EN16 Final Energy Consumption by Sector

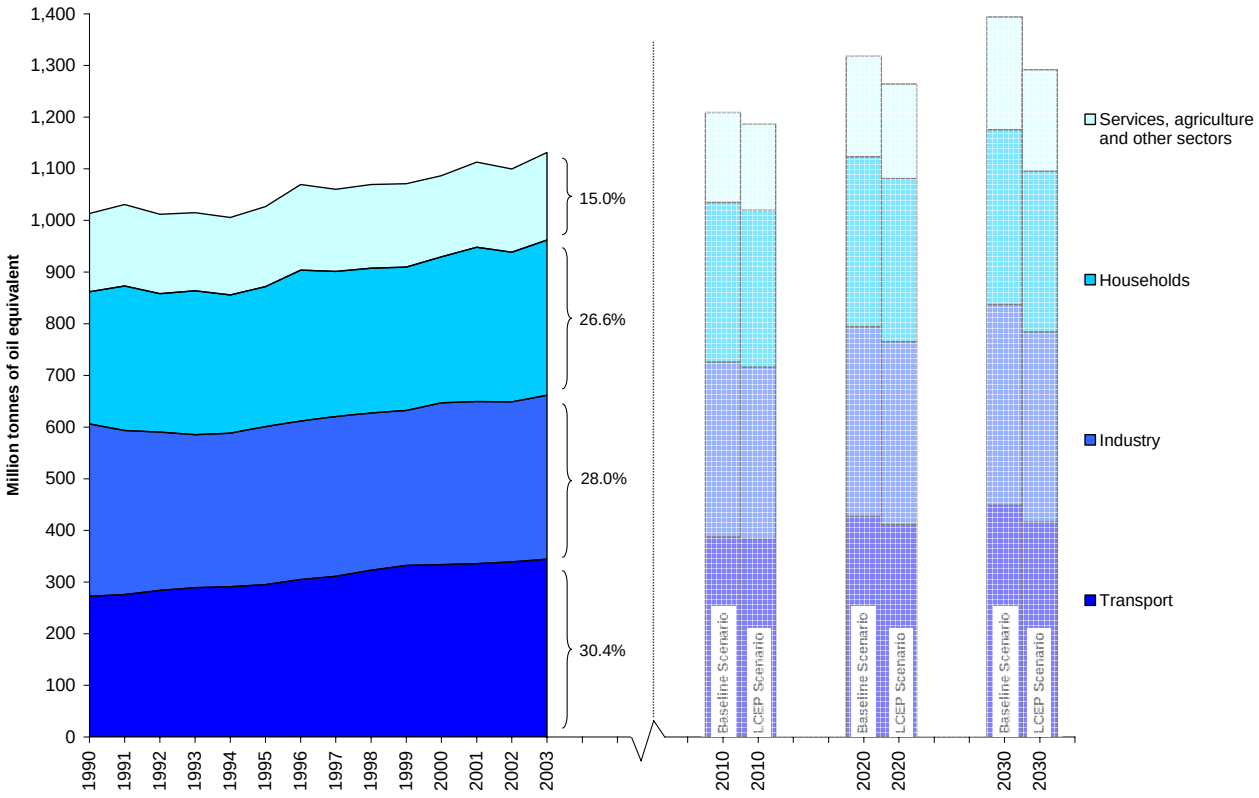
Key message

Final energy consumption in the EU-25 grew by 2.9 % from 2002 to 2003 and has risen by 11.6 % overall between 1990 and 2003. Transport has been the fastest-growing sector since 1990 and is now the largest consumer of final energy. EU-wide energy projections anticipate a continued growth in final energy consumption to 2030 in all end-use sectors, indicating a risk of ongoing underlying pressure on the environment.

Rationale

The trend in final energy consumption by sector provides a broad indication of progress made in reducing energy consumption and associated environmental impacts by the different end-use sectors. It can be used to help monitor the success of key policies that attempt to influence energy consumption and energy efficiency.

Fig. 1: Final energy consumption by sector in the EU-25, 1990-2003



Data source: Eurostat (historic data), EEA (2005) for projections.

Note: EEA baseline projections are consistent with European Commission (2004). The Low-Carbon-Energy Pathway (LCEP) scenario assumes that ambitious future greenhouse gas emission reduction targets will be reached, with a CO_2 permit price of EUR 30/t CO_2 and EUR 65/t CO_2 in 2020 and 2030, respectively. Historic energy data for services, agriculture and other sectors are aggregated to be consistent with the projections.

1. Indicator assessment

Final energy consumption in the EU-25 increased by 11.6 % between 1990 and 2003, thus partly counteracting reductions in the environmental impact of energy production, which were achieved as a result of fuel mix changes and technological improvements. Between 2002 and 2003, final energy consumption grew by 2.9 %. This was largely driven by increases in the household and service sector as a result of higher space heating requirements due to lower winter temperatures. At a sectoral level, final energy consumption increased in every sector except industry between 1990 and 2003. The structure of final energy consumption has also undergone significant changes in recent years.

- Transport was the fastest-growing sector in the EU-25 between 1990 and 2003, with final energy consumption increasing by 26.3 %. Improvements in fuel efficiency were offset by increases in passenger and freight transport demand. Higher transport demand has resulted from increased ownership of private cars, particularly in the new EU Member States, growing settlement and urban sprawl with longer distances and changes in lifestyle. The development of the internal market resulted in increased freight transport as companies exploit the competitive advantages of different regions. Furthermore, improvements in transport infrastructure may also have contributed to transport growth by reducing the travel times and sometimes costs. Rapid increases in passenger aviation have been apparent, in part due to the growth of low-cost airlines, which have made this mode of transport more accessible to a larger section of the population.
- Household final energy consumption increased by 17.4 % as rising personal incomes have permitted higher standards of living, with increases in comfort levels and the ownership of domestic appliances. Space heating and cooling is the most significant component of household energy demand[1], and can vary substantially from year to year depending on climatic variations. Cold winters have influenced the increase in final energy consumption in particular between 1990-91, 1995-96, 2000-2001 and 2002-2003 (ADEME, 2005). However, it is the demand for electricity from appliances that has increased most rapidly in percentage terms in recent years (see EN18-EU-25).
- Services (including agriculture and other sectors) final energy consumption grew by 11.8 % due to rapid growth of a wide range of service sectors.[2] This had led to a continued increase in the demand for electrical appliances, in particular information and communication technology (such as computers and photocopiers), but also for other energy-intensive technologies such as air-conditioning.
- The industry sector showed a decrease in final energy consumption between 1990 and 2003 (-4.9 %). This was largely the result of a shift towards less energy-intensive manufacturing industries, as well as the continuing transition to a more service-oriented economy. It was stimulated by structural changes in many countries (including post re-unification effects in Germany) and the rapid transition to market-based economies in the new Member States.

These developments meant that by 2003, transport was the largest consumer of final energy, followed by industry, households and services. There are significant differences in the pattern of final energy consumption between the pre-2004 EU-15 Member States and the new EU-10 Member States. The new Member States have seen falling final energy consumption mainly as a result of economic restructuring following the political changes of the early 1990s, which led principally to a decline in heavy industry. However, with the recovery in these countries' economies, final energy consumption has grown slightly since 2000. These structural changes and improvements in energy efficiency meant that between 1990 and 2003 the average annual growth rate of final energy consumption (0.8 %) was well below that of the gross domestic product of the EU-25 (2.0 %). This led to a decrease in final energy consumption intensity at an average annual rate of -1.2 %, but this trend has slowed down in recent years and final energy intensity actually increased by 1.8 % from 2002 to 2003 (see EN-21 on final energy intensity).

Baseline projections of the development of the EU-25 energy system indicate a continuous overall increase in final energy consumption in all sectors to 2030, although the rate of increase is projected to slow after 2010. A further decoupling from GDP growth is expected (see EN17-EU-25 and EN21-EU-25). This is in large part due to technological progress in transport efficiency, improved insulation standards in homes and other buildings and further development of industrial energy efficiency (European Commission, 2004).

If dedicated energy efficiency policies and measures were implemented along the lines of the Action Plan on Energy Efficiency (COM(2000)247 final), the EU-25 final energy consumption would increase by 23 % compared with the year 1990 instead of 38 % under a baseline scenario. Total energy-related CO_2 emissions between 1990 and 2030 would decrease by 4.5 % instead of increasing by 14 % as in the baseline, underlining the importance of energy efficiency improvements in reducing CO_2 emissions (European Commission, 2004, 'Energy Efficiency Case'). Introducing a carbon-permit price in order to reduce CO_2 emissions as assumed in the Low Carbon Energy Pathway scenario (EEA, 2005) will also result in a lower rate of growth in final energy consumption than the baseline scenario. Nevertheless, energy consumption would continue to increase in all sectors except for the household sector from 2020-2030, which shows a decrease in final energy consumption over this 10 year period.

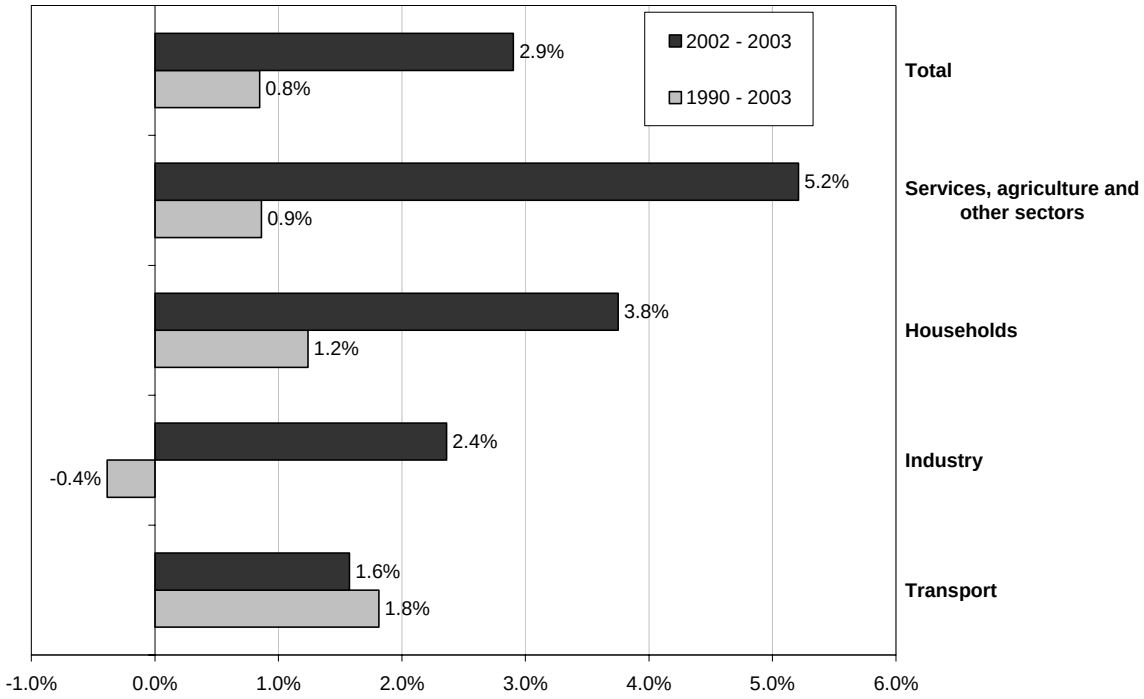
[1] The share of energy used for space heating varies with the outside temperature between years and countries. ADEME (2005) estimates it as being around 70 % in the EU-15.

[2] Services without agriculture and other sectors increased by about 28 % over the period 1990-2003, final energy consumption of agriculture fell by 4.4 %.

These scenario results suggest that there are significant opportunities to reduce final energy consumption in all sectors beyond a baseline development, but particularly in the household and service sectors via a reduction in energy consumption for heating, electrical appliances and lighting. In these sectors, the use of minimum standards for new buildings and appliances, more wide-spread uptake of existing cost-effective measures (such as insulation and combined heat and power) and the provision of energy services and demand side management may be important to ensure that this potential reduction is realised.

The continued potential for saving energy in all sectors is widely recognised. The Directive on end-use efficiency and energy services (2006/32/EC) as well as the new Green Paper (COM(2005)265 final) on energy efficiency note that in the EU-15 energy consumption is approximately 20 % higher than can be justified on economic grounds, with an even higher potential in the new EU Member States. Additional policy measures in all sectors are necessary to overcome barriers to the uptake of more energy efficient technologies and cost-effective energy efficiency investments, in order to speed up the decrease in total energy consumption intensity. Well-known barriers include inefficient for example energy pricing, and lack of information and financing mechanisms.

Fig 2: Average annual growth rates in final energy consumption by sector, EU-25



Data source: Eurostat

Notes: Services, agriculture and other sectors are aggregated in order to be consistent with projection data. It should be noted that final energy consumption of services alone increased by on average 1.9 % per year over the period 1990-2003, while final energy consumption of agriculture fell by annually -0.3 %.

2. Indicator rationale

2.1 Environmental context

The trend in final energy consumption by sector provides a broad indication of progress in reducing energy consumption and associated environmental impacts by the different end-use sectors (transport, industry, services (incl. agriculture) and households). It can be used to support monitoring of the success of key policies that attempt to influence energy consumption and energy efficiency.

Final energy consumption helps to estimate the scale of environmental impacts of energy use, such as air pollution, global warming and oil pollution. The type and extent of energy-related pressures on the environment depends both on the sources of energy (and how they are used) and on the total amount of energy consumed. One way of reducing energy-related pressures on the environment is thus to use less energy. This may result from reducing the demand for energy-related activities (e.g. for warmth, passenger or freight transport), or by using energy in a more efficient way (thereby using less energy per unit of activity), or a combination of the two.

2.2 Policy context

The reduction of final energy consumption is seen in the context of enhancing the security of energy supply and of reducing greenhouse gas emissions. It will help in 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. The Action Plan to Improve Energy Efficiency in the European Community (COM(2000)247 Final) outlines a wide range of policies and measures aimed at removing barriers to energy efficiency. It builds upon the Communication on 'Energy Efficiency in the European Community - Towards a Strategy for the Rational Use of Energy' (COM(98)246 Final), that was supported by the Council (Council Resolution (98/C 394/01) on energy efficiency in the European Community), and proposed an EU indicative target of reducing final energy intensity by 1 % per year above 'that which would have otherwise been attained' during the period 1998-2010.

Following on this, the directive on energy end-use efficiency and energy services aims at boosting the cost-effective and efficient use of energy in the EU (2006/32/EC). It includes an indicative target of saving 1 % more every year of the energy previously used in each Member State through increased energy efficiency. This will lead to a reduction below business-as-usual of 9 % after nine years of implementation of the directive.

The EU's recent Green Paper on energy efficiency (COM(2005)265 final) estimates that the EU could reduce its current level of energy consumption by up to 20 % in a cost-effective manner (with a technical potential of almost 40 %). It aims to identify and address the reasons why these cost effective improvements are not already being taken up, in particular on the demand side, as well as aiming to drive forward a new EU-wide energy efficiency initiative.

Fig. 3: Final energy consumption by country

Units: ktoe	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	Annual % change 1990-2003	Overall % change 1990-2003
EEA Members	1121060	1126815	1177284	1166739	1174926	1171616	1191586	1214387	1204636	1242179	0.8	10.8
EU25	1015931	1026963	1069143	1059949	1069644	1071188	1086646	1112894	1099645	1131588	0.8	11.4
EU15 pre-2004 Members	858007	895887	933678	926363	942294	947531	965881	988722	976631	1003506	1.2	17.0
EU10 New Members	157924	131076	135465	133586	127350	123657	120765	124172	123014	128082	-1.6	-18.9
Austria	18479	20302	22001	21607	22216	21821	22117	23782	24507	26288	2.7	42.3
Belgium	31277	34489	36383	36530	37092	36931	36931	37219	35825	38104	1.5	21.8
Bulgaria	16041	11402	11520	9286	9904	8798	8578	8611	8695	9356	-4.1	-41.7
Croatia	n/a	4473	4659	5130	5195	5354	5340	5460	5591	5948	n/a	n/a
Cyprus	1264	1409	1458	1461	1531	1575	1634	1689	1700	1792	2.7	41.8
Czech Republic	37032	25611	25826	25696	24444	23139	24060	24156	23624	25752	-2.8	-30.5
Denmark	13457	14751	15385	15021	14985	14935	14617	14946	14708	14901	0.8	10.7
Estonia	6002	2486	2895	2967	2609	2355	2362	2517	2586	2656	-6.1	-55.7
Finland	21634	22010	22345	23484	24188	24637	24543	24739	25541	25676	1.3	18.7
France	135709	141242	148620	145652	150825	150719	151624	158820	154403	158306	1.2	16.7
Germany	227142	222342	230895	226131	224450	219934	228700	231900	225796	230443	0.1	1.5
Greece	14534	15811	16870	17257	18159	18157	18508	19112	19497	20456	2.7	40.7
Hungary	19066	15621	16200	15509	15598	15851	15799	16400	17013	17559	-0.6	-7.9
Iceland	1602	1660	1726	1753	1819	1953	2057	2071	2152	2158	2.3	34.7
Ireland	7265	7910	8229	8655	9308	9835	10520	10932	11227	11318	3.5	55.8
Italy	106963	113563	114339	115335	118451	123073	123005	125625	125163	130200	1.5	21.7
Latvia	6328	3807	3528	3802	3655	3423	3206	3598	3628	3739	-4.0	-40.9
Liechtenstein	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Lithuania	9683	4524	4397	4402	4343	3956	3639	3778	3903	4003	-6.6	-58.7
Luxembourg	3329	3151	3238	3229	3187	3346	3549	3692	3734	3947	1.3	18.6
Malta	332	435	505	548	529	551	501	387	452	461	2.6	38.9
Netherlands	42801	47623	51620	49413	49615	48790	50066	50700	50547	51937	1.5	21.3
Norway	16087	16854	17669	17466	18187	18659	18087	18561	18261	18117	0.9	12.6
Poland	59586	63360	66192	65224	60378	58716	55588	56206	54396	56606	-0.4	-5.0
Portugal	11208	13042	13863	14550	15421	15982	16937	18069	18342	18301	3.8	63.3
Romania	32947	25356	28516	28025	25577	21855	22076	22851	22910	24475	-2.3	-25.7
Slovakia	15263	9883	10105	9507	9991	9739	9499	10883	11092	10776	-2.6	-29.4
Slovenia	3368	3940	4359	4470	4272	4352	4477	4558	4620	4738	2.7	40.7
Spain	56647	63536	65259	67986	71750	74378	79411	83221	85379	89730	3.6	58.4
Sweden	30498	33679	34603	33977	34204	34076	34532	33132	33668	33841	0.8	11.0
Switzerland	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Turkey	38452	44580	48710	50260	49795	49163	54142	49399	52973	56485	3.0	46.9
United Kingdom	137064	142436	150028	147536	148443	150917	150821	152833	148294	150058	0.7	9.5

Data Source: Eurostat

Note: No data was available from Eurostat for Liechtenstein or Switzerland.

References

ADEME (2005): Energy-efficiency monitoring in the EU-15

COM (2000) 247 final - Action Plan to Improve Energy Efficiency in the European Community

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

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

Council resolution on energy efficiency 98/C 394/01

DG TREN Energy sources and demand management legislation website http://europa.eu.int/comm/energy/index_en.html

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

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

Mantzos, L, et al. (2004), European Energy and Transport - Scenarios on Key Drivers, European Commission – Directorate General for Energy and Transport, ISBN 92-894-6684-7, Office for Official Publications of the European Communities, Luxembourg.

Meta data

Technical information

1. Data source:
   Final Energy Consumption: Eurostat (historical data) http://europa.eu.int/comm/eurostat/ At the end of May 2006 Eurostat published a revised time series for Latvia. 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.
   Projection data: European Environment Agency (2005) – baseline projections are consistent with European Commission (2004).
   Final energy consumption is one of the European Environment Agency's core-set indicators. More information can be found at http://themes.eea.eu.int/IMS/CSI.

2. Description of data/Indicator definition:
   Final energy consumption covers energy supplied to the final consumer for all energy uses. It is calculated as the sum of final energy consumption of all sectors. These are disaggregated to cover industry, transport, households, services and agriculture.
   The indicator can be presented in relative or absolute terms. The relative contribution of a specific sector is measured by the ratio between the final energy consumption of that sector and total final energy consumption calculated for a calendar year. It is a useful indicator which highlights a country's sectoral needs in terms of final energy demand.
   Units: Final energy consumption is measured in thousand tonnes of oil equivalent (ktoe).
   The PRIMES model was used by the EEA to analyse possible future developments of the European energy sector, including a baseline scenario without a permit price and the low carbon energy pathway (LCEP) scenario. The latter describes the least-cost response of the EU-25 energy system to the introduction of a carbon permit price that rises to EUR 65/t CO_2-equivalent by 2030.

3. Geographical coverage:
   The Agency had 31 member countries at the time of writing of this fact sheet. These are the 25 European Union Member States and Bulgaria, Romania and Turkey, plus Iceland, Norway and Liechtenstein. On 1 April 2006, Switzerland joined the EEA, bringing its number of member countries to 32.
   No energy data available for Switzerland and Liechtenstein. No projection data are available for Iceland, Liechtenstein.

4. Temporal coverage: 1990-2003, projections to 2030 in 10 year intervals.

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: [(last year/base year) ^ (1/number of years) –1]*100
   The coding (used in the Eurostat New Cronos database) and specific components of the indicator are:
   • Numerator: final energy consumption industry 101800 + final energy consumption transport 101900 + final energy consumption households 102010 + final energy consumption services/agriculture calculated as (final energy consumption households/services 102000 - final energy consumption households 102010).
   • Only if needed for shares; Denominator: (total) final energy consumption 101700

Qualitative information

7. Strengths 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 final energy 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 final energy consumption and not on the sectoral redistribution of such consumption, the trends in the absolute values (in thousand tonnes of oil equivalent) 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 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 energy consumption of a sector should be analysed in that broader context.
   The sectoral breakdown of final energy consumption includes industry, transport, households, services, agriculture, fisheries and other sectors. The projection data aggregates agriculture, fisheries and other sectors together with the services sector, and projections are based on such aggregation. To be consistent with these projections, the core set 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 is worth noting that according to Eurostat final energy consumption in agriculture is not very reliable and it mainly means consumption from engines used for agricultural transportation. From next year a new definition will be used in the energy questionnaires to be more in line with the IPCC guidelines.

   Indicator uncertainty (scenarios/projections):
   Scenario analysis always includes many uncertainties and the results should thus be interpreted with care.
   - uncertainties related to future socioeconomic developments (e.g. GDP) and human choices;
   - uncertainties in the underlying statistical and empirical data (e.g. on future technology costs and performance);
   - uncertainties in the choice of indicators (representativeness);
   - uncertainties in the dynamic behaviour of systems and its translation into models;
   - uncertainties in future fuel costs and the impact on low carbon technologies.

   The baseline and LCEP scenarios use relatively optimistic assumptions on economic growth, compared with other scenarios. The same level of carbon prices as in the LCEP scenario would lead to higher CO_2 emission reduction when simulated with other models (e.g. TIMER), which may partly result from the fact, that carbon capture and storage was not included in the PRIMES LCEP scenario.

9. Overall scoring – historic data (1 = no major problems, 3 = major reservations):
   Relevance: 1
   Accuracy: 1
   Comparability over time: 1
   Comparability over space: 1