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Review of selected indicators not covered by the guidelines

Energy and environment indicators

Note by the secretariat

Summary

The present note was prepared following a decision taken by the informal joint meeting on environmental indicators held from 31 August to 2 September 2009 in Geneva (ECE/CEP/2009/9, para.53(d)). It aims to assist the Joint Task Force in its deliberations on the latest developments regarding the production of energy and environment indicators at the international level and outlines proposals for specific indicators for consideration by the Joint Task Force. The proposals are presented in the format that is used in the UNECE Guidelines on the Application of Environmental Indicators in Eastern Europe, Caucasus and Central Asia.

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I. Introduction

1. During the past two decades various international and national organizations have been developing sets of indicators to measure and assess the interlinkages between energy and environment. This note was prepared with the assistance of Ms. Ljubov Gornaja, consultant to the secretariat.

2. The European Environment Agency (EEA) has developed a set of 24 indicators for energy and environment that are updated regularly. The indicators describe the development of the sector and implications for the environment and related policy actions. Annex I lists these indicators. The EEA indicator fact sheets on energy and environment constitute the basis for its energy and environment reporting. The fact sheets are organized around policy questions and are available from the website of the EEA, www.eea.europa.eu/.

3. The Organisation for Economic Co-operation and Development (OECD) has been developing a set of energy and environment indicators to better integrate environmental concerns into energy policy (see annex II). The energy and environment indicators are structured around three themes:

(a) Energy trends and patterns of environmental significance (i.e. indirect pressures and/or related driving forces);

(b) Interactions between energy and the environment (direct pressures and resulting environmental and social conditions);

(c) Economic and policy aspects of the energy and environment interface, such as environmental damage, environmental expenditure, economic and fiscal instruments, and trade aspects.

4. A core set of Energy Indicators for Sustainable Development (EISD) has been developed by the International Atomic Energy Agency (IAEA) in cooperation with the United Nations Department of Economic and Social Affairs (UNDESA), the International Energy Agency (IEA), Eurostat and EEA. The set aims to provide information on current energy-related trends in a format that aids decision-making at the national level and to help countries assess effective energy policies towards sustainable development.

5. The 30 EISD are classified according to the three main dimensions of sustainable development: social (4 indicators), economic (16 indicators) and environmental (10 indicators). Annex III lists the indicators that are included in the EISD set.

6. The analysis of energy and environmental indicators used by OECD and EEA has shown that some of these indicators have already been included in the Guidelines for the Application of Environmental Indicators in Eastern Europe, Caucasus and Central Asia¹ prepared by the United Nations Economic Commission for Europe (UNECE). Some indicators could also be produced using basic statistical data collected for indicators already included in the Guidelines. Furthermore, a proposal has been made to add three new indicators to the Guidelines: final electricity consumption, gross electricity production, and efficiency of conventional electricity and heat production.

¹ See United Nations publication, Environmental Indicators and Indicators-based Assessment Reports: Eastern Europe, Caucasus and Central Asia, Sales No. E 07.II.E.9. available on-line at www.unece.org/env/documents/2007/ece/ece.belgrade.conf.2007.inf.6.e.pdf.

7. On the basis of the above-mentioned sets of energy and environment indicators, the following 12 indicators can be recommended for use in the countries of Eastern Europe, Caucasus, Central Asia and South-Eastern Europe:

(a) Energy-related greenhouse gas emissions: sub-indicator of indicator 6 (greenhouse gas emissions) from the Guidelines;

(b) Energy-related emissions of ozone precursors substances: can be developed on the basis of data collected for indicator 1 (emission of pollutants into the atmospheric air) – emissions of nitrogen oxides, carbon monoxide and non-methane volatile organic compounds by economic activities as defined by the International Standard Industrial Classification of All Economic Activities (ISIC) and for indicator 6 (greenhouse gas emissions) – emissions of methane by sectors;

(c) Energy-related emissions of acidifying substances: can be developed on the basis of data collected for the indicator 1 (Emission of pollutants into the atmospheric air) – emissions of sulphur dioxide, nitrogen oxides and ammonia by economic activities as defined by ISIC Rev. 3.1;

(d) Energy-related particle emissions: can be developed on the basis of data collected for indicator 1 (emission of pollutants into the atmospheric air)–emissions of particulate matter and total suspended particulates–by economic activities as defined by the ISIC;

(e) Final energy consumption by energy sector: sub-indicator of indicator 25 (final energy consumption) from the Guidelines;

(f) Final electricity consumption: new proposed indicator;

(g) Total energy consumption intensity: indicator 27 from the Guidelines;

(h) Final energy consumption intensity: indicator 27 from the Guidelines;

(i) Efficiency of conventional electricity and heat production: new proposed indicator;

(j) Total energy consumption by fuel: sub-indicator of indicator 26 (total energy consumption) from the Guidelines;

(k) Gross electricity production: new proposed indicator;

(l) Renewable energy consumption: indicator 28 from the Guidelines.

8. A detailed description of the three new proposed indicators is given below.

II. Proposed additional indicators

A. Final electricity consumption

1. General description

(a) **Brief definition:** Electricity consumption, represented by electricity supplied to the final consumer's door for all energy uses: total, per capita, average annual rate of growth and the amount used by major users (industry, transport, households, services, agriculture and other sectors).

(b) **Unit of measurement:** Terawatt hours for total consumption and for consumption by major consumers; percentage with regard to annual growth rate and the shares of particular consumers.

2. Relevance for environmental policy

(a) **Purpose:** Final electricity consumption is a driving force indicator and shows trends in final electricity consumption. The trend in final electricity consumption (total and by users) provides a broad indication of progress made in reducing electricity consumption and associated environmental impacts by the different end-use sectors (industry, transport, households, services, agriculture and others). The indicator can be used to help monitor and assess the success of key policies that attempt to influence electricity consumption and energy efficiency.

(b) **Issue:** There is a close correlation between electricity consumption and economic growth. However, increases in electricity consumption result not only from a growing economy, but also from an increasing share of electricity in final energy consumption. The attractiveness of electricity is due to its flexibility of use and the importance placed by consumers on the variety of energy services it provides. The main reasons for higher electricity consumption in the service sector are the increased use of electrical appliances used in air conditioning, lighting and information technology equipment, for example, and the advent of new electrical devices. In the household sector, rising incomes, higher living standards and the trend towards smaller households have led to more and larger dwellings, and a growing demand for electrical appliances. There have been continued technical improvements in the efficiency of large electrical appliances resulting in a decrease in average specific consumption of 1.5 per cent per year in refrigerators, freezers, washing machines, dishwashers, televisions and dryers. However, these improvements have been offset by increases in the use, numbers and size of large appliances, as well as a growing number of smaller appliances such as videos and computers. Also of concern is the growing level of electricity consumption from appliances in stand-by mode, estimated at 5–10 per cent of household energy consumption in the European Union. The switch from other end-use fuels to electricity increases the environmental pressure in many cases, as roughly three units of energy are needed to produce one unit of electricity, owing to efficiency losses in electricity generation and transmission.

(c) **International agreements and targets:**

(i) Global and regional level: The United Nations Framework Convention on Climate Change and its Kyoto Protocol call for curbing total greenhouse gas emissions, the major share of which is carbon dioxide emissions caused by combustion of fossil fuels. The Convention on Long-range Transboundary Air Pollution requires the implementation of concrete measures to reduce emissions of pollutants into the air, including those originating from fuel combustion.

(ii) Subregional level: The European Union Directive on energy end-use efficiency and energy services (2006/32/EC) aims to boost the cost-effective and efficient use of energy in the European Union. According to this Directive, each year Member States should save 1 per cent more energy than in the previous year through raised energy efficiency.

3. Methodology and guidelines

(a) **Data collection and calculations:** Final electricity consumption is the electricity consumption of the final energy demand sectors. It does not include own use by electricity producers or transmission and distribution losses. Total final electricity consumption is calculated as the sum of final electricity consumption from all sectors. Electricity consumption per capita is calculated by dividing final electricity consumption by population. The share of a specific sector can be measured by the ratio of final energy consumption in that sector to the total final electricity consumption.

(b) **Internationally agreed methodologies and standards:** In 2005, IAEA, in cooperation with UNDESA, IEA, Eurostat and EEA, put out the EISD, along with corresponding methodologies and guidelines.

4. Data sources and reporting

9. Data on final electricity consumption are available from national energy balances of many countries, as well as from various international information sources on energy. The United Nations Statistics Division maintains a statistical database on energy, based on reports by various countries, including the countries of Eastern Europe, Caucasus and Central Asia, and of South-Eastern Europe. The most comprehensive database on energy balances is maintained by IEA and includes national data as well as data and estimates collected by other international bodies.

5. References at the international level

United Nations (1987). Energy Statistic –Definitions, Units of Measure and Conversion Factors. Series F, No. 44. New York. Available from http://unstats.un.org/unsd/publication/SeriesF/SeriesF_44E.pdf

IAEA, UNDESA, IEA, Eurostat and EEA (2005). Energy Indicators for Sustainable Development: Guidelines and Methodologies. (IAEA, 2005). Available from http://www.pub.iaea.org/MTCD/publications/PDF/Pub1222_web.pdf

COM (2005) 265 final. Green Paper on Energy Efficiency, or Doing More with Less. Commission of the European Communities.

Directive 2003/66/EC amending Directive 94/2/EC implementing Council Directive 92/75/EEC with regard to energy labelling of household electric refrigerators, freezers and their combinations.

Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council.

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.

EEA (2006). Energy and Environment in the European Union–Tracking Progress Toward Integration. EEA Report No 8/2006. Copenhagen.

EEA (2008). Energy and Environment Report 2008. EEA Report No. 6/2008.

European Commission and Eurostat (2007). Energy, Transport and Environment Indicators. Eurostat Pocketbooks. Luxembourg.

<http://www.iea.org/stats>

<http://unstats.un.org/>

B. Gross electricity production

1. General description (brief definition and unit of measurement)

10. This indicator is presented in three ways:

- (a) Total gross electricity generation in all types of plants, in terawatt hours;

(b) Electricity production by fuel: coal and lignite, oil, nuclear, natural and derived gas, renewables (wind, hydro, biomass and waste, solar photovoltaic and geothermal) and other fuels, in terawatt hours;

(c) The share of each fuel in electricity production, as a percentage.

2. Relevance for environmental policy

(a) **Purpose:** Gross electricity production represents a driving force indicator. The objective of the indicator is to analyse the fuel shares of electricity production and the growth in production by fuel type. It points out any switches to less polluting fuels.

(b) **Issue:** The type and extent of energy-related pressures on the environment depends upon the sources of electricity generation and how the electricity is produced. Electricity production from fossil fuels, such as crude oil, oil products, hard coal, lignite and natural and derived gas, provides a proxy indicator of resource depletion. The degree of environmental impact depends on the relative share of different fossil fuels and the extent to which pollution abatement measures are used. Natural gas, for instance, has approximately 40 per cent less carbon content than coal per unit of energy content, and 25 per cent less carbon content than oil, and only marginal quantities of sulphur. The level of nuclear electricity production provides an indication of the trends in the amount of nuclear waste generated and of the risks associated with radioactive leaks and accidents. Increasing consumption of nuclear energy at the expense of fossil fuels would, however, contribute to reductions in carbon dioxide emissions.

Renewable electricity production is a measure of the contribution from technologies that are, in general, more environmentally benign, as they produce little or no net carbon dioxide and usually significantly lower levels of other pollutants. Renewable electricity can, however, have an impact on landscapes and ecosystems, for example, potential flooding and changed water levels from large hydro power. The incineration of municipal waste, generally composed of both renewable and non-renewable materials, may also generate local air pollution.

(c) **International agreements and targets:**

(i) Global and regional level: Agenda 21, chapter 4, states that more efficiency in the use of energy sources and a transition to the environmentally friendly use of renewable resources should be achieved. The United Nations Framework Convention on Climate Change and its Kyoto Protocol call for curbing total greenhouse gas emissions, the major share of which is carbon dioxide emissions caused by combustion of fossil fuels. The UNECE Convention on Long-range Transboundary Air Pollution requires the implementation of concrete measures to reduce emissions of pollutants into air, including those originating from fuel combustion.

(ii) Subregional level: The EECCA Environment Strategy calls, in particular, for the mobilization of domestic and foreign investments for the development of renewable energy sources and the development and dissemination of alternative energy technologies in order to increase the share of renewable energies in the energy mix.

(iii) The Directive of the European Union on the promotion of electricity from renewable energy sources in the internal electricity market (2001/77/EC) sets an indicative target of 22.1 per cent of gross EU-15 electricity consumption from renewable sources by 2010. Targets for the new Member States and a target for the EU-25 of 21.0 per cent are included in the Treaty of Accession of the European Union 2003. The Large Combustion Plant Directive

(2001/80/EC), which aims to control emissions of sulphur dioxide, nitrogen oxides and particulate matter from large combustion plants (> 50 MW), also has a sizeable effect on the shares of electricity generation by fuel type, as it effectively favours the use of higher efficiency gas plant as opposed to coal plants.

3. Methodology and guidelines

(a) **Data collection and calculations:** Total gross electricity generation covers gross electricity generation in all types of plants. The gross electricity generation at the plant level is defined as the electricity measured at the outlet of the main transformers, that is, the consumption of electricity in the plant auxiliaries and in transformers is included. Electricity production by fuel is the gross electricity generation from plants utilizing the following fuels: coal and lignite, oil, nuclear, natural and derived gas, renewables (wind, hydro, biomass and waste, solar photovoltaic and geothermal) and other fuels. The share of each fuel in electricity production is taken as the ratio of electricity production from the relevant category to total gross electricity generation.

(b) **Internationally agreed methodologies and standards:** In 2005, IAEA, in cooperation with UNDESA, IEA, Eurostat and EEA, put out the EISD, along with corresponding methodologies and guidelines.

4. Data sources and reporting

11. Data on gross electricity generation and electricity production by fuels are available from national energy balances of many countries and from various international information sources on energy. The United Nations Statistics Division maintains a statistical database on energy based on reports by various countries, including countries of Eastern Europe, Caucasus and Central Asia, and of South-Eastern Europe. The most comprehensive database on energy balances is maintained by IEA and includes national data as well as data and estimates collected by other international bodies.

5. References at the international level

United Nations (1987). Energy Statistics—Definitions, Units of Measure and Conversion Factors. Series F, No. 44. New York. Available from http://unstats.un.org/unsd/publication/SeriesF/SeriesF_44E.pdf

OECD/IEA (2009). Energy Statistics of OECD Countries and Energy Statistics of Non-OECD Countries, Part I: Methodology.

IAEA, UNDESA, IEA, Eurostat and EEA(2005). Energy Indicators for Sustainable Development: Guidelines and Methodologies. (IAEA, 2005). Available from http://www-pub.iaea.org/MTCD/publications/PDF/Pub1222_web.pdf

COM (2000) 769 final. Green Paper: Towards a European Strategy for the Security of Energy Supply. Commission of the European Communities.

COM (2005) 265 final. Green Paper on Energy Efficiency, or Doing More with Less. Commission of the European Communities.

Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market.

EEA (2006). Energy and Environment in the European Union—Tracking Progress Toward Integration. EEA Report No 8/2006. Copenhagen.

EEA (2008). Energy and Environment Report 2008, EEA Report No 6/2008. Copenhagen.

European Commission and Eurostat (2007). Energy, Transport and Environment Indicators. Eurostat Pocketbooks. Luxembourg.

<http://www.iea.org/stats>

<http://unstats.un.org/>

C. Efficiency of conventional electricity and heat production

1. General description

(a) **Brief definition:** The efficiency of conventional electricity and heat production is defined as the ratio of the sum of electricity and heat produced to the energy input as a fuel.

(b) **Unit of measurement:** percentage.

2. Relevance for environmental policy

(a) **Purpose:** Efficiency of conventional electricity and heat production is a response indicator. Changes in the efficiency of electricity and heat production from conventional thermal power plants provide an indication of their environmental impact.

(b) **Issue:** The majority of conventional thermal power plants use fossil fuels with their associated environmental impacts such as greenhouse gas emissions and the release of other pollutants such as nitrogen oxides, sulphur dioxide and particles. However, the overall environmental impact has to be seen in the context of the type of fuel and the extent to which abatement technologies are used. All other things being equal, the greater the efficiency of thermal power generation the lower the environmental impacts for each unit of electricity produced, as less input fuel is required to produce it.

12. The efficiency of electricity and heat production from conventional power plants can be enhanced through a combination of factors including the closure of old inefficient plants, improvements in existing technologies and the installation of new, more efficient technologies, often combined with a switch to fuels with better generating efficiency. Environmental regulation and the progressive introduction of competition in the electricity supply industry has also helped promote improvements and fuel switching towards more efficient fuels.

3. International agreements and targets:

(a) **Global and regional level:** Agenda 21, Chapter 4, states that more efficiency in the use of energy sources should be achieved. The United Nation Framework Convention on Climate Change and its Kyoto Protocol call for curbing total greenhouse gas emissions, the major share of which is carbon dioxide emissions caused by combustion of fossil fuels. The UNECE Convention on Long-range Transboundary Air Pollution requires the implementation of concrete measures to reduce emissions of pollutants into the air, including those originating from fuel combustion.

(b) **Subregional level:** European Union directives concerning common rules for the internal market in electricity (2003/54/EC) and natural gas (2003/55/EC) establish such rules for the transmission, distribution, supply and storage of electricity and gas and the organization and functioning in the sectors. The main impact of the directives, in terms of efficiency of conventional thermal generation, is that they have led to the progressive

introduction of competition in the electricity supply industry, both within and between Member States. It is expected that these new market structures will encourage switching to cheaper and more efficient technologies, in particular gas technologies.

4. Methodology and guidelines

(a) **Data collection and calculations:** The efficiency of electricity and heat production is the ratio of electricity and heat output to total fuel input calculated for a calendar year, expressed as a percentage. Fuels include solid fuels (i.e. coal, lignite and equivalents), oil and other liquid hydrocarbons, gas, thermal renewables (industrial and municipal waste, wood waste, biogas and geothermal energy) and other non-renewable waste.

Electricity output and fuel input are converted into common energy units (tonnes of oil equivalent or joules using the conversion multiplier factor for each fuel type and electricity.

(b) **Internationally agreed methodologies and standards:** In 2005, IAEA, in cooperation with UNDESA, IEA, Eurostat and EEA, put out the EISD, along with corresponding methodologies and guidelines.

5. Data sources and reporting

13. Data on fuel input to, and electricity and heat output from conventional thermal power plants are available from national energy balances of many countries and various international information sources on energy. The United Nations Statistics Division maintains a statistical database on energy based on reports by various countries, including countries of Eastern Europe, Caucasus and Central Asia, and of South-Eastern Europe. The most comprehensive database on energy balances is maintained by IEA and includes national data as well as data and estimates collected by other international bodies.

6. References at the international level

United Nations (1987). *Energy Statistic –Definitions, Units of Measure and Conversion Factors*. Series F, No. 44. New York. Available from http://unstats.un.org/unsd/publication/SeriesF/SeriesF_44E.pdf

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COM (2000) 769 final. Green Paper: Towards a European Strategy for the Security of Energy Supply. Commission of the European Communities.

COM (2005) 265 final. Green Paper on Energy Efficiency, or Doing More with Less. Commission of the European Communities.

Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants.

Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in electricity and repealing Directive 96/92/EC.

Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in natural gas and repealing Directive 98/30/EC.

Directive 2004/8/EC of the European Parliament and of the Council of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market amending Directive 92/42/EEC.

Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control.

EEA (2006). *Energy and Environment in the European Union—Tracking Progress Toward Integration*. EEA Report No 8/2006. Copenhagen.

EEA (2008). *Energy and Environment Report 2008*, EEA Report No 6/2008. Copenhagen.

Annexes

Annex I

EEA Energy and Environment Indicators

Is the use and production of energy having a decreasing impact on the environment?

- EN01 Energy and non-energy related greenhouse gas emissions
- EN02 Energy-related greenhouse gas emissions
- EN05 Energy-related emissions of ozone precursors
- EN06 Energy-related emissions of acidifying substances
- EN07 Energy-related particle emissions
- EN08 Emissions intensity of public conventional thermal power production
- EN09 Emissions from public electricity and heat production—explanatory indicators
- EN13 Nuclear waste production
- EN14 Accidental oil tanker spills
- EN15 Discharge of oil from refineries and offshore installations

Is energy use declining?

- EN16 Final energy consumption by sector (core set indicator 27)
- EN18 Electricity consumption

How rapidly is energy efficiency increasing?

- EN17 Total energy consumption intensity (core set indicator 28)
- EN21 Final energy consumption intensity
- EN19 Energy efficiency of conventional thermal electricity generation
- EN20 Combined heat and power

Is there a switch to less polluting fuels?

- EN26 Total energy consumption by fuel (core set indicator 29)
- EN27 Electricity production by fuel

How rapidly are renewable energy technologies being implemented?

- EN29 Renewable energy consumption (core set indicator 30)
- EN30 Renewable electricity (core set indicator 31)

Are environmental costs better incorporated into the pricing system?

- EN31 Energy prices
- EN32 Energy taxes
- EN34 Energy subsidies

Source: EEA (2006). Energy and Environment in the European Union—Tracking Progress Toward Integration. EEA Report No 8/2006. Copenhagen.

Annex II

OECD Energy and Environment Indicators

Sectoral Trends of Environmental Significance

- 1. Overall energy use**
 - (a) Total primary energy supply
 - (b) Total final consumption by fuel type
 - (c) Total final consumption by sector

- 2. Energy use by fuel type**
 - (a) Percent of total primary energy supply by fuel type
 - (b) Percent of electricity generation by fuel type

- 3. Indigenous energy production**
 - (a) Primary energy produced nationally as a percentage of total
 - (b) Primary energy supply

- 4. Energy intensity**
 - (a) Total primary energy supply per unit of gross domestic product
 - (b) Sectoral end uses
 - (i) residential: tonnes of oil equivalent per square metre
 - (ii) commercial and public sector: tonnes of oil equivalent per capita
 - (iii) industry: tonnes of oil equivalent per unit of value added
 - (iv) transport: tonnes of oil equivalent per road vehicle x km

- 5. Fossil fuel efficiency for electricity generation**

Environmental Interactions

- 1. Energy resources: proven oil/coal/gas reserves in tonnes of oil equivalent**

- 2. Air pollution**
 - (a) Annual volume of air pollution emissions (sulphur dioxide, nitrogen oxides, carbon dioxide, carbon monoxide, volatile organic compounds, methane)
 - (b) Ratio of emissions per unit of gross domestic product
 - (c) Ratio of emissions by end uses

- 3. Water pollution: tonnes of oil released**
 - (a) through accidents
 - (b) on a continuous basis (refineries, platforms, tankers)

- 4. Waste**
 - (a) Volume of solid waste from energy production
 - (b) Volume of radioactive waste (spent fuel)

5. **Land use:** Hectares of land taken up by energy production, transport, and transformation, such as reservoirs, pipelines, open-cast mines and harbours
6. **Safety:** Number of people killed and injured

Economic Considerations

1. **Environmental damage:** Environmental pollution damage relating to energy production and consumption, for certain types of pollutants (e.g. sulphur dioxide)
2. **Environmental expenditure**
 - (a) Total expenditure on pollution prevention and/or clean-up
 - (i) abatement vs. clean technology
 - (ii) public vs. private
 - (b) Environmentally related research and development expenditures: public vs. private.
3. **Taxation and subsidies**
 - (a) Direct subsidies by fuel type
 - (iii) ratio by tonnes of oil equivalent
 - (iv) as a percentage of sectoral activity
 - (v) share of subsidies for environmental purposes
 - (b) Total economic subsidies (direct and indirect subsidies, plus externalities)
 - (c) Relative taxation by different fuel types in per cent
4. **Real energy prices per fuel type**

Source: List based on the *OECD Environment Monograph on Indicators for the Integration of Environmental Concerns into Energy Policies*. OCDE/GD(93)133. Paris: 1993.

Annex III

Selected Energy Indicators for Sustainable Development

<i>Theme</i>	<i>Sub-theme</i>	<i>Energy indicator</i>	
Economic dimension			
Use and production patterns	Overall use	ECO1	Energy use per capita
	Overall productivity	ECO2	Energy use per unit of gross domestic product
	Supply efficiency	ECO3	Efficiency of energy conversion and distribution
	Production	ECO4	Reserves-to-production ratio
		ECO5	Resources-to-production ratio
	End use	ECO6	Industrial energy intensities
		ECO7	Agricultural energy intensities
		ECO8	Service/commercial energy intensities
		ECO9	Household energy intensities
		ECO10	Transport energy intensities
Use and production patterns	Diversification (fuel mix)	ECO11	Fuel shares in energy and electricity
		ECO12	Non-carbon energy share in energy and electricity
		ECO13	Renewable energy share in energy and electricity
	Prices	ECO14	End-use energy prices by fuel and by sector
Security	Imports	ECO15	Net energy import dependency
	Strategic fuel stocks	ECO16	Stocks of critical fuels per corresponding fuel consumption
Environmental dimension			
Atmosphere	Climate change	ENV1	Greenhouse gas emissions from energy production and use per capita and per unit of gross domestic product
		ENV2	Ambient concentrations of air pollutants in urban areas
	Air quality	ENV3	Air pollutant emissions from energy systems
Water	Water quality	ENV4	Contaminant discharges in liquid effluents from energy systems including oil discharges

<i>Theme</i>		<i>Sub-theme</i>	<i>Energy indicator</i>
Land	Soil quality	ENV5	Soil area where acidification exceeds critical load
	Forest	ENV6	Rate of deforestation attributed to energy use
	Solid waste generation and management	ENV7	Ratio of solid waste generation to units of energy produced
		ENV8	Ratio of solid waste properly disposed of to total generated solid waste
		ENV9	Ratio of solid radioactive waste to units of energy produced
	ENV10	Ratio of solid radioactive waste awaiting disposal to total generated solid radioactive waste	

Source: IAEA, UNDESA, IEA, Eurostat and EEA (2005). *Energy Indicators for Sustainable Development: Guidelines and Methodologies*. (IAEA, 2005). Available from http://www.pub.iaea.org/MTCD/publications/PDF/Pub1222_web.pdf