

EN18 Electricity Consumption

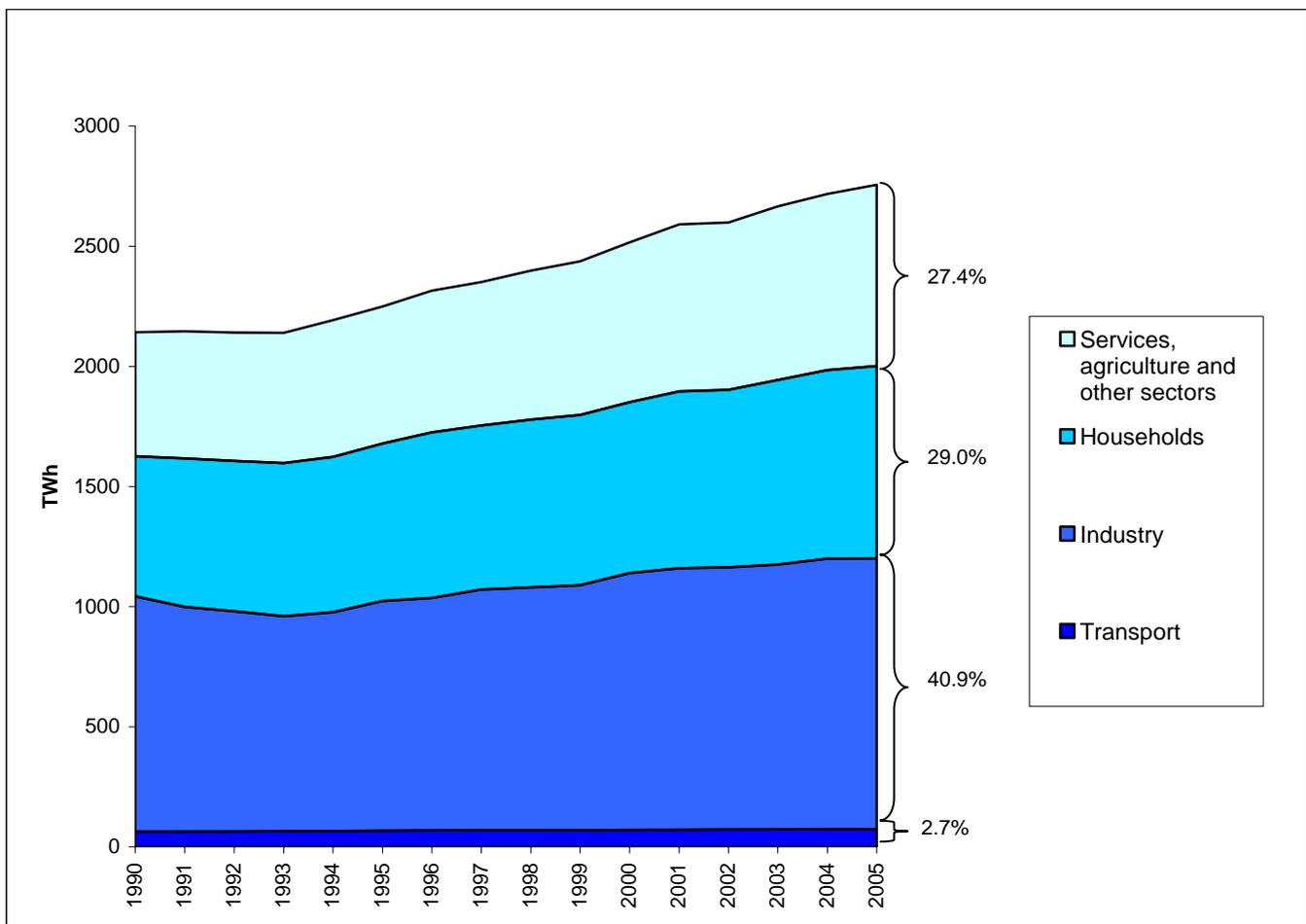
Key message

Final electricity consumption is increasing rapidly in all economic sectors, at an average of around 1.7% per year from 1990-2005. This is the consequence of both the attractiveness of electricity as an energy carrier and continuing economic growth. Due to the high level of efficiency losses involved in both the production, particularly from conventional thermal and nuclear power, and transmission of electricity, the rise in electricity consumption is of particular concern for the environment.

Rationale

The trend in final electricity consumption by sector monitors progress made in reducing electricity consumption. The associated environmental impacts, however, depend on both the amount of electricity consumption and the way the electricity is generated (in particular fuel mix, efficiency and the use of abatement technologies).

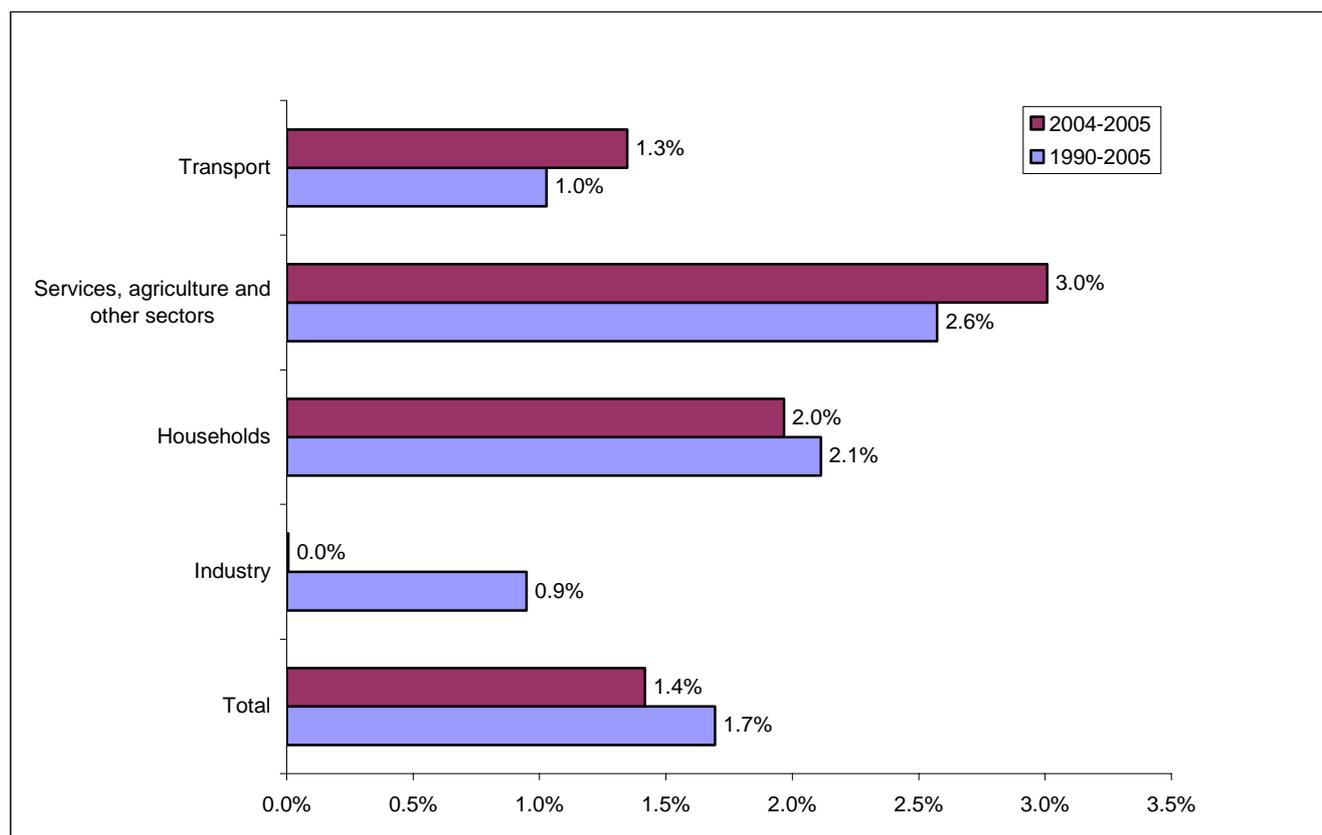
Fig. 1: Final electricity consumption by sector, EU-27



Data Source: Eurostat

Notes: 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.

Fig 2: Average annual growth rate in electricity consumption by sector, 1990-2005 and 2004-2005 in EU-27



Data Source: Eurostat

1. Indicator assessment

Final electricity consumption grew across the EU-27 at an average annual rate of 1.7 % between 1990 and 2005 (an absolute increase of 28.7 %). This rate of increase was only slightly less than the average GDP growth rate over the same period, showing an apparent strong correlation between electricity consumption and economic growth. However, the increases in electricity consumption resulted not only from a growing economy, but also from an increasing share of electricity in final energy consumption, rising from 17.2 % in 1990 to 20.3 % in 2005. 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. Furthermore, influenced by the liberalisation of the power market, electricity prices decreased considerably between 1990 and 2006 – although they have started to rise again in the last few years (see EN-31).

For the EU-27 as a whole, growth in electricity consumption was particularly strong in the service sector, followed by households. The main reasons for increased electricity consumption in the service sector were the sustained growth of this sector throughout the EU, the increased use of electrical appliances (such as air conditioning, lighting or IT equipment) and the advent of new electrical devices. In the household sector, rising incomes, higher living standards and the trend towards smaller households led to more and larger dwellings and a growing demand for electrical appliances. In 2005 total household final energy consumption was 799 TWh across a total of almost 200 million households in the EU-27.

There have been continued technical improvements in the efficiency of large electrical appliances; a decrease in average specific consumption of 1.5 % per year in the case of refrigerators, freezers, washing machines, dishwashers, TVs 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 (Enerdata et al, 2003).

In the industry sector electricity consumption grew between 1990 and 2005, but at a slower rate compared with the services and household sectors. Between 2004 and 2005 the electricity consumption of the industry sector showed a minimal growth of 0.01 %. Industry electricity consumption in the new Member States fell sharply during the early 1990s during the process of economic restructuring, although some growth has occurred more recently. This is reflected in the significant variation between the EU-27 member states, for example, the consumption in Ireland increased by 11.4 % whilst the consumption in Romania decreased by 6.2 % over the same period.

The transport sector is only responsible for around 2.7% of total electricity consumption in EU-27 and the increase in the 1990s can be attributed to growing consumption in the EU-15, due to increased electrification of Europe's railways (especially in France and the United Kingdom). The trend for the new Member States was opposite to that of EU-15, with a gradual decrease in electricity consumed for transport purposes due to lower usage of trains and other domestic public transport and an increase in car and air transport.

Most countries in EU-27 saw increased electricity consumption over the period from 1990 to 2005, except for Latvia, Lithuania, Estonia, Slovakia, Bulgaria and Romania. The growth rate of electricity consumption varied greatly by country, ranging from less than 1 % per year in the Germany, Czech Republic, Denmark, Poland, Hungary and Sweden to over 4 % in Malta, Spain, Portugal, Ireland and Cyprus. The decrease or low growth in electricity consumption in the new Member States was as a result of economic restructuring in the 1990s. Electricity consumption per capita also varies greatly between countries, with the lowest per capita consumption occurring in some new Member States of central and Eastern Europe and southern European countries (Romania, Lithuania, Latvia, Poland, Hungary, Portugal). Although the use of air conditioning in southern European countries contributes to a large increase in electricity consumption during the summer months, the highest consumption per capita was in the most northerly countries, Norway, Iceland, Sweden and Finland, where electrical heating based on low cost electricity produced by hydropower meets a large part of the overall heating requirements.

The average electricity use per capita in the EU-27 is almost 2.5 times the global average and 3.5 times that for China. Only Luxembourg, Sweden, Finland, Norway and Iceland are using more electricity per capita than in the United States. The rest of the EU-27 is well below the US.

Projections:

Projections from POLES indicate an overall increase of electricity consumption for both the Baseline Scenario as well as the GHG Reduction Scenario. In comparison with the Baseline Scenario, the GHG Reduction Scenario projects a reduction of the electricity consumption in Households, Services, Agriculture and other sectors. The WEO 2007 projections show the same increase in electricity consumption but, with the exception of the Alternative Policy scenario, these are significantly lower than the POLES projections.

Fig 3: Final electricity consumption by sector in EU-27, 2020 (TWh)

	(IPTS) POLES		(IEA) WEO 2007	
	Baseline	GHG Reduction	Reference	Alternative Policy
Total	3,782	3,311	3,407	3,130
Transport	120	119	95	104
Industry	1,541	1,503	1,357	1,260
Households	2,121	1,689	1,955	1,766
Services, agriculture and other sectors				

Data source: IPTS, IEA

2. Indicator rationale

2.1 Environmental context

The trend in final electricity consumption by sector provides a broad indication of progress made in reducing electricity consumption by the different end-use sectors transport, industry, households, and services (including agriculture and other sectors). Reducing electricity consumption is a robust way to lower the environmental impacts of electricity generation. This may result from reducing the electricity consumption for related activities (e.g. for lighting, appliances and information and communication technology equipment), or by using electricity in a more efficient way (thereby using less electricity per unit of demand), or from a combination of the two.

However, the type and extent of energy-related pressures on the environment depends not only on the amount of electricity consumed (and thus generated), but on the fuels used for electricity generation, which are predominantly still fossil fuels (see EN27 for more information about electricity production by fuel and its impacts) and how the electricity is produced (see EN06 on the extent to which pollution abatement technologies are used). The efficiency with which electricity is produced also strongly determines the size of the environmental impacts of electricity production and consumption (see EN19 and EN20), as it determines the amount of input fuel required to generate a given quantity of electricity.

The switch from other end-use fuels towards electricity increases the environmental pressure in many cases, as around three units of energy are needed to produce one unit of electricity, due to efficiency losses in electricity generation and transmission.

However, if the electricity is generated by high efficiency, low emission technologies, such a switch could also reduce sufficiently the environmental consequences of electricity production. Electricity also offers a route for developing and exploiting non-fossil energy sources such as wind energy and hydropower, which are renewable energy sources that produce electricity directly.

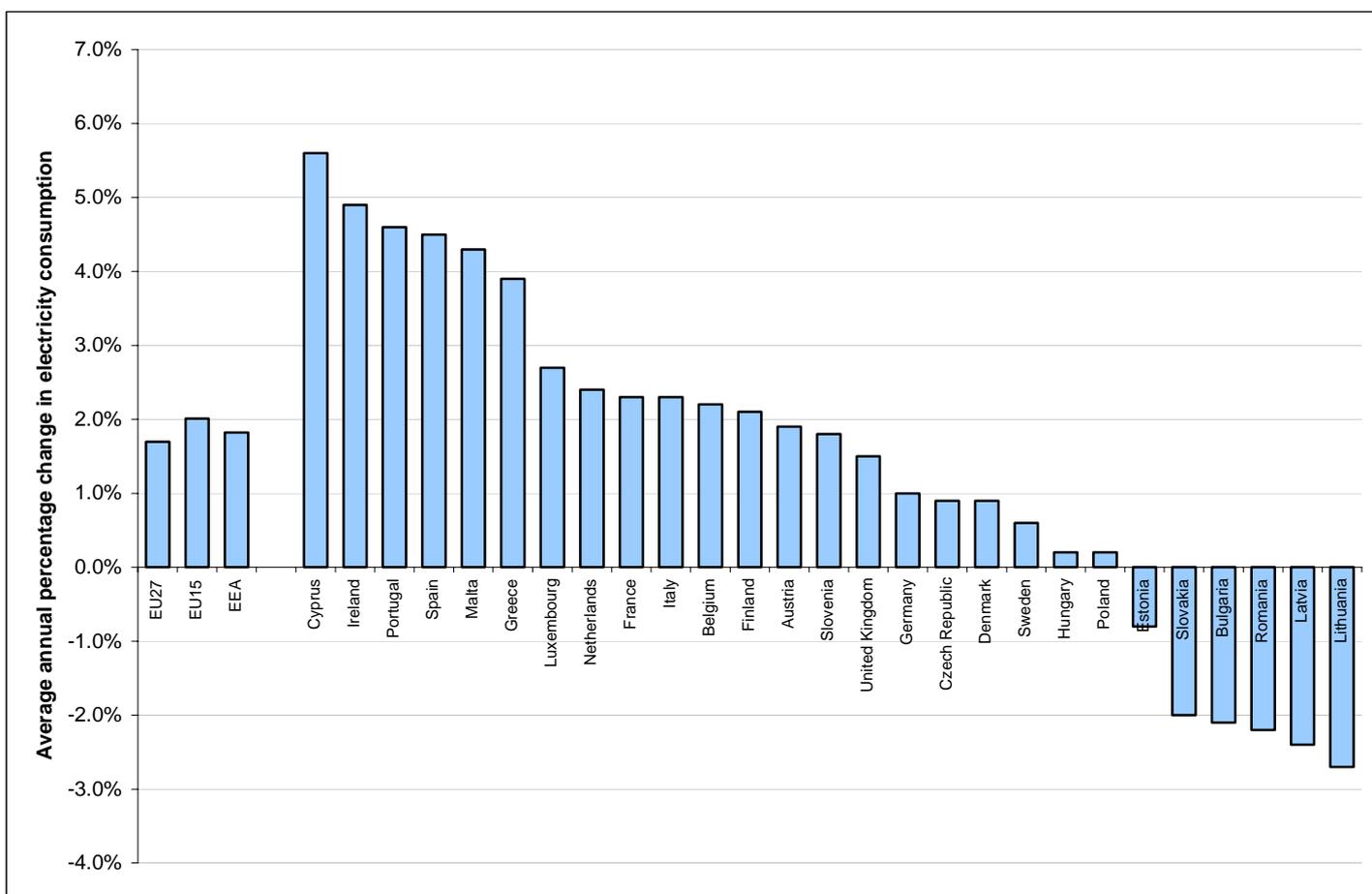
2.2 Policy context

This indicator can be used to help monitor the success of key policies at EU and Member State level that attempt to influence electricity consumption and energy efficiency.

The EU Action Plan for Energy Efficiency (SEC(2006)1173, 1174 and 1175) aims at boosting the cost-effective and efficient use of energy in the EU. It sets a target of 20% reduction of energy-use by 2020, compared to the baseline-projections. This target is also part of the EU Energy Policy for Europe (COM(2007)2). The target of 20% equals 1,5% more energy-efficiency per year. This regards the total use of energy, and including the use of other energy-carriers than electricity.

The power generation sector was responsible for 24 % of EU-15 emissions in 2005 (EEA, Greenhouse Gas inventory, 2007). Therefore, the reduction of electricity consumption is also to be seen in the context of reaching the target of an 8 % reduction in greenhouse gas emissions by 2008-2012 from 1990 levels for the EU-15 and individual targets for most new Member-States as agreed in 1997 under the Kyoto Protocol of the United Nations Framework Convention on Climate Change, as well as reaching the target of 20 – 30% reduction of emissions by 2020 as defined in the EU Energy Policy.

Fig. 4: Average annual percentage change in final electricity consumption, EU-27 1990-2005



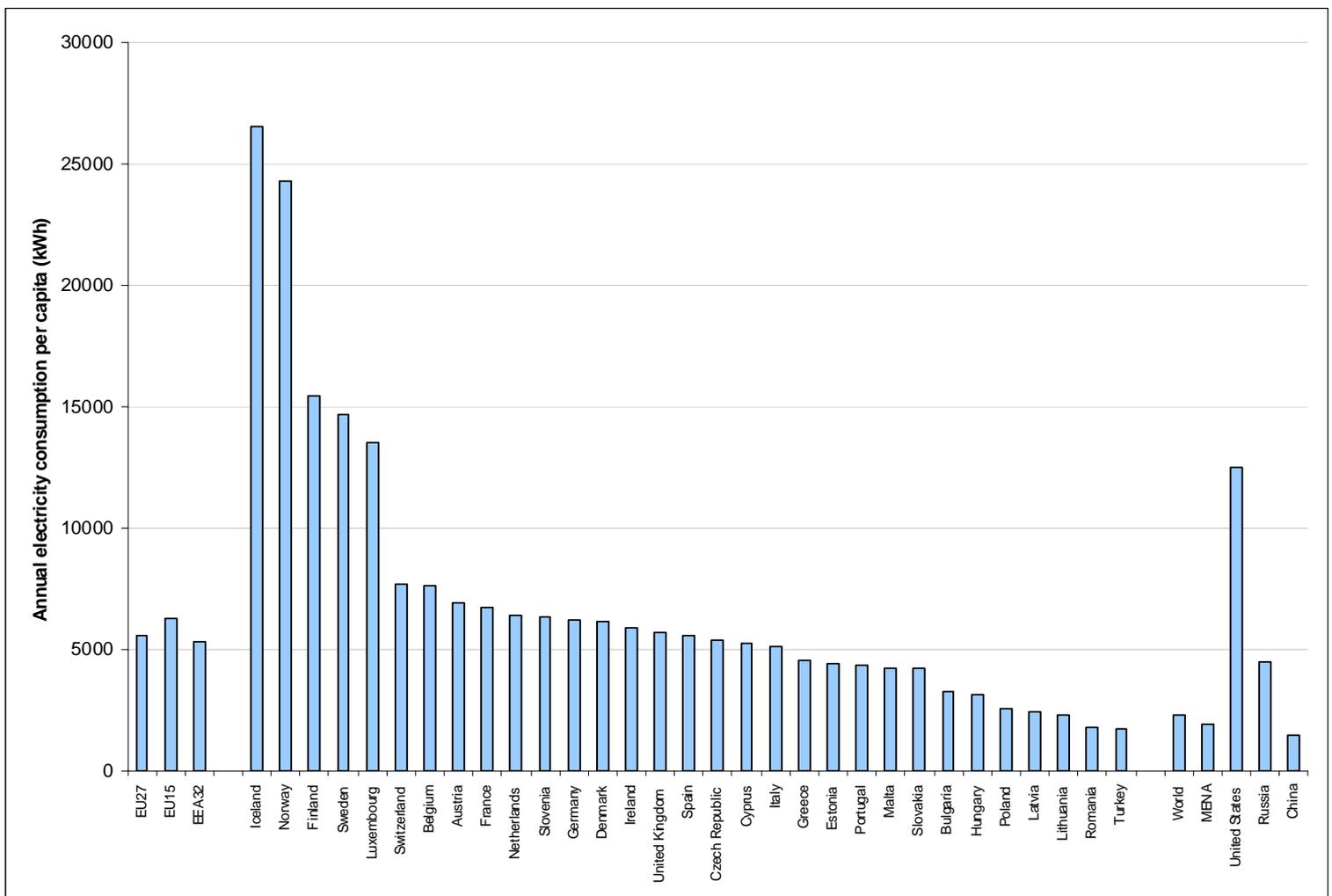
Data source: Eurostat

On January 23rd 2008 the European Commission presented a new package of legislative proposals regarding energy use and climate change. These include an improvement of the EU Emissions Trading Scheme (with a binding target of 21% emission reduction in 2020 vs. 2005), and binding targets for Member States for emissions which fall outside the EU-ETS. The caps on emissions in the EU-ETS will probably result a rise of electricity prices with app. 10 – 15% (European Commission, Impact Assessment 2008). This will have an impact on the demand for electricity. Moreover, other legislative proposals from this package are likely to result in a decrease of the growth of energy consumption.

The Action Plan for Energy Efficiency sets 10 priority actions. Some of these will mainly affect the use of electricity. One important will be the labelling and setting of minimum energy performance standards for appliances and other energy-using equipment. This will be done by implementing Directives for 14 priority product groups by 2008. These include computers, televisions, standby-equipment, cooling and street lighting. Other priority actions include building performance requirements, facilitating financing of energy investments and raising energy efficiency awareness. Furthermore, it expands on measures to introduce more efficient electricity generation and transmission in order to reduce environmental pressures.

The Action Plan builds on existing EU energy efficiency regulation, such as the Directive 2005/32/EC on the eco-design of Energy-using Products. This directive provides coherent EU-wide rules for eco-design and ensures that disparities among national regulations do not become obstacles to intra-EU trade. However, it does not introduce directly binding requirements for specific products, but defines conditions and criteria for setting, through subsequent implementing measures, requirements regarding environmentally relevant product characteristics, such as electricity consumption. Other existing regulation includes the EC energy label Directive (92/75/EEC) introducing mandatory labels stating the energy efficiency grade for specific household appliances, Directive (96/57/EC) on minimum energy efficiency requirements for household electric refrigerators and freezers, and the Directive 2003/66/EC introducing the new energy classes A+ and A++ for the most efficient appliances.

Fig 5: Electricity consumption per capita (kWh) in 2005



Source: Eurostat, IEA

Notes: MENA is Middle East and North Africa

References

COM(2003) 739 - Proposal for a Directive of the European Parliament and the Council on energy end-use efficiency and energy services.

COM(2005) 265 final – Green Paper on energy efficiency, or doing more with less , European Commission

http://europa.eu.int/comm/energy/efficiency/doc/2005_06_green_paper_text_en.pdf

COM (2006) 32 Directive of the European Parliament and the Council on energy end-use efficiency and energy services.

COM(2008) 16 Proposal for a Directive amending Directive 2003/87/EC (EU ETS)

COM(2008) 17 Proposal for a Decision on the effort of Member States to reduce their greenhouse gas emissions

Council Decision 2002/358/EC to ratify the Kyoto Protocol under the United Nations Framework Convention on Climate Change

Directive (92/75/EEC) on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances

Directive (96/57/EC) on energy efficiency requirements for household electric refrigerators, freezers and combinations thereof.

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 (amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC) on the eco-design of Energy-using Products

EEA (2005) Climate change and a low-carbon European energy system, European Environment Agency report No 1/2005.

ENERDATA/FhG-ISI (2003) Energy efficiency in the European Union 1990-2001, SAVE-ODYSSEE Project on Energy Efficiency Indicators.

European Commission (2003) European energy and transport, Trends to 2030, Directorate General for Energy and Transport.

European Commission (2004) European energy and transport – scenarios on key drivers, Directorate General for Transport and Energy

European Commission (2006) European energy and transport: Trends to 2030 - Update 2005
http://ec.europa.eu/dgs/energy_transport/figures/trends_2030_update_2005/index_en.htm

Research Centre. <http://energyefficiency.jrc.cec.eu.int/pdf/publications/ACEEE2002%20paper%20569%20final.pdf>

JRC (2004) <http://energyefficiency.jrc.cec.eu.int/pdf/publications/ACEEE%202004%20paper191.pdf>

JRC http://energyefficiency.jrc.cec.eu.int/html/standby_initiative.htm

Meta data

Technical information

1. Data source:
Final Electricity Consumption: Eurostat (historical data) <http://europa.eu.int/comm/eurostat/> There were important corrections for the year 1990 in the energy balance. These changes for Latvia have been taken into account as much as possible. However, the EU-10 and EU-25 aggregates could not be updated. Changes to the EU aggregates are likely to be limited as in 1990 the total energy consumption in Latvia represented approximately 3 % and 0.5 % of the total energy consumption in the EU-10 and EU-25, respectively.
2. Description of data/Indicator definition:
Final electricity consumption covers electricity supplied to the final consumer's door for all energy uses, it does not include own use by electricity producers or transmission and distribution losses. It is calculated as the sum of final electricity consumption from all sectors. These are disaggregated to cover industry, transport, households, services (including agriculture and other sectors).
Units: Final electricity consumption is measured in terawatt hours (TWh).
Projections are for 2020 from the POLES (IPTS) Baseline and GHG Reduction Scenario and from the WEO 2007 (IEA) Reference and Alternative Policy Scenario.
3. Geographical coverage:
The Agency had 32 member countries at the time of writing of this fact sheet. These are the 27 European Union Member States and Turkey, plus Iceland, Norway, Liechtenstein and Switzerland.
No energy data available for Switzerland and Liechtenstein. No projection data are available for Iceland, Liechtenstein.
Data for World, United States, China, Russia and the Middle East and North Africa (MENA).
4. Temporal coverage: 1990-2005, projections 2020.
5. Methodology and frequency of data collection:
Data collected annually.
Eurostat definitions for energy statistics <http://forum.europa.eu.int/irc/dsis/coded/info/data/coded/en/Theme9.htm>
Eurostat metadata for energy statistics http://europa.eu.int/estatref/info/sdds/en/sirene/energy_base.htm
6. Methodology of data manipulation:
Average annual rate of growth calculated using: $[(\text{last year}/\text{base year})^{(1/\text{number of years})} - 1] * 100$
Electricity consumption per capita calculated by dividing final electricity consumption by population for each country (demo_pjan).
The coding (used in the Eurostat New Cronos database) and specific components of the indicator (in relation to the product '6000 - electrical energy') are:
Numerator: final electricity consumption industry 101800 + final electricity consumption transport 101900 + final electricity consumption households 102010 + final electricity consumption services/agriculture calculated as (final electricity consumption households/services 102000 - final electricity consumption households 102010).
Only if needed for shares; Denominator: (total) final electricity consumption 101700
For non-EEA members data from the IEA is used:
Report 'Electricity Information', table 'World, Electricity/Heat Supply and Consumption', product 'Electricity (GWh)', balance ('Observed



Consumption – Total Energy Sector'). Report 'World Energy Balances', table 'World Indicators', flow 'Population (millions)':

Projections:

POLES: Demand of electricity by sectors (TWh)

WEO 2007: Total Final Consumption Electricity by sector (Mtoe) * 11.63

Qualitative information

7. Strength and weaknesses (at data level)

Officially reported data, updated annually. No obvious weaknesses.

Data have been traditionally compiled by Eurostat through the annual Joint Questionnaires, shared by Eurostat and the International Energy Agency, following a well established and harmonised methodology. Methodological information on the annual Joint Questionnaires and data compilation can be found in Eurostat's web page for metadata on energy statistics.

http://europa.eu.int/estatref/info/sdds/en/sirene/energy_sm1.htm

8. Reliability, accuracy, robustness, uncertainty (at data level):

Indicator uncertainty (historical data)

Any cross-country comparison of the distribution of electricity consumption between sectors will have to be accompanied by a relevant measure of the importance of the sector in the economy, as the sectoral shares also depends on the country's economic circumstances. Because the focus is on the reduction of electricity consumption and not on the sectoral redistribution of such consumption, the trends in the absolute values (in TWh) should be preferred as a more meaningful indicator of progress. However, even if the same sectors in two countries are equally important to the economy, the gross (primary) consumption of energy needed to generate the electricity before it reaches the final user might draw from energy sources that pollute the environment in different ways. Thus, from an environmental point of view, the final electricity consumption of a sector should be analysed in that broader context.

The sectoral breakdown of electricity consumption includes industry, transport, households, services, agriculture, fisheries and other sectors. As projections aggregate agriculture, fisheries and other sectors together with the services sector, the indicator uses the same aggregation. The inclusion of agriculture and fisheries together with the services sector is however questionable given their divergent trends. Separate assessments are therefore made where appropriate.

It should also be noted that electricity consumption in 1990 for Germany refers only to the western part.

9. Overall scoring - historical data (1 = no major problems, 3 = major reservations):

Relevance: 1

Accuracy: 1

Comparability over time: 1

Comparability over space: 1