2.2. Economic developments

1. Economy and industry

Completion of the Single Market and the introduction of the European Monetary Unit (the euro) are major political events within the EU in the 1990s, which have an important economic bearing. In the process of ongoing globalisation, these are seen as vital for European economic competitiveness.

It is important to recognise the qualitative dimension of economic growth, in terms of impacts on the environment and natural resources. This was highlighted by the European Commission sponsored Task Force on the Environment and the Internal Market (Task Force, 1993), which drew attention to the danger that accelerated economic growth due to European Single Market would have negative environmental consequences, in terms of higher energy demand, international transport, waste generation, and spatial problems for the peripheral EU Member States. On the other hand, the need for harmonisation within the single market has generally resulted in adoption of legislation at EU level embodying environmental standards. The same is expected to happen in the Accession Countries.

In the Fifth Environmental Action Programme (European Commission, 1992) and its review (European Commission, 1996), households and five production sectors were identified that are major driving forces of environmental pollution and the depletion of natural resources. They include industry, agriculture, energy, transport and tourism. Industry is part of this first section. Households and tourism are dealt with in the next section, and agriculture, energy and transport are the subject of sections 3 through 5.

1.1. Historical developments

The economic development in Europe in the 1990s is typically characterised by two main trends: continuing growth in western European countries and recovery from deep recession associated with economic restructuring in the Accession Countries. Over the last three decades, Member States have experienced steady growth in GDP, albeit subject to cyclical recessions.

Developments in industry are characterised by the growth of the service sector and some decline in manufacturing, mainly in heavy industry. In Germany, for example, the share of manufacturing on total value added has decreased from one-third to one-fourth since 1970. The manufacturing industry has also been the source of many of the environmental impacts, such as air and water pollution, waste and noise, targeted by EU environmental legislation. Industrial pollution problems have mainly been dealt with by end-of-pipe measures, many times creating problems of transfer of pollution between media.

Since the 1970s, several policy measures have been proposed to deal with industrial pollution. In the beginning, these polices were primarily directed at point sources (for instance, the Large Combustion Plant Directive). More recently, non-point sources have also been addressed. An integrated, cross-media approach to pollution control is embodied in the Directive on Integrated Pollution Prevention and Control (European Community, 1996), which establishes a framework for improvements in the use of resources, such as energy and raw materials, as part of the solution to pollution and environmental problems created by industry.

1.2. Outlooks

Socio-economic and sectoral long-term outlooks are presented that are the backbone for environmental pressures, state and impact outlooks. Scenarios for the next decade have been used for population size, volumes of production and consumption (by sector), volumes of transport, etc. These scenarios, explained in the introduction to the report, are based on a consistent set of assumptions of which the most essential are shown in Box 2.2.1.

The scenarios show the potential for economic growth (44% growth of GDP in the period 1995 – 2010) in the EU under the favourable conditions as assumed (Figure 2.2.1). This would in particular lead to an increase in European transport and tourism in the services sector and in certain industrial sectors. The outlooks for the manufacturing sectors show constant growth expectations for four of the major sectors within manufacturing. Growth in the metals indus-

Box 2.2.1 Main assumption of the socio-economic scenarios

Rapid technological change in the world (industrial and agricultural production, transport and communication, environmental technology).

An increasingly open world economy (e.g. ultimately a complete removal of trade barriers is assumed and decreasing international transport and communication costs).

Favourable domestic political and economic development in particular in important countries such as China, boosting the world economy and trade.

Europe enjoys a healthy world economy. Growth is further increased by monetary unification around 2000 – 2005.

A relatively stable population size in Europe, with no shortage of labour force.

A gradual economic convergence between European Union Member States is assumed (implying that the less prosperous countries experience faster economic growth), and observed sector trends by country were further projected to the future: some specialisation of countries occurs, and the services sector (which includes transport and tourism) increases its dominance.

Sources: European Commission, 1999

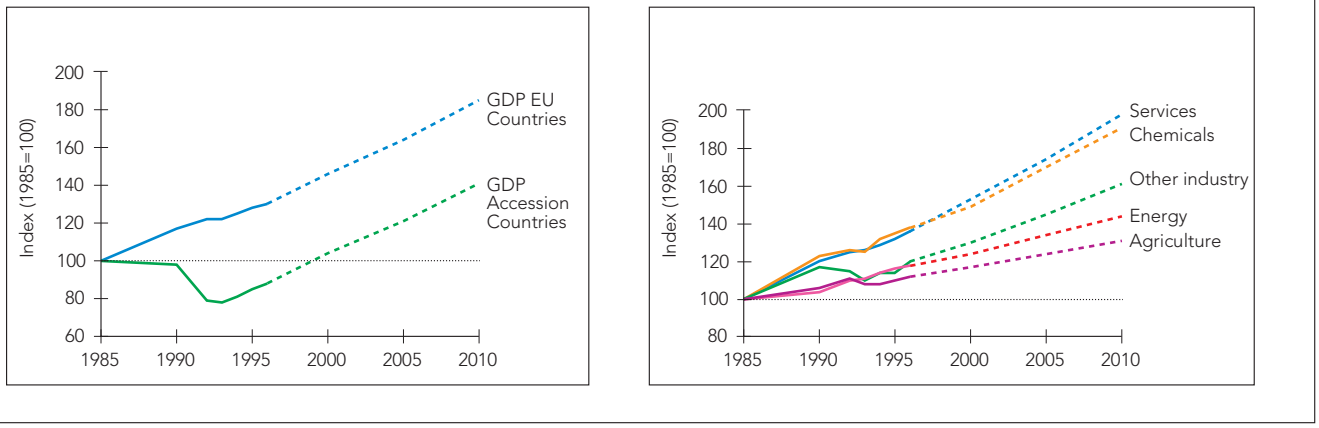
try is modest; growth in the chemicals, paper and building materials sectors amount to about 40 % in the period up to 2010. Many of these developments are based on sector-specific assumptions, and country differences may be large. However, the expected growth is general. It should be remembered that these scenarios are particularly sensitive to assumptions about long-term structural developments, and are subject to inherent uncertainty, particularly with respect to short-term fluctuations.

1.3. Accession Countries

The transition of the central and eastern European Accession Countries (AC10) from centrally planned to market economies initiated at the end of last decade and their prospective accession to the EU have far-reaching implications for the structure of their economies, and also for the existing EU. Changes are already noticeable, in particular a larger volume and a changing pattern of trade between the EU and the AC10. The AC10 used to export resource and capital-intensive goods. They have now shifted to exporting goods produced with less capital and resources and more labour. In some Accession Countries, the share of human capital or skill-intensive exports is also growing. Easier access to the western European market has tempted AC10 to copy production profiles which have been successful in the EU and to compete on the basis of lower labour costs (e.g. textiles). The example of Spain and Portugal, entering the EU in 1986, proves that developing an own profile and producing high-quality industrial manufactures such as electro-technical products, motorcars and machinery could be a successful avenue (EEA, 1999a).

The AC10 which began to develop their market economies in the early 1990s plunged into a deep recession around 1990. Most countries are now recovering. In Poland, growth rates began become positive by 1992, and GDP in real terms was slightly higher in 1996 than it was in 1989. A common characteristic is that at the point that the growth rates of these economies began to recover, the recovery was sustained. Expectations for the future are also hopeful (see Figure 2.2.1). The outlook shows a growth of 65% in the period 1995 to 2010. This is considerably stronger than in EU15 (44%). Through the period of transition and accession to the EU market, AC10 are

Figure 2.2.1 **Gross domestic product (GDP) in EU and Accession Countries, and gross value added in main economic sectors in EU, 1985-2010**



Sources: New Cronos, Eurostat; EEA, 1998; European Commission, 1999

expected to reinforce their economies and to be able to close the gap with the EU15, albeit only in the long run.

As accession to the EU is expected to bring an acceleration in economic growth, this will not go without environmental consequences. For example, after accession to the EU, Spain saw its growth of GDP rise to 27% in the period 1985 to 1993. In the same period energy consumption rose at the same rate, while increases in car ownership (+49%), road traffic (+38%) and emissions of NO_x (50%) exceeded GDP growth. Although currently stricter policies on emissions are in force in AC10 to control point source pollution, further attention will be needed in sectors such as transport.

Box 2.2.2 Energy consumption by households in the UK

A study for the UK has investigated the balance of negative and positive factors on the use of energy in households. It appeared that the energy use per household decreased by 7% in the period 1974 to 1994. Positive factors were an improvement in the energy-efficiency of the average house (building heat loss -23%) and heating system (wasted heat -17%), a negative factor was the increase of electricity consumption by 29%. The number of households grew 23% in that period, so that on balance, the overall energy consumption by households has increased by 15%.

A second study predicts that the energy consumption by households will continue to grow by 0.5% between 1990 and 2010, as a result of the further increasing number of households

Source: Boardman et al., 1997; Cambridge Econometrics, 1999

2. Population, households, consumption and tourism

During the last decade final consumption of households in the EU accounted for almost 60% of GDP. Consumer demand is determined by individual purchasing power and preferences, the numbers of consumers as well as on the way they have organised themselves. For example, a large household, according to surveys, uses resources more efficiently than single persons do.

2.1. Historical developments

In the period 1985 to 1996, the number of households in the EU grew faster than the population, as household size decreased (Eurostat, 1997); this, together with increasing per capita consumption (Figure 2.2.2), tends to increase pressures on natural resources. Improvements in efficiency of the use of natural resources are not sufficient to curb that development, as is illustrated with an example of energy use in households in the UK (Box 2.2.2).

The composition of final consumption of households has changed over the last 15 years. Whereas the proportion of expenditure on clothing and food of total consumption has significantly decreased, the share of expenditures on rent, fuel and power has increased, as has expenditure on services and transport, among which leisure activities, tourism, and communication are featured (New Cronos, Eurostat).

As the result of increased purchasing power by consumers, and also through reduction of prices and increased efficiency of transport and services in the tourism sector (WTO, 1994), the areas of leisure activities and tourism are rapidly growing. International tourism in Europe, in terms of numbers of international arrivals, rose by 60% between 1985 and 1996.

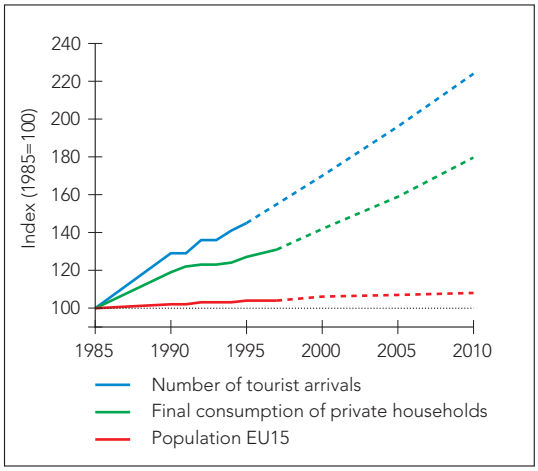
Tourist developments are characterised by several trends (see also Chapters 3.13-15). In particular, active holidays (skiing, hiking, cycling, climbing, etc.) gain popularity (WTO, 1994; Eurostat, 1995; European Commission, 1998a) and tourists tend to scatter over larger and often more sensitive areas, where their activities are more difficult to manage and control. Also certain particularly attractive areas, such as historic cities, are becoming more and more crowded with tourists, having impacts on the people who live there. Some coastal areas are overcrowded in summer and deserted in winter. Certain tourist activities are intrinsically harmful to the environment, such as golf in arid areas, requiring large amounts of water (WTO, 1994).

2.2. Outlooks

Figure 2.2.2 shows a considerable increase in final consumption, although projected population growth is only 4% between 1995 and 2010. The number of households is expected to increase (as average household size declines), both in the EU and even more so in the AC10. Per capita consumption is on a rising trend and some environmentally harmful activities, such as tourist trips, benefit more than proportionally. The World Tourism Organisation expects continued growth in the sector (an increase of international arrivals by about 50% between 1996 and 2010) (EEA, 1998).

The environmental impacts of steadily growing consumption depends upon the material intensity of consumption, in terms of use of materials and energy, and the 'eco-efficiency' of production (see Chapter 2.1).

Figure 2.2.2 **Population growth, increase in final consumption by households and tourist arrivals in EU**



Sources: New Cronos, Eurostat; Capros, 1997; EEA, 1998

Eco-efficiency depends upon the attitudes and behaviour of producers, retailers and consumers. Producers are increasingly entering into voluntary agreements aimed at the design of more efficient household appliances. In the energy sector for example, this is supported by progressive adoption of energy labels and minimum efficiency standards at EU level (SAVE) for a variety of appliances such as fridge-freezers and washing machines. Building regulations also increasingly require a better energy performance of residential housing by prescribing better insulation and double glazing. Consumers should be encouraged to be more open to energy and environmental aspects of durable consumer goods in their purchasing behaviour.

2.3. Accession Countries

Population in the AC10 declined very slightly between 1990 and 1995 (-0.6%), while the number of households (Slovenia excluded) fell by 2.6%. Hence the number of persons per household is growing, contrary to the experience in the EU. Bigger households may be the consequence of the worsened economic conditions in that period, and it is not unlikely that the trend will be reversed as incomes increase.

After the growing openness of the central and eastern European countries in the second half of the 1980s, tourism is developing quickly. The number of international arrivals showed a sharp increase of 180% in the period 1985 to 1996. This growth is stronger than in the whole of Europe in the same period. The outlook shows a continuous growth of tourism of about 60% between 1996 and 2010 which is also stronger than the predicted growth of about 50% for Europe as a whole (EEA, 1998).

3. Agriculture

The contribution of agriculture to overall economic output in the EU is modest: 2.3% of GDP and 5.3% of employment. Value added in the agricultural sector grew by 10% in the period 1985 to 1995, a much slower rate of growth than in most other sectors (New Cronos, Eurostat). The rural economy has become increasingly diversified (see Chapter 3.13). Nevertheless, agriculture is both a primary supplier of food and raw materials and a driving force exerting a major influence on the management of land and environmental quality. This is due to the high proportion of rural land devoted to farming in most of Europe, the large throughput of nutrients and chemicals, and the close link between agricultural systems, biodiversity and the visual-cultural landscape.

In many areas in the EU, agriculture is now using intensive and large-scale production methods. This has and continues to involve significant use of artificial fertiliser (mainly nitrogen and phosphate) and the application of plant protection products such as herbicides, insecticides and fungicides. Not all of these substances are taken up by the crops and certain amounts of fertilisers contribute to eutrophication of soil and water systems, whereas pesticides pollute soil, ground and surface water and air. Livestock creates eutrophication as well and contributing to acidification and producing greenhouse gases. Agriculture also contributes in some areas to soil degradation, erosion and salinisation (IEEP, 1998; Baldock *et al.*, 1996) (See Chapter 3.6).

Farmers also have a major role to play in the protection of biodiversity and landscapes. Many of the sites important for biodiversity are on, or adjacent to, agricultural land. There are sizeable areas of low intensity farmland of high nature value, including areas which merit protection under the EU Birds and Habitats' Directives (see Chapter 3.11).

While technical change has driven down costs for most agricultural products, many consumers are now expressing a preference for food produced using more traditional systems and giving greater priority to farm animal welfare. The increased popularity of

organic farming products in many countries is a clear sign of new attitudes.

The agricultural sector is subject to structural changes under the Common Agricultural Policy and its subsequent reforms. These adaptations could have positive as well as negative effects for its performance with regard to environmental quality and nature conservation (European Commission, 1997a).

3.1. Historical development

For many decades, EU agriculture has become progressively more specialised and concentrated in areas with the lowest production costs. This process, driven largely by technological change and cheaper and faster transport, has been accomplished by growing intensification on the best land and in key production areas near to important markets. Higher labour costs and declining prices have also contributed to the reduced viability of farming in more marginal zones. In many marginal areas, including mountains and arid zones, production has been wound down and traditional management displaced. Afforestation, marginalisation or complete abandonment occur in some places (see Chapters 3.13 and 3.15).

Pastoral farming with cattle, sheep and occasionally other animals including goats and horses, is the main means of managing grassland in Europe and therefore of great significance to cultural landscapes and biodiversity. The maintenance of more extensive livestock farming systems is essential if stretches of grassland and other semi-natural vegetation is to continue to be grazed or kept under forms of management appropriate for species which have adapted to this environment.

However, livestock also contributes to environmental pressures. In the EU, cattle population has decreased from 98 million heads in 1984 to 85 million heads in 1996, while the pig population increased in the 1980s and has fluctuated around 118 million in the 1990s. The number of sheep grew slightly by 15% between 1985 and 1995. It has been estimated by Eurostat that about 41% of the total emissions of methane and nitrous oxide in the EU arise from the agricultural sector, mainly attributable to ruminants such as cattle, and livestock manure.

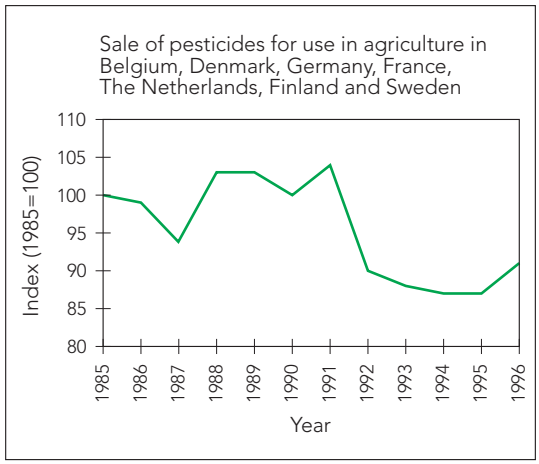
The use of inorganic fertilisers was fairly stable in the EU between 1985 and 1990, and has since declined, while there has been a gradual increase in nitrogen fertiliser usage after 1992 (See Figure 2.2.4). Total nitrogen use decreased by about 12% between 1985 and 1995. This arose from a reduction in the use of artificial fertilisers, also made possible by improvement of uptake by the crop, and an increase in the volume of manure, connected with growing numbers of livestock. The surplus of nitrogen input over uptake varies widely among EU countries. This surplus is high in certain areas of Belgium, Denmark, France, The Netherlands and the UK. It has been estimated that the supply of manure (in EU12) exceeds 170 kg N per ha – a threshold set by the Nitrate Directive for zones which are identified to be vulnerable to leaching of nitrate – in around 13% (or almost 1 million) of the farms for EU12, ranging from 63% in The Netherlands to less than 10% in France, Ireland and Italy (Brouwer *et al.*, 1997).

The use of plant protection products rose between 1985 and 1991, was lower thereafter, but tended to increase again after 1994 (use is measured in terms of the weight of active substances applied; Figure 2.2.3). However, crude measures of this kind provide little guidance about overall environmental impact, since the efficacy of many new products is increasing per kilogram of substance. The use of plant protection products partly depends on weather conditions, and the relatively dry conditions in the early 1990s were an important reason for the temporary drop in consumption.

Common Agricultural Policy and reforms

Approximately half of the EU budget goes towards financing the Common Agricultural Policy. In 1997, this amounted to over 40

Use of pesticides in selected EU Member States, 1985-1996 — Figure 2.2.3



Source: New Cronos, Eurostat

billion euros. For comparison, Portugal's GDP amounted to 63 billion euros in that year. The process of reforming the CAP began in 1984 with the introduction of milk quotas and continued in 1992, in conjunction with the agricultural negotiations in the Uruguay Round/WTO. At the heart of the 1992 CAP reform was a policy of reducing price support and compensating farmers with more direct income support, such as payments per hectare of arable land. These payments make up more than half of the total CAP expenditures now. One aim was to remove the incentive for ever-increasing production levels. For the first time, all Member States were obliged to introduce agri-environmental measures providing financial support for farmers who agreed to adopt environmentally sensitive practices such as reduced inputs of fertilisers, the maintenance of extensive grassland and conversion to organic production. There was new recognition of the fact that farmers have a major role to play in the protection of biodiversity and landscapes.

Since 1992, there have been some further changes to the CAP, including reform of the fruit and vegetable regime and a new premium for more extensive beef farmers. In some, but not all cases, an environmental element has been included in these new measures in response to the overall goal of better integration between agriculture and the environment.

At the same time, a number of the existing EU environmental policy measures, such as the 1991 Nitrate Directive and the 1992 Habitats Directive, are beginning to exert a greater influence on farmland.

Links between agriculture as an important driving force and environmental pressures are diverse and complex. There is relatively little data available at a European level to provide an objective view of changing pressures on the rural environment. Although work is progressing on agri-environment indicators within the EU and the OECD (OECD, 1996) as well as at national level, they have yet to be applied in a systematic way (see Chapter 4.2). Moreover, the future for the agricultural sector is hard to predict from past trends, because of the many, partly policy-driven, structural changes. Farmers may be more exposed to economic conditions, such as market determined prices, and have more options open, including set-aside, adapted farm management and even abandonment.

3.2. Outlooks

It is possible that, as a result of the Agenda 2000 measures (see Box 2.2.3), farmers producing cereal crops will reduce their use of certain inputs, such as plant protection products and artificial fertiliser, in response to the anticipated drop in market prices. In any case, there is growing evidence that integrated crop production involving lower input use is becoming more competitive. It is generally expected that there will be further changes in the beef farming sector which has been affected by overproduction, low prices and the 'mad cow' (bovine spongiform encephalopathy (BSE)) episode which has, at least temporarily, undermined consumer confidence in many countries. Although Agenda 2000 includes proposals to assist more extensive beef farming, much of which plays an important role in the management of semi-natural grassland, there are doubts about whether this activity will remain competitive in the future. There must be a concern that polarisation between intensification and marginalisation will continue (see Chapter 3.11).

There has been a rapid growth in the number and scope of agri-environmental schemes in the EU since the current Regulation 2078/92 came into effect. By 1997, it was estimated by the European Commission that about 20% of farm holdings in the EU were participating in a voluntary agri-environment scheme and a similar proportion of the total agricultural land had been enrolled. It is expected that such schemes will continue in the future as a compulsory element in a broader rural development policy envisaged in Agenda 2000.

The baseline scenario, based on policies in force in 1997 and discounting Agenda 2000,

Box 2.2.3 Agenda 2000

Currently, a further reform of the Common Agriculture Policy (CAP) is envisaged as part of the Agenda 2000 package adopted by the European Council in March 1999. Agenda 2000 sets out to build further on the approach in the 1992 reforms and is due to come into effect after 2000. Objectives include increased competitiveness of European agriculture on the global market, high food safety and quality, fuller integration of environmental objectives into agricultural policy and the creation of alternative jobs in rural areas. Once again, there will be a reduction in price levels, with farmers receiving direct payments in compensation. Agri-environment and rural development measures are given more prominence as a second pillar of the CAP and there is greater scope for Member States to adapt selected elements of the CAP more to their own requirements. The effect of the proposals, if agreed, will not be confined to the EU but will potentially apply to applicant countries, including several in central and eastern Europe with great agricultural potential.

suggests that the dairy cattle population might fall by about 16% between 1995 and 2010, while the pig population might increase by 9% and the population of laying hens rise by 6% (EEA, 1998).

Overall EU consumption of nitrogen as well as of phosphorus in fertilisers is expected to decrease further, at a very slow rate (European Fertiliser Manufacturers Association (EFMA)) (Figure 2.2.4). This projection is based on several assumptions summarised in Box 2.2.4.

As to the consumption of plant protection products, the European Crop Protection Association (ECPA) expects an overall decrease in the volume of active substances from 270 million kg in 1996 to 190 million kg in 2008, for the EU. However, the impact on the environment is uncertain. Developments in pesticide use are mainly driven by technological progress, including the advance of biotechnology, but the industry also expects policy changes, such as Agenda 2000, to have an impact. If organic agriculture were to take a larger share of the market, this would also contribute to a reduction in pesticide use.

3.3. Accession Countries

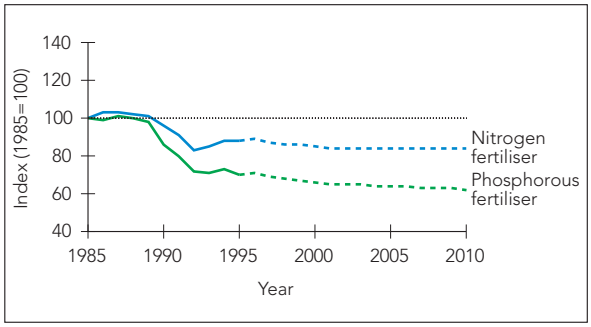
In most of the Accession Countries, privatisation of the state owned and collective farms generally has resulted in a dual farm structure. Typically, there is a large number of small family farms, subject to rapid amalgamation in some areas, which exist alongside a group of larger units comprising co-operatives, limited companies and state farms. During the economic transition period, agricultural output fell drastically. The decline in output was most pronounced in livestock production as consumers switched to cheaper staple products and export markets were lost. In most countries, cattle and sheep numbers fell to about half their former level and there was a decline of 30-35% in pig and poultry populations. Crop production fell by up to a third compared to 1989 but there has been an increase in average yields and production in most countries recently. Hence there has been a reduction in pollution from agriculture in recent years because of the lower intensity and fall in livestock numbers. The use of fertilisers and pesticides remains much below levels in the EU. Aggregate use of nitrogen fertiliser in the EU and AC10 in recent years is shown in Figure 2.2.5. But the potential for increasing the use of fertilisers and pesticides, and the spread of manure represents an important threat to water quality.

Box 2.2.4 Assumptions in fertiliser projections

The outlook assumptions:

- Farmers increasingly improve the efficiency with which they use nutrients in livestock manure. The implementation of the Nitrate Directive is expected to affect nitrogen application rates;
- A progressive change from present Common Agricultural Policy (CAP) policies to a more liberalised regime in 2006/7;
- Greater efficiency in manure storage and application;
- Set-aside reducing from 10% of the base area in 1997/8 to 8-10% in 2001/2 and being eliminated altogether by 2006/7. Potentially significant changes in cereal and sugar beet production.

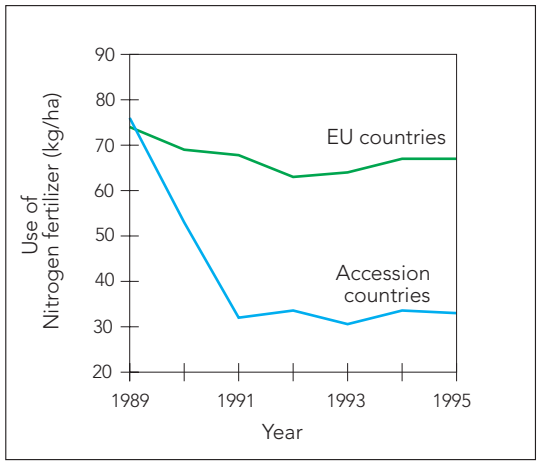
Use of fertilisers in EU, 1985-2010 Figure 2.2.4



Source: EEA, 1998

In general, prices of agricultural products are still below those in the EU but there has been a decline in AC exports to the EU, which are subject to quota and hygiene restrictions. The Common Agricultural Policy and the Agenda 2000 proposals for reform will potentially be a major force in determining the pattern of agricultural development in Accession Countries. Given the surplus in the agricultural market within the EU and the tendency to cut subsidies, it is expected that the EU's agricultural policy for Accession Countries

Use of nitrogen fertiliser (kg/ha) in Accession Countries and the EU, 1989-1995 Figure 2.2.5



Sources: EEA, 1998; EEA, 1999a

will focus on structural adjustments and rural development, rather than stimulating output.

4. Energy

Environmental impacts arise at each operating phase of the energy system (production, transmission, transformation, distribution and consumption). Among other issues, the combustion of fossil fuels generates emissions to the air (mainly greenhouse gases and acid compounds), creates waste, and the nuclear energy industry creates risks and a hazardous waste problem. There is therefore wide-spread consensus that any strategy aimed at lessening the environmental impact caused by energy use should basically rely on improved energy efficiency and the development of environmentally-friendly energy sources (e.g. renewable sources) (European Commission, 1995a).

The EU environmental policy seeks to reduce the environmental impact of particular energy sources, especially fossil fuels (European Commission, 1995a). Of particular importance are the Commission's strategy documents on acidification and tropospheric ozone, and specific measures such as the Large Combustion Plant Directive, the Directive on Integrated Pollution Prevention and Control, and measures to limit the sulphur content of heavy fuel oils. Measures specific to the transport sector are addressed in greater detail below.

4.1. Historical developments

Between 1985 and 1995, total primary energy supply in the EU increased by 11%, while GDP rose by 24% (Figure 2.2.6), indicating a modest (10%) reduction of energy intensity (defined as primary energy supply per unit of GDP). This is small when compared with the decrease of 16% achieved from 1976 to 1986 and with the EU policy objectives established in 1985 for a 20% reduction by 1995 (European Commission, 1998b). Nevertheless, the general downward trend has remained, despite the strong drop in world energy prices. This trend resulted mainly from the continuous effects of structural changes which have occurred in the EU economy (increased share of less energy-intensive economic sectors in the GDP) and from general technological improvements in the production of goods and services (e.g. in most cases, technological changes in industrial processes lead to reduced energy requirements).

The growth of final energy consumption varies between sectors (Figure 2.2.7). In transport, energy demand grew by almost 40% from 1985 to 1996 and has essentially relied on oil. Despite the new regulations on fuel quality and the ongoing development of new technology (e.g. electric cars), the impact of air emissions due to transport remains a major concern. This growth in energy consumption by transport was considerably stronger than the growth in industry (3%) and other sectors (14%) in the same period. The share of transport in final energy demand amounted to 29.6% in 1996, and ranked third shortly after industry (30.6%) and after other sectors (39.8%).

The share of different energy sources in final consumption has been subject to considerable changes. Between 1985 and 1996, natural gas and nuclear energy increased substantially at the expense of oil and coal (in spite of the integration of the former German Democratic Republic, a substantial user of solid fuels). The share of renewable energy sources was 5-6% in 1995, about the same as in 1985.

Energy consumption is influenced by economic growth, structural economic changes and social behaviour, but is also influenced by the energy policy which can improve the efficiency of energy use and give guidelines to both operators and users when they choose their sources of energy. Although the EU has a limited role to play in terms of energy policy under the Treaty of Rome, the European Union has had to adopt a common target, in particular due to the need to define the options for the Community's Climate Change Strategy (for a detailed presentation of the EU's general policy on energy and environment, see reference to document European Commission, 1997b). Guidelines and measures have been proposed (and several adopted) to enforce the improvement of energy efficiency and the development of renewable energies. In general they fall within a general trend of liberalisation of the internal energy market, which may have a diversified impact on the structure of energy supply and consumption, particularly in the context of a continuously low level of world energy prices.

A range of energy policy initiatives and framework documents has been launched recently. These are increasingly linked to the Community's Climate Change Strategy since the Kyoto Conference of December 1997 (European Commission, 1998c) (see Chap-

ter 3.1). They include an overall framework for energy policy and more specific strategies on renewable energy, combined heat and power (CHP) and energy efficiency, which are outlined in Box 2.2.5 (Decision 96/737/EC; European Commission 1997c).

4.2. Outlooks

The trend of decreasing energy intensity is expected to continue in the years to come. From 1995 to 2010, GDP in the EU15 is expected to grow by 44% and total primary energy supply would increase by 15%, implying a slightly better than 1% drop of energy intensity per year. The policy goal of 20% improvement (SAVE II) will then almost be met.

The share of transport in total final energy consumption is expected to increase to 32% in 2010. Since energy use by the industrial sector will only take up a slow growth path, as the balance of continued energy savings and substantially increased production volumes, the share of industry in final energy demand will remain relatively stable (29% in 2010). By then, transport will have outranked industry and become the second largest energy consumer, after other sectors (household and services). Together with services mainly, energy consumption by household will continue to grow modestly and is expected to remain the largest proportion of final energy demand, with 39% by 2010.

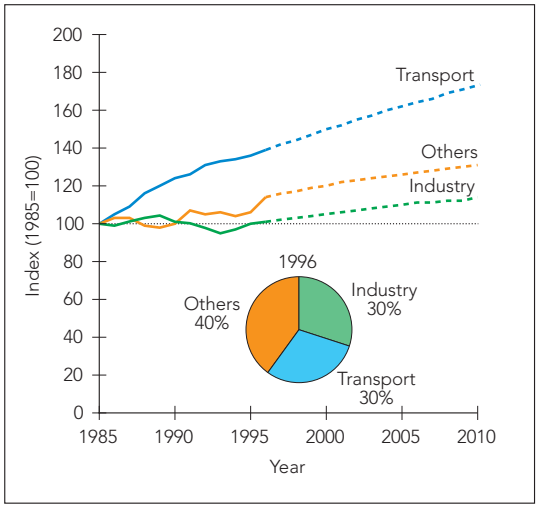
Despite the expected increase in average thermal efficiency of power generation (from 38% in 1995 to 44% in 2010), the consumption of the electricity sector will grow slightly. This is due to an increase of approximately 18% of electricity consumption, based essentially on additional thermal generation. These figures assume that the share of thermal co-generation (approximately 9% in 1995) will remain unchanged.

Up to 2010, the use of natural gas is expected to increase slowly, at the expense of solid fuels and oil. The baseline scenario comes up with a share of renewable energy sources of about 8% in 2010 which is considerably lower than the policy target. Nuclear energy is expected to maintain its share. However, policy decisions in some countries may reduce the share of nuclear energy in the long run.

4.3. Accession Countries

Total final energy consumption in most of the AC10 dropped in the 1985-1995 period, due mainly to the economic recession associated with drastic political changes.

Total Final Energy Consumption by Sectors, EU — Figure 2.2.6

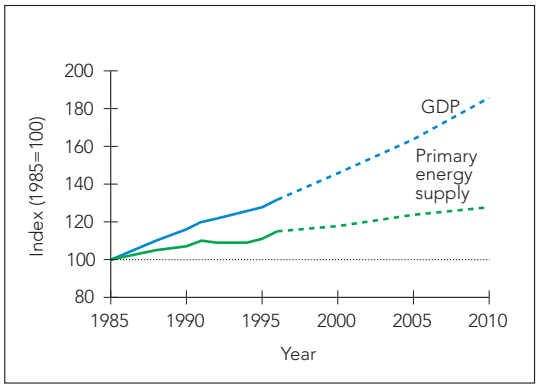


Sources: IEA; Capros, 1997

Box 2.2.5 Main policy developments in energy

- Under the umbrella of SAVE II programme, following SAVE I, the EU is implementing measures with a view to increasing energy efficiency in different sectors. The Energy Efficiency Strategy set a present target to cut back on energy intensity by 20% from 1995 to 2010.
- The Combined Heat and Power (CHP) Strategy (October 1997) set the goal of doubling the current share (9%) of electricity produced by CHP generation by 2010 which should lead to a reduction of 4% of total CO_2 emissions.
- The White Paper on renewables establishes a target of doubling energy production from renewable energy sources compared with the current level, which is supported by ALTENER II (Decision 98/352/EC).
- A new proposal for a Directive to set minimum excise duties for energy products was published in March 1997 (the proposal for an EU Carbon/Energy Tax not having been adopted).

Primary energy supply and GDP in EU15, 1985-2010 — Figure 2.2.7



Source: IEA; Capros, 1997; New Cronos, Eurostat

Energy intensity in the AC10 is much higher than in the EU (from factor 1.5 in Slovenia, to factor 3 in Bulgaria). This is partly due to the economic structure of AC10, with a share of the industrial sector in GDP of 49% on average, but mainly due to the low efficiency of energy use – by the energy sector and by consumers.

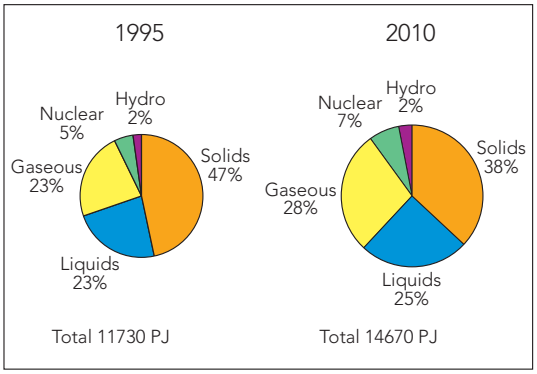
In 1990, the energy consumption structure by sector was dominated by the industry. The share of transport in final consumption amounted to less than 16%, on average. As a result of restructuring and modernisation of industrial production facilities, energy intensity in the industry could decrease dramatically up to 2010 (approximately 35%), if appropriate policies and financial instruments are in put in place (EEA, 1999b). In the same period, energy consumption in the household and services sectors (35% of the consumption in 1990) is expected to rise by at least 20% due to increased income. In the transport sector consumption is expected to grow, mainly due to increasing use of private cars (up to 56%).

Overall, total primary energy supply by energy source (Figure 2.2.8) is dominated by solid fuels (47%), followed by liquid fuels (23%) and gas (23%), in 1995. Nuclear energy (5%) and hydro-power (2%) play a modest role. Up to 2010, the increased energy consumption by the transport and household sectors will induce a switch from coal to oil and natural gas. Nuclear energy will grow slightly. But the future of nuclear power is difficult to predict, particularly due to concerns over nuclear safety.

The evolution of the energy sector in the AC10 will not be influenced only by economic growth and the general re-structuring of the economy, but also by the general policy on energy and environment. The modernisation of sectors such as energy, industry, transport and housing may be triggered by the commitments made under the Kyoto Protocol (see Chapter 3.1): the industrialised countries having anticipated an ambitious reduction target for the 2008-2012 period can invest in energy-efficiency projects in central and eastern Europe to improve the cost-effectiveness of said reduction. The transfer of technologies aimed at reducing greenhouse gas emissions between the EU Member States and Accession Countries would benefit both parties, though the rules for such procedures have yet to be agreed upon in detail. If these transfers occur, they may speed up the process of energy efficiency improvement and the switch from coal to natural gas (namely as regards the substitution of coal in heavily polluting power plants).

Figure 2.2.8 **Energy supply in the Accession Countries by fuel type, 1995 and forecast 2010**

Source: EEA, 1999b



5. Transport

Transport is of great economic importance and the source of many environmental problems. Polluting emissions from transport sources adversely affect air quality, ozone levels and acidification, and contribute to global climate change. In addition, significant energy and other resources are also consumed in vehicle production, while disposal of vehicles, tyres, batteries, etc. contributes significantly to Europe's waste streams. Moreover, transport infrastructure construction has environmental impacts, including threats to biodiversity, fragmentation of landscapes and usage of raw materials.

In the past, economic growth and lowering transport prices have raised demand for transport. Where congestion occurred, new roads, airports and other infrastructure were constructed. This again lowered transport time and cost, inducing more transport in the short term, and in the long term causing enterprises and households to choose locations which may also require more transport. This closes the vicious circle of ever expanding transport volumes. Limits are largely set by the time people want to spend on travel, and the technically achievable speed of travel (see Box 2.2.6). By far the majority of transport use is still national or even local in nature, but European liberalisation of transport services and trade have contributed, and will contribute, significantly to the overall increase. The same is also expected to happen in the Accession Countries as they converge with the market structures of EU countries.

5.1. Historical developments

Carbon dioxide (CO_2) emitted from transport sources has increased dramatically in recent decades. On the other hand, emissions of lead and nitrogen oxides (NO_x) by road traffic are decreasing because of much improved technology (e.g. lead emissions from road transport which have since 1990 decreased by more than 70% in the EU following unleaded petrol sale). In contrast, the local impacts of transport infrastructure that was constructed in the past decades on residents and biodiversity are huge, but difficult to quantify or even characterise.

In the EU, the energy consumed by transport increased by more than 40% in the period 1985-96 (IEA), due mainly to the increase in volume of transport. At the same time, there was no improvement in energy efficiency: the amount of energy used per unit of transport (passenger-kilometre or tonne-kilometre) remained the same. Although engines are more energy-efficient than 20 years ago, heavier and more powerful vehicles are used and on average less passengers or freight are transported per vehicle.

In line with the increase in use of road transport, the road network has been expanding while the railway network has either stabilised or being reduced in some countries. Motorways have been built across the continent, with large increases in total length (over 200% in the EU alone since 1970), particularly in Greece, Portugal and Spain where the total length of motorways has more than tripled in the period 1980-1996. Occupation of land by infrastructures is high in Belgium, Germany and the Netherlands, where the density of motorways exceeds 30 km per 1 000 km² of total land area (Table 2.2.1).

The total length of all roads has also increased, by 17% in the EU and 12% in the AC10 since 1970. The pattern for railways is consistent with the trends in goods transported: the railway network has shrunk by 6% in the EU, while in the AC10 it remains mostly unchanged so far.

Passenger transport

The main historical developments in EU passenger transport are presented in Box 2.2.8. This large growth of road and air passenger transport in particular was caused by increasing incomes, in combination with a decrease in real terms in transport prices, including the prices of cars and air fares.

Box 2.2.6 Travelling time in 1750 and 1998

'The traveller who landed around 1750 at Dover or Harwich after an unpredictable and often lengthy crossing (say thirty-odd hours from Holland) would be well advised to rest the night in one of the expensive, but remarkably comfortable, English inns […]. He would travel perhaps fifty miles by coach the next day, and, after another night's rest at Rochester or Chelmsford, would enter London in the middle of the next day.' (Hobsbawn, 1968).

This voyage that took almost 3 days in 1750, would not usually take more than 6 hours today. Some transport scientists claim that according to the 'law of conservation of travelling time' people have tended to spend roughly the same time on travelling since the Middle Ages. Consequently, as travel becomes faster, people will travel longer distances. However, faster travelling requires more energy. In effect, time is exchanged for energy.

Box 2.2.7 Driving a car: direct and indirect need for resources

Driving a car requires energy. Of every litre of fuel extracted from the earth's oil sources, only a small portion – 2 cl or less than a shot glass – is directly used for moving the driver from A to B. Thirty-five percent disappears unused and converted into fumes through the exhaust and 40% heats the air around the car. Six percent is lost in internal friction. So, the remaining 19% is used for movement, of which 17% moves the car, and 2% the driver.

If we manage to double car fuel efficiency, we manage to increase the portion of the fuel that is directly used to move the driver from 2 to 4%.

Source: Fussler & James, 1996

Motorway density in the EU Table 2.2.1.

Country	1970	1980	1990	1996
Austria	5,3	10,5	17,8	19,4
Belgium	14,9	36,3	50,8	51,0
Denmark	4,3	12,2	14,2	20,7
Finland	0,4	0,7	0,7	1,4
France	2,8	9,6	12,4	15,1
Germany	17,4	26,4	31,0	32,4
Greece	0,1	0,7	1,5	3,6
Ireland	0,0	0,0	0,4	1,2
Italy	13,3	20,1	21,0	21,9
Luxembourg	-	-	-	-
Netherlands	35,6	52,3	61,7	69,6
Portugal	0,7	1,4	3,5	7,8
Spain	0,8	3,9	8,9	14,6
Sweden	1,0	2,1	2,3	3,2
United Kingdom	4,4	10,6	13,2	13,8

Sources: *Eurostat*, IRF, national statistics. European Commission (DG VII, Eurostat), EU Transport in Figures, Statistical Pocket Book, April 1998

units: km per km² of country land area

1996 data: estimates for France and UK

The real prices of road transport fuels returned to previous levels after past oil crises, and aviation fuels remain exempt from taxes.

Box 2.2.8 Historical developments in EU transport sector

Passenger transport
- an increase of total passenger transport by over 50% between 1980 and 1996;
- an increase of 60% between 1980 and 1996 of car passenger-kilometres;
- the number of air passengers arriving at the major EU airports grew by more than 100% between 1980 and 1996 and the air passenger-kilometres grew more than 200% in that period;
- a growth of 10% of rail passenger traffic in the period 1980 to 1996.

Freight transport
- an increase of 75% between 1980 and 1996 of road freight transport tonne kilometres;
- an decrease of 25% between 1980 and 1996 of rail freight transport tonne kilometres;
- zero growth of the freight transport volumes by inland shipping.

Sources: ECMT national statistics, estimates; European Commission, 1998d

Freight transport
The removal of internal trade barriers in the EU and lower transport prices have caused a concentration of the production of goods in a smaller number of places, giving scale advantages which outweigh the cost of larger transport distances. Completion of the Single Market is estimated to have created an extra 20 to 30% of trade among Member States. This has also led to a speeding-up of improvement of logistic systems in the freight transport sector. Cheaper, faster and more reliable transport has also facilitated development of just-in-time delivery systems, which require faster freight movements in smaller quantities (i.e. rather by road or air than by water or rail).

The preference of transport users for reliability and flexibility has provoked a shift away from rail and inland navigation towards road transport. This trend was also supported by a structural change in the type of products to be transported. The volume of freight transport by rail in the EU reached an historic high level in 1980 but fell to about 80% of that level in 1996. Transport of goods on inland waterways is less important overall in terms of volume (7% of total EU freight transport), but is important in some countries such as the Netherlands, Germany, Luxembourg and Belgium.

In 1995, the European Commission published its action programme on the common transport policy (European Commission, 1995b), setting out proposals for the years 1995 to 2000. The Commission recently also outlined the perspectives for continuing the action programme in 2000-2004 (European Commission, 1998e). Many items in this programme are of direct or indirect relevance to the environment. Since 1995, policies have been adopted at EU level concerning the development of the Trans-European Transport Network (TEN – Box 2.2.9 and Map 2.2.1), the improvement of local passenger transport, the internalisation of external cost (European Commission, 1998f and 1995c; ECMT, 1998), the revitalisation of railways and of public transport and the development of combined transport.

Stricter standards on vehicle emissions and fuel composition will have a significant impact on some regulated pollutants. To reduce CO_2 emissions, the European Commission has recently agreed with European car manufacturers on significant reductions in new car emission rates, and a labelling scheme has been proposed (European Commission, 1998g) (see section 4 in Chapter 3.12).

Box 2.2.9 Main objectives and development of the TEN

Objectives:
- to create an intermodal transport system in which modes are combined according to their comparative advantages;
- to enhance socio-economic cohesion;
- to contribute to the achievement of the EU's environmental objectives.

Projects envisaged:
TEN Rail network:
- 2 600 km of existing new high-speed lines and 2 300 upgraded high-speed lines;
- 10 000 km of planned high-speed tracks;
- 14 000 km of lines to be upgraded to high-speed standard;
- 48 400 km of existing conventional lines;
- 1 300 km of planned conventional lines.

TEN road network:
- 47 500 km of existing TEN roads. 27 000 km of planned TEN roads of which around 54% will be upgradings and 46% will be new roads).

Inland waterway network and inland ports:
- achieve 12 000 km of navigable canals and rivers.

Airport infrastructure:
- some of the 290 strategic European airports will be refurbished for greater capacity and efficiency.

Overall foreseen investment: 400 billion euros.

5.2. Outlooks

The main assumptions in the outlooks, from the baseline scenario, are summarised in Box 2.2.10. The local effects of infrastructure building (and resources use) will however continue in the future. The number of residents at short distances from infrastructure will increase. Energy demand by transport will also continue to increase, by about 30% from the 1996 level (Figure 2.2.9).

Increase in trans-European transport network

0 500 km

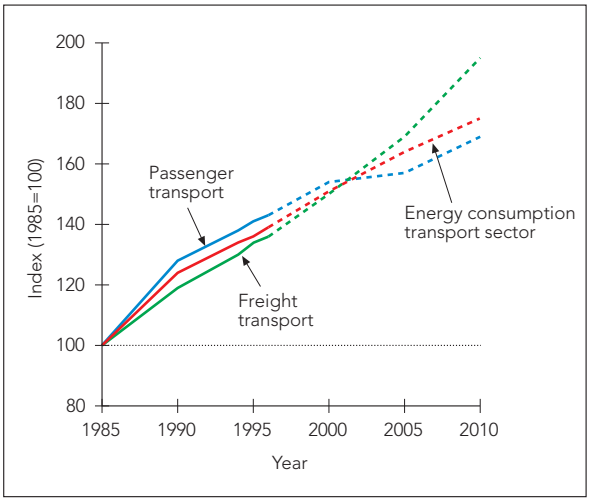
infrastructures
existing
planned

Map 2.2.1

Source: European Commission, 1998h

Figure 2.2.9 **Development of freight and passenger kilometres and energy consumption by transport, EU**

Source: European Commission, 1998d; IEA; Capros, 1997



Passenger transport

Passenger transport is expected to grow by 30% between 1995 and 2010 and the current patterns of growth favouring road and air are expected to continue. Passenger car transport will also grow by 30% between 1995 and 2010 and will maintain its share in the modal split. Passenger air travel will almost double. Rail transport is likely to increase by 30%, partly as the result of supportive policy measures, whereas bus transport will only grow by 5%. These developments are driven by the same causes as past developments (Hahn, 1997). Curbing this development and encouraging people to shift from cars to public transport could not be done without major investment in public transport systems, as is illustrated in Box 2.2.11. In addition, the construction of new motorway and rail infrastructure (including the implementation of the TEN programme) can be expected to lead to additional growth in traffic. The extension of the high speed rail (HSR) network is expected to divert travellers from air to rail, but it will also induce additional travel.

Freight transport

Total freight transport is expected to grow by around 50% between 1994 and 2010. This is mainly caused by an increase of international freight movements. Transport distances will increase, largely due to the same mechanisms as in the past. Some effects are expected, especially on longer distances, of efforts to encourage rail and combined transport (road/rail) (Figure 2.2.10). The transport outlook, from the baseline scenario, predicts that the volume of road transport will increase by 50% between 1994 and 2010. The volume of rail freight transport is expected to rise by 55% up to 2010. Although the use of inland waterways has hardly grown since 1970, an increase of about 40% from the 1994-level is expected by 2010.

5.3. Accession Countries

The transport systems in AC10 have been affected by the recession in the early 1990s. Freight transport decreased sharply after 1990 (except in the Czech and Slovak Republics). Road transport has recovered since then; in 1995 the transport volume already exceeded the 1990 level. The inland water transport sector suffered from the economic recession and lost about 40% of its volume in the period 1989–1992, and it remains relatively insignificant, despite a recovery after 1992 (Figure 2.2.11). Freight transport by rail used to be dominant throughout the 1970s and the 1980s, but was matched by road transport in 1995. In 1996, for the first time in history, the volume of road transport surpassed the

Box 2.2.10 Main assumptions for transport outlooks

The outlooks set out below take into account the main EU policies adopted or proposed by 1997 which affect transport growth. World oil price is, in this scenario, expected to increase, as well as taxes on transport fuels. Prices at the pump are projected to increase slightly.

EU policy has some effect on passenger modal split, for example through the construction of a High Speed Rail Network (EEA, 1998), and other measures to encourage public transport modes.

For freight transport, some assumptions with respect to the integration of Accession Countries markets into the EU single market. Freight modal split is assumed to be influenced by EU policies to encourage rail transport. The main freight transport policy assumptions are:

- continuing development of the TENs as scheduled by the European Commission in 1997;
- new freight rail connections (mainly part of the TENs) are foreseen where congestion of road traffic threatens economic growth;
- new road connections have been assumed where (in the total transport infrastructure network) this is needed to reduce congestion;
- other assumptions have been made concerning free access to markets, abolition of customs barriers within the EU, harmonisation of road taxes, harmonisation of fuel taxes, speed limitation, harmonisation of weight and taxes, harmonisation of VAT.

Assumptions specifically made for modal split are:

- about road taxation, fuel taxation, liberalisation of rail and inland waterways transport markets;
- influences of government policy (e.g. TENs programme) on tariffs and times.

Box 2.2.11 Relation between reduced car use and capacity of public transport in commuter traffic in The Netherlands, 1997

On a normal weekday, 5 million Dutch commuters set off for work in the morning (1997). Out of them, 2.9 million take the car, 220 000 take the train, and the same number of people goes by bus, tram and metro. At rush hour, many highways are jammed and the capacity of the public transport system is fully deployed.

The dominance of the car in commuter traffic and the large efforts that would be required to accommodate people who, e.g. for environmental reasons, would be willing to shift from car to train or bus, is illustrated by a numerical example. It shows that policy measures in support of such a shift alone, like road pricing, may not be sufficient.

Assuming that 10% of the car users will shift to the train – which will help solving quite a number of traffic jam problems – then 290 000 more people, on top of the 220 000 regular train commuters, will try to board at morning rush hour, which would require more than a doubling of the passenger railway capacity.

If the additional public transport users are spread evenly over the public transport system (which would be the case in an ideal situation only), then the railway and bus capacities would still have to grow by 40%. In many cases, commuters will be on the train as well as on the bus in one home-to-work trip, so that doubling the capacity of railway and bus systems is more than likely to be required.

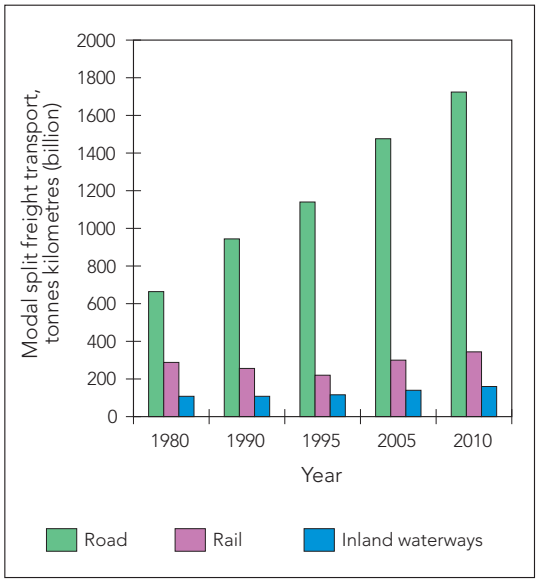
Substantially expanding the public transport system will require huge investment and lengthy political decision procedures, but it may be necessary to provide people with an alternative to private car use.

Source: Central Bureau of Statistics, Transport Sector, Heerlen, the Netherlands

volume of rail transport in terms of tonne-kilometres. The extensive existing rail infrastructure is still intact and provides options for restoring and maintaining the share of rail transport in the modal split in AC10.

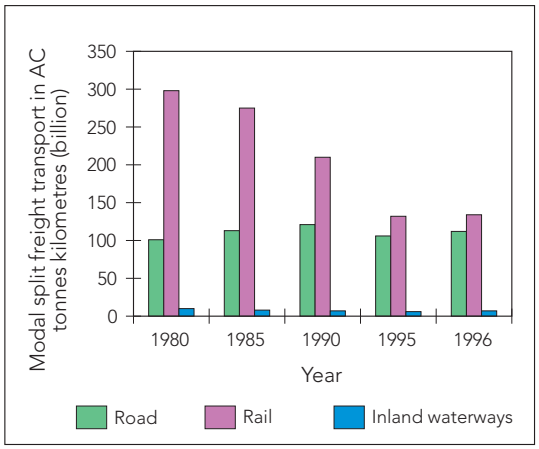
In some respects, the changes in AC10 will have positive impacts because an outdated stock of vehicles is being replaced by cleaner and more modern ones, although much of the demand for private car travel is currently being met by larger second-hand cars from western Europe. On the other hand, the same environmental pressures will arise as in the EU, and rapid growth in road transport, following substantial economic growth, will add to environmental pressures. A pan-European network of transport corridors is being considered, covering the candidate Member Countries. A further future demand can be expected following the extension of the EU. As an example, prospects for Hungary and Poland suggest that the growth of car kilometres in and between these countries and with the EU15 Member States will be even stronger than in the EU15 (EEA, 1998 and 1999a).

Modal split freight transport, EU Figure 2.2.10



Sources: European Commission, 1998d; EEA, 1998

Modal split in freight transport, Accession Countries, 1970-1995 Figure 2.2.11



Source: ECMT, 1996; Eurostat; UIC

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