmful subsidies		

Source: SEC(2005) 161 final; Šteinbuka and Wolff (2007), Eurostat (2009).

A.2. UN INDICATORS FOR SUSTAINABLE DEVELOPMENT

Dimension / Subtheme	Indicator
Social dimension	
Theme: Equity	
Poverty	Percent of Population Living below Poverty Line
	Gini Index of Income Inequality
	Unemployment Rate
Gender Equality	Ratio of Average Female Wage to Male Wage
Theme: Health	
Nutritional Status	Nutritional Status of Children
Mortality	Mortality Rate Under 5 Years Old
	Life Expectancy at Birth
Sanitation	Percent of Population with Adequate Sewage Disposal Facilities
Drinking Water	Population with Access to Safe Drinking Water
Healthcare Delivery	Percent of Population with Access to Primary Health Care
	Immunization Against Infectious Childhood Diseases
	Contraceptive Prevalence Rate
Theme: Education	
Education Level	Children Reaching Grade 5 of Primary Education
	Adult Secondary Education Achievement Level
Literacy	Adult Literacy Rate
Theme: Housing	
Living Conditions	Floor Area per Person
Theme: Security	
Crime	Number of Recorded Crimes per 100,000 Population
Theme: Population	
Population Change	Population Growth Rate
	Population of Urban Formal and Informal Settlements

A.2. UN INDICATORS FOR SUSTAINABLE DEVELOPMENT (continued)

Dimension / Subtheme	Indicator
Environmental Dimension	
Theme: Atmosphere	
Climate Change	Emissions of Greenhouse Gases
Ozone Layer Depletion	Consumption of Ozone Depleting Substances
Air Quality	Ambient Concentration of Air Pollutants in Urban Areas
Theme: Land	
Agriculture	Arable and Permanent Crop Land Area
	Use of Fertilizers
	Use of Agricultural Pesticides
Forests	Forest Area as a Percent of Land Area
	Wood Harvesting Intensity
Desertification	Land Affected by Desertification
Urbanization	Area of Urban Formal and Informal Settlements
Theme: Oceans, Seas and Coasts	
Coastal Zone	Algae Concentration in Coastal Waters
	Percent of Total Population Living in Coastal Areas
Fisheries	Annual Catch by Major Species
Theme: Fresh Water	
Water Quantity	Annual Withdrawal of Ground and Surface Water as a Percent of Total Available Water
Water Quality	BOD in Water Bodies
	Concentration of Faecal Coliform in Freshwater
Theme: Biodiversity	
Ecosystem	Area of Selected Key Ecosystems
	Protected Area as a % of Total Area
Species	Abundance of Selected Key Species

A.2. UN INDICATORS FOR SUSTAINABLE DEVELOPMENT (continued)

Dimension / Subtheme	Indicator
Social Dimension	
Theme: Economic Structure	
Economic Performance	GDP per Capita
	Investment Share in GDP
Trade	Balance of Trade in Goods and Services
Financial Status	Debt to GNP Ratio
	Total ODA Given or Received as a Percent of GNP
Theme: Consumption and Production Patterns	
Material Consumption	Intensity of Material Use
Energy Use	Annual Energy Consumption per Capita
	Share of Consumption of Renewable Energy Resources
	Intensity of Energy Use
Waste Generation and Management	Generation of Industrial and Municipal Solid Waste
	Generation of Hazardous Waste
	Generation of Radioactive Waste
	Waste Recycling and Reuse
Transportation	Distance Travelled per Capita by Mode of Transport
Institutional Dimension	
Theme: Institutional Framework	
Strategic Implementation of SD	National Sustainable Development Strategy
International Cooperation	Implementation of Ratified Global Agreements
Theme: Institutional Capacity	
Information Access	Number of Internet Subscribers per 1000 Inhabitants
Communication Infrastructure	Main Telephone Lines per 1000 Inhabitants
Science and Technology	Expenditure on Research and Development as a Percent of GDP
Disaster Preparedness and Response	Economic and Human Loss Due to Natural Disasters

Source: UNCSD (2001).

A.3. OECD Better Life Indicators

Dimension of well-being / Topic	Headline indicator	Secondary indicator
Quality of Life		
Civic engagement		
	Voter turnout Consultation on rule-making	Participation in other types of political activities Trust in institutions
Social connections		
	Social network (Quality of support network)	Frequency of social contact Time spent volunteering Trust in others
Education		
	Educational attainment Students' cognitive skills	Education expectancy Lifelong learning Students' civic skills
Environment		
	Air pollution	Environmental burden of disease Satisfaction with the quality of local environment Access to green spaces
Health		
	Life expectancy at birth Self-reported health	Infant mortality rate Self-reported longstanding illness Self-reported limitations in daily activities Overweight and obesity
Life satisfaction		
	Life satisfaction Affect balance	
Personal security		
	Homicide rate Assault rate	Violence against children Feeling of security

A.3. OECD Better Life Indicators (continued)

Dimension of well-being / Topic	Headline indicator	Secondary indicator
Subjective well-being		
	Employees working very long hours	Commuting time
	Time devoted to leisure and personal care	Satisfaction with allocation of time
	Employment rate of mothers with children of compulsory school age	
Material Living Conditions		
Income and Wealth		
	Household disposable income	Household final consumption
	Household financial wealth	Subjective evaluation of material well-being
Jobs and Earnings		
	Employment rate	Involuntary part-time employment
	Long-term unemployment rate	Employees working on temporary contracts
	Personal earnings	Work accidents
Housing		
	Rooms per person	Housing cost overburden rate
	Dwellings with basic facilities	Satisfaction with housing

Source: OECD (2011).

A.4. IEA/IAEA INDICATORS FOR SUSTAINABLE ENERGY DEVELOPMENT

Dimension / Category	Indicator
Economic Dimension	
Indirect driving forces	
	Population: total; urban
	GDP per capita
	End-use energy prices with and without tax/subsidy
	Shares of sectors in GDP value added
	Distance travelled per capita : total, by urban public transport mode
	Freight transport activity : total, by mode
	Floor area per capita
	Manufacturing value added by selected energy intensive industries
Indirect driving forces (within energy sector)	
	Energy intensity: manufacturing, transportation, agriculture, commercial & public services, residential sector
	Final energy intensity of selected energy intensive products
	Energy mix: final energy, electricity generation, primary energy supply
	Energy supply efficiency: fossil fuel efficiency for electricity generation
	Status of deployment of pollution abatement technologies: extent of use, average performance
Direct driving forces	
	Energy use per unit of GDP
	Expenditure on energy sector: total investments, environmental control, hydrocarbon exploration & development, R&D , net energy import expenses
State	
	Energy consumption per capita
	Indigenous energy production
	Net energy import dependence

A.4. IEA/IAEA INDICATORS FOR SUSTAINABLE ENERGY DEVELOPMENT (continued)

Dimension / Category	Indicator
Social Dimension (Energy accessibility and affordability)	
Indirect driving forces	
	Income inequality
Indirect driving forces (within energy sector)	
	Ratio of daily disposable income/ private consumption per capita of 20% poorest population to the prices of electricity and major household fuels
Direct driving forces	
	Fraction of disposable income/ private consumption spent on fuel and electricity by: average population; group of 20% poorest population
State	
	Fraction of households: heavily dependent on non-commercial energy; without electricity

A.4. IEA/IAEA INDICATORS FOR SUSTAINABLE ENERGY DEVELOPMENT (continued)

Dimension / Category	Indicator
Environmental Dimension	
Direct driving forces	
Air pollution	
	Quantities of air pollutant emissions (SO2, NOx, particulates, CO, VOC)
	Quantities of greenhouse gas emissions
	Radionuclides in atmospheric radioactive discharges
Water pollution	
	Discharges into water basins: waste/storm water, radionuclides, oil into coastal waters
Waste	
	Generation of solid waste
	Generation of radioactive waste
Land	
	Land area taken up by energy facilities and infrastructure
Energy resources depletion	
	Fraction of technically exploitable capability of hydropower currently not in use
	Proven recoverable fossil fuel reserves
	Proven uranium reserves
Deforestation	
	Intensity of use of forest resources as fuel wood
State	
Air pollution	
	Ambient concentration of pollutants in urban areas : SO2, NOx, suspended particulates, CO, ozone
	Land area where acidification exceeds critical load
Waste	
	Accumulated quantity of solid wastes to be managed
	Accumulated quantity of radio-active wastes awaiting disposal
Accident risks	
	Fatalities due to accidents with breakdown by fuel chains
Energy resources depletion	
	Life time of proven fossil fuel reserves
	Life time of proven uranium reserves
Deforestation	
	Rate of deforestation

Source: IEA/IAEA (2001); IAEA et al. (2005)

A.5. ENVIRONMENTAL PERFORMANCE INDEX (EPI) 2010

Policy Category	Indicators
Objective: Environmental Health	
Environmental burden of disease	Environmental burden of disease
Air pollution (effects on humans)	Indoor air pollution
	Outdoor air pollution
Water (effects on humans)	Access to water
	Access to sanitation
Objective: Ecosystem Vitality	
Air Pollution (effects on ecosystem)	Sulfur dioxide emissions per populated land area
	Nitrogen oxides emissions per populated land area
	Non-methane volatile organic compound emissions per populated land area
	Ecosystem ozone
Water (effects on ecosystem)	Water quality index
	Water stress index
	Water scarcity index
Biodiversity & Habitat	Biome protection
	Marine protection
	Critical habitat protection
Forestry	Growing stock change
	Forest cover change
Fisheries	Marine trophic index
	Trawling intensity
Agriculture	Agricultural water intensity
	Agricultural subsidies
	Pesticide regulation
Climate Change	Greenhouse gas emissions per capita (including land use emissions)
	CO_2 emissions per electricity generation
	Industrial greenhouse gas emissions intensity

Source: EPI (2010).

A.6. MILLENIUM ASSESSMENT - ECOSYSTEM SERVICE INDICATORS

Service	Category	Indicator
PROVISIONING SERVICES		
Food	**Crops**	Crop production
		Dietary energy supply
		Employment in crop production and processing
		Value of crop production
	Livestock	Livestock production
		Livestock products production
		Value of livestock products production
	Capture fisheries	Employment in the marine products sector
		Fish meal in animal feed
		Fish products as a percent of total animal protein in peoples' diets
		Total fish catch
		Total marine production
		Total value of marine products
		Value of coastal products used for jewellery and curios
	Aquaculture	Fish production from aquaculture
		Total aquaculture production (including non-fish products)
	Wild foods	Number of wild species used for human food
Biological raw materials	**Timber and other wood products**	Employment in forest sector
		Forest biomass production
		Round wood production
		Value of forest products
		Volume of forest products used for local crafts
		Wood pulp production
	Fibres and resins, animals skins, sand, and ornamental resources	Employment in fibres production
		Fibres production
		Production of wildlife-derived skins, wool and feathers
		Value of fibres production
Biomass Fuel		Charcoal production
		Fuel wood production
		Industrial energy production from forest systems
		Monetary value of fuel production

A.6. MILLENIUM ASSESSMENT - ECOSYSTEM SERVICE INDICATORS (continued)

Service	Category	Indicator
Freshwater resources		Population served by renewable water resource Renewable water supply Renewable water supply accessible to humans Water storage capacity
Genetic resources		Investment into natural products prospecting Number of species that have been the subject of major investment or have become a commercial product Value of genetic resources
Biochemicals, natural medicines, and pharmaceuticals		Number of organisms from which drugs have been derived Value of pharmaceutical products developed in natural systems

A.6. MILLENIUM ASSESSMENT - ECOSYSTEM SERVICE INDICATORS (continued)

Service	Category	Indicator
REGULATING SERVICES		
Regulating	**Air quality regulation**	Flux in atmospheric gases
		Atmospheric cleansing (tropospheric oxidizing)
Climate regulating	**Global climate regulation**	Atmospheric gases flux (CO_2, CH_4, etc)
		Carbon accumulation
		Carbon uptake
		Cloud formation
		Evapotranspiration
		Carbon sequestration capacity
		Surface albedo
	Regional and local climate regulation	Canopy stomatal conductance
		Cloud formation
		Evapotranspiration
	Water regulation	Soil water infiltration
		Soil water storage
	Erosion regulation	*No Indicators Identified*
	Water purification and waste treatment	Amount of waste processed by ecosystems
		Capacity of ecosystem to process waste
		Value of ecosystem waste treatment and water purification
	Disease regulation	Disease vector predator populations
		Estimated change in disease burden as a result of changing ecosystems
		Population increase in disease vectors mosquitoes following ecosystem conversion
	Soil quality regulation	*No Indicators Identified*
	Pest regulation	*No Indicators Identified*
	Pollination	*No Indicators Identified*

A.6. MILLENIUM ASSESSMENT - ECOSYSTEM SERVICE INDICATORS (continued)

Service	Category	Indicator
	Natural hazard regulation	Changes in seasonality of flood events
		Economic losses associated with natural disasters
		Flood attenuation potential: residence time of water in rivers, reservoirs, and soils
		Floodplain water storage capacity
		Soil capacity to transfer groundwater
		Soil water storage capacity
		Trends in number of damaging natural disasters
CULTURAL SERVICES		
	Aesthetic/ ethical values	Comparative value of real estate near cleaner water bodies
		Comparative value of real estate nearer to nature
		Number of nature/rural visitors
		Willingness to pay for improved water quality in local waterbodies
	Spiritual and religious values	*No Indicators Identified*
	Recreation and ecotourism	Nature and/or rural tourism employment
		Number of recreational anglers and hunters
		Spending on nature tourism
		Total recreational value
		Visitors to natural areas

Source: Millennium Assessment Report (2005).

A.7. PASHMINA ENERGY INDICATORS

	Households	Passenger transport	Freight transport	Manufacturing	Services	Energy supply
Context	Households Household size Stock of appliances Stock of heating systems Floor area p.c. Household income Income inequality Energy prices	Stock of vehicles Energy prices Public pkm Private pkm Km of road / km of rail	Stock of trucks Energy prices Tkm road Tkm rail Tkm ship Km of road / km of rail	Share of GVA in GDP Energy prices	Share of GVA in GDP Energy prices	Installed RES capacity Energy imports Electricity imports FEC
Energy services	Space heating and lighting - proxy: floor area Hot water - proxy: population Other (e.g. cooking) - proxy: number of appl.	Mobility - proxy: pkm	Mobility - proxy: tkm	GVA	GVA	
Energy productivity	Energy services by service type per FEC	Pkm per FEC	Tkm per FEC	GVA per FEC	GVA per FEC	Energy efficiency of fossil generation
Energy use and provision	FEC per household FEC by activity and energy source (percentage shares)	FEC by energy source and transport mode	FEC by energy source and transport mode	FEC by energy source	FEC by energy source	TO by energy source and installation type TI by energy source and installation type
Environmental aspects	Air pollutants GHG emissions	Air pollutants GHG emissions	Air pollutants GHG emissions	Air pollutants GHG emissions	Air pollutants GHG emissions	Air pollutants GHG emissions Agricultural land used for energy production Radioactive waste
Social aspects	Share of energy costs in average household income Share of energy costs in household income of lowest 20%	Share of transport costs in average household income Share of transport costs in household income of lowest 20%				

A.7. PASHMINA ENERGY INDICATORS (continued)

Drivers	GDP Population HDD Energy/environmental R&D capital stock Distance to target - RES Distance to target - GHG Realisation of RES potentials Oil and gas burden

Source: Kettner et al. (2011).

Short description of the PASHMINA indicator set

The PASHMINA system of energy indicators is based on the following principles:

- It focuses on the role of energy services, flows and related stocks.
- We choose a sectoral structure for the representation of indicators as this structure allows for a comprehensive and detailed analysis of specific status and impacts regarding respective stocks, energy flows and energy services as well as underlying driving forces (disaggregated by sectors in order to identify specific conditions).

Energy services play a crucial role for the development of sustainable energy structures. It is not the quantity of energy demanded by households and companies that is relevant for welfare and development, but the amount and quality of the energy services consumed. These energy services, such as nutrition, housing, mobility and information, are provided by products (food, houses, fuel and media) combined with a wide range of capital stocks (as buildings, arable land, cars and the internet).

A given level of energy services can be provided by different combinations of technologies and energy flows. The range of available technologies and energy sources thus opens up a spectrum of options, which result in different amounts of energy flows and greenhouse gas emissions (GHG) for any given level of services. From a sustainability point of view energy services should hence be provided with the lowest possible input of (fossil) fuels and minimal greenhouse gas emissions.

As there is a strong connection between energy consumption and economic and social development we focus on indicators based on energy services that can be traced back through the energy system to energy consumption, taking into account the relevant technologies. We hence develop energy indicators starting from services that are related to the major components of final energy demand and which will be complemented by key indicators for electricity and heat production.

In the PASHMINA system of energy indicators, the indicators are arranged in a matrix system. The columns illustrate the six sectors for which the indicators are provided: energy supply, manufacturing, services, households, passenger transport and freight transport, representing the major drivers for energy use.

The rows illustrate the different levels of the energy system: The first row summarises the contextual indicators which include information on the respective relevant stocks and supplementing data (like the share of energy imports, energy prices, etc.). In the second row indicators are summarised that describe or are used to approximate energy services, such as the gross value added (GVA) of the manufacturing and the service sector as well as the number of tonne-kilometres (tkm) and passenger-kilometres (pkm). For the household sector three different energy service indicators are used: the floor area for space heating and lighting; the number of persons living in the household as approximation for hot water demand and the number of appliances as proxy for other energy services (e.g. cooking or ICT). Energy intensities – i.e. the amount of final energy per energy service – and energy efficiencies of fossil energy generation are then depicted. The next indicator row gives the energy flows – transformation input and output as well as final energy consumption – that are the result of the energy services demanded and the energy efficiencies that are defined by the quality of the capital stocks. The last two rows provide information on environmental aspects (the ecological impacts of energy use and supply, such as emissions of GHG and air pollutants) and social aspects (the economic impacts of energy use for housing and passenger transport).

B.1. GENUINE PROGRESS INDICATOR (GPI) / INDEX OF SUSTAINABLE ECONOMIC WELFARE (ISEW)

Index of Sustainable Economic Welfare (ISEW)	
+	Personal consumption weighted by income distribution index
+	Value of household work
+	Services of consumer durables
+	Services of streets and highways
+	Public expenditure on health and education
-	Cost of consumer durables
-	Private expenditure on health and education
-	Advertising expenditure
-	Costs of commuting
-	Cost of urbanisation
-	Cost of automobile accidents
-	Cost of water pollution
-	Cost of air pollution
-	Cost of noise pollution
-	Loss of wetlands
-	Loss of agricultural land
-	Use of non-renewable natural resources
-	Value of long-term environmental hazards
+/-	Net capital growth
+/-	Changes in international position
=	**ISEW**

	Genuine Progress Indicator
+	Personal consumption weighted by income distribution index
+	Value of household work and parenting
+	Value of higher education
+	Value of volunteer work
+	Services of consumer durables
+	Services of highways and streets
-	Cost of crime
-	Loss of leisure time
-	Cost of unemployment
-	Cost of consumer durables
-	Cost of commuting
-	Cost of household pollution abatement
-	Cost of automobile accidents
-	Cost of water pollution
-	Cost of air pollution
-	Cost of noise pollution
-	Loss of wetlands
-	Loss of farmland
-/+	Loss of forest area and damage from logging roads
-	Depletion of non-renewable energy resources
-	Carbon dioxide emissions damage
-	Cost of ozone depletion
+/-	Net capital investment
+/-	Net foreign borrowing
=	**GPI**

Source: Hoffren (2012).

B.2. GENUINE SAVING / ADJUSTED NET SAVING

	Gross National Savings
-	Consumption of fixed capital
	Net National Savings
+	Education expenditures
-	Energy depletion
-	Mineral depletion
-	Net forest depletion
-	PM_{10} damage
-	CO_2 damage
	Genuine Savings

Source: World Bank (2012).

B.3. HUMAN DEVELOPMENT INDEX (HDI)

	Sub-Index	Indicator
HDI	Life expectancy index	Life expectancy in years
	Education index	Mean years of schooling Expected years of schooling
	GNI index	Per capita income (in PPP)

Source: UNDP (2012).

C.1. NATIONAL ACCOUNTING MATRIX INCLUDING ENVIRONMENTAL ACCOUNTS (NAMEA)[3]

Economic figures
Production value
Gross value added
Labour force

Environmental material flows	
Material input	
Fossil materials	
	Domestic extraction
	Imports
Biomass	
	Domestic extraction (excl. wood)
	Domestic extraction of wood
	Imports (excl. wood and wood products)
	Imports of wood and wood products
Mineral materials	
	Domestic extraction of metallic minerals
	Domestic extraction of non-metallic minerals
	Imports of metallic minerals
	Imports of non-metallic minerals
Energy consumption	
Emission-relevant non-renewable energy sources	
Crude oil	
Emission-relevant renewable energy sources	
Non emission-relevant renewable energy sources	
Other non emission-relevant energy sources	
Air emissions	
SO_2	
NO_x	
NMVOC	
CH_4	
CO	
CO_2	
	CO_2 from fossil sources
	CO_2 from biogeneous sources
	CO_2 from other sources
N_2O	
NH_3	
PM_{10}	
Hazardous wastes	
Non-hazardous wastes	

[3] The tables are provided for different industry branches as well as for households and agriculture.

C.1. NATIONAL ACCOUNTING MATRIX INCLUDING ENVIRONMENTAL ACCOUNTS (NAMEA) continued

Environmental expenditure
Environmental protection expenditure
Protection of ambient air and climate
Waste management
Environmental taxes
Energy taxes
Transport taxes
Resource taxes
Pollution taxes

Source: Statistics Austria (2009).

C.2. MATERIAL FLOW ACCOUNTS

Classification of material inputs (broad categories)	
Domestic extraction (used)	
	Fossil fuels
	Minerals
	Biomass
Imports	
	Raw materials
	Semi-manufactured products
	Finished products
	Other products
	Packaging material imported with products
	Waste imported for final treatment and disposal
Memorandum items for balancing (oxygen for combustion, etc.)	
Unused domestic extraction	
	Unused extraction from mining and quarrying
	Unused biomass from harvest
	Soil excavation and dredging
Indirect flows associated to imports	
	Raw material equivalents of imported products
	Unused extraction associated to imported products

C.2. MATERIAL FLOW ACCOUNTS (continued)

Classification of material outputs (broad categories)	
Emissions and wastes	
	Emissions to air
	Waste landfilled
	Emissions to water
Dissipative use of products and dissipative losses	
	Dissipative use of products
	Dissipative losses
Exports	
	Raw materials
	Semi-manufactured products
	Finished products
	Other products
	Packaging material exported with products
	Waste exported for final treatment and disposal
Memorandum items for balancing	
	Water vapour from combustion
	Water evaporation from products
	Respirations of humans and livestock (CO_2 and water vapour)
Disposal of unused domestic extraction	
	Unused extraction from mining and quarrying
	Unused extraction from biomass harvest
	Soil excavation and dredging
Indirect flows associated to exports	
	Raw material equivalents of exported products
	Unused extraction associated to exported products

C.2. MATERIAL FLOW ACCOUNTS (continued)

Classification of material stock changes		
Total (gross) additions		
	Infrastructure and buildings	
		Construction minerals
		Metals
		Wood
		Other construction materials
	Other (machinery, durable goods, etc.)	
		Metals
		Other minerals
Removals (incl. losses)		
	Infrastructure and buildings	
	by demolition	Construction minerals
		Metals
		Wood
		Other construction materials
	by dissipative losses	Construction minerals
		Metals
		Wood
		Other construction materials
	Other (machinery, durable goods, etc.)	
	by discard	Metals
		Other minerals
	by dissipative losses	Metals
		Other minerals
Net additions to material stock		
	Infrastructure and buildings	
		Construction minerals
		Metals
		Wood
		Other construction materials
	Other (machinery, durable goods, etc.)	
		Metals
		Other minerals

C.2. MATERIAL FLOW ACCOUNTS (continued)

Key indicators

DMI (Direct Material Input) = Domestically extracted raw materials + imports

DMC (Domestic Material Consumption) = Domestic extraction (used) + Imports - Exports

PTB (Physical Trade Balance) = Imports -Exports

TMC (total material consumption) = TMR (Domestic extraction (used and unused) + Imports + indirect flows imported) - Exports - indirect flows exported

Source: European Communities (2001).

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Project Information

Welfare, Wealth and Work for Europe

A European research consortium is working on the analytical foundations for a socio-ecological transition

Abstract

Europe needs a change: The financial crisis has exposed long neglected deficiencies in the present growth path, most visibly in unemployment and public debt. At the same time Europe has to cope with new challenges ranging from globalisation and demographic shifts to new technologies and ecological challenges. Under the title of Welfare, Wealth and Work for Europe – WWWforEurope – a European research consortium is laying the analytical foundations for a new development strategy that enables a socio-ecological transition to high levels of employment, social inclusion, gender equity and environmental sustainability. The four year research project within the 7th Framework Programme funded by the European Commission started in April 2012. The consortium brings together researchers from 33 scientific institutions in 12 European countries and is coordinated by the Austrian Institute of Economic Research (WIFO). Project coordinator is Karl Aiginger, director of WIFO.

For details on WWWforEurope see: www.foreurope.eu

Contact for information

Kristin Smeral

WWWforEurope – Project Management Office

WIFO – Austrian Institute of Economic Research

Arsenal, Objekt 20

1030 Vienna

wwwforeurope-office@wifo.ac.at

T: +43 1 7982601 332

Domenico Rossetti di Valdalbero

DG Research and Innovation

European Commission

Domenico.Rossetti-di-Valdalbero@ec.europa.eu

WWWFOR EUROPE
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