

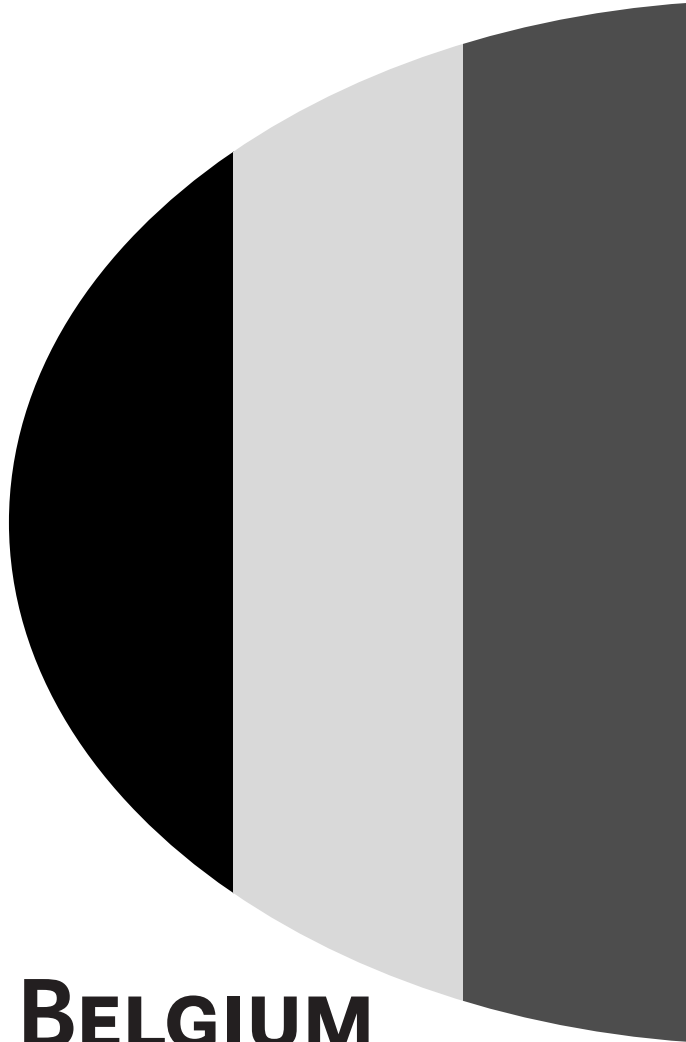


INTERNATIONAL ENERGY AGENCY

Energy
Policies
of IEA
Countries

**BELGIUM
2001 REVIEW**

Energy
Policies
of IEA
Countries



BELGIUM
2001 REVIEW

INTERNATIONAL ENERGY AGENCY

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The International Energy Agency (IEA) is an autonomous body which was established in November 1974 within the framework of the Organisation for Economic Co-operation and Development (OECD) to implement an international energy programme.

It carries out a comprehensive programme of energy co-operation among twenty-five* of the OECD's thirty Member countries. The basic aims of the IEA are:

- To maintain and improve systems for coping with oil supply disruptions;
- To promote rational energy policies in a global context through co-operative relations with non-member countries, industry and international organisations;
- To operate a permanent information system on the international oil market;
- To improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use;
- To assist in the integration of environmental and energy policies.

* *IEA Member countries: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States. The European Commission also takes part in the work of the IEA.*

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- To achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- To contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- To contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

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SUMMARY AND RECOMMENDATIONS

SUMMARY

Because of the country's strategic location, cross-border trade of electricity and gas and the energy policies of neighbouring countries affect Belgium's energy policy in such different areas as energy supply security, competition in energy markets and the battle against climate change. Belgium's role as a transit country will become more important in the future.

With the division of responsibilities between the regions and the federal government in Brussels, energy policies involve many different players. Policy-making is inevitably complex. This has been compounded by the need to address sustainable development issues, including the mitigation of global climate change.

In recent years, Belgium's energy supply has been diversified. Its capacity as an energy transit country has been expanded. Competition in both the electricity and gas markets has been introduced. Belgium has moved to meet the emissions reduction target it accepted in the Kyoto Protocol. The federal government has to ensure co-ordination among the many players involved in all the issues. Cellule CONCERE/ENOVER is a formal and important body for discussion between the federal and regional governments on all energy matters. Other advisory and co-ordinating bodies for energy policy are the Federal Council on Sustainable Development (FRDO/CFDD) and the Inter-departmental Commission for Sustainable Development (ICDO/CIDD).

Belgium is trying to open its electricity and gas markets at a faster pace than required by the relevant European Union directives. Market liberalisation is very important for Belgium. It is expected to augment social benefits and provide a competitive advantage for the nation. In light of progress being made in neighbouring countries, Belgium should pursue market liberalisation promptly and effectively. Implementation has been delayed and is currently being defined. Because of the country's administrative and political complexities, there is concern that it may take some time for the necessary details to be worked out.

In the electricity market, the federal government is responsible for generation, transmission and pricing, while the regional governments are in charge of distribution, energy efficiency and promoting the use of combined heat and power production, and of renewables. Some progress has been made. The time-frame for liberalisation is mostly set, the federal regulator has been established and the unbundling of supply transmission and distribution activities has been planned for. The necessary legislation and regulation have not, however, been completed. The electricity Transmission System Operator has not been named, and regional regulators have not been established.

Both the electricity and gas markets are dominated by single companies, and there are no clear prospects for new entrants. Market segmentation is also a major barrier to new entrants. There will be two regulators at the federal level during the transition phase. One will be responsible for regulating the liberalised market, and the other for regulating the captive market that remains. In addition, each of the three regions will have its own regulatory bodies. There will be independent regulators in Flanders and Wallonia, but in Brussels-Capital the energy administration will carry out regulatory activities. The situation may be further complicated if the regions do not co-ordinate the timetable for opening their markets or establishing their regulatory regimes for distribution. Close co-operation or even integration of these regulatory bodies should be sought.

Internally, the energy sector presents several structural problems. There is no plan now to break up incumbent monopolies. As a result, international competition is the only apparent path to real competition in Belgium. But the prospects for such international competition are not clear. Cross-shareholding among companies in the electricity and gas sectors may become an obstacle to competition.

Captive consumers throughout the country pay a single price for gas and electricity. This single price does not necessarily reflect real cost. In fact, the distribution company with the highest cost defines the price for all captive consumers. Regulation does not provide proper incentives for distributors to make their operations more efficient and reduce prices. The government should consider replacing this system with one that encourages each distributor to reduce its prices.

Because of Belgium's complex market structure and lengthy decision-making process, many participants find it hard to follow recent developments and to foresee future situations. Effective communication among all concerned parties is essential.

Achieving the Kyoto target for emissions reductions is a great challenge. In Belgium, energy-related greenhouse gas emissions continued to grow significantly during the 1990s, and are currently about 15% more than in 1990. The Kyoto commitment to achieve a 7.5% reduction of emissions by 2008-2012 compared to 1990 was made at the federal level. But real reduction will depend on actions by regions. ICDO/CIDD has presented the first Federal Plan for Sustainable Development. The plan provides a general framework for a number of federal schemes, including a National Climate Plan that has yet to be worked out. Some cost-effectiveness analyses have been made for different policies, but no quantitative policy goals have been set for any sector.

One of the major reasons for falling behind schedule has been Belgium's reliance on the implementation of a carbon tax by the European Union but such a tax is not foreseen in the immediate future. The Federal Plan for Sustainable Development contemplates the possibility of introducing national taxation in such a case. Impact studies on a national carbon tax have been done and the first steps towards implementation have been announced for 2002.

Many Belgian authorities believe that significant improvements in energy efficiency can be made. The Federal Plan for Sustainable Development calls for reducing

energy consumption by 7.5% in 2010 compared to 1990. But energy intensity grew in the 1990s. In 1999, energy consumption was 20 to 30% above its level in 1990. Because all the regions are not committed to the same target, harmonisation and strong policy measures will be needed.

Neither renewable sources of energy nor combined heat and power (CHP) generation, which could limit carbon emissions, can be easily introduced in Belgium, because they are more expensive than electricity supplied through the grid. The barriers to increased use of CHP should be removed. For example, back-up power requirements and buy-back tariffs should be set at a level that does not distort competition between CHP and other generation methods. CHP producers should be able to choose their gas supplier, and to sell their production to consumers freely. Such devices as green certificates should be developed to promote both renewables and CHP. After the barriers have been identified and removed, financial incentives for CHP could be phased out.

The Belgian government sets price ceilings on oil products. These reflect the market price but also avoid sharp price increases caused by speculation. In an emergency situation, ceilings could encourage hasty buying both by Belgians and foreigners. Fraud linked to the quality of oil products has decreased significantly as a result of more quality checks in the markets. Monitoring the markets remains important to identify quality problems and stop fraud.

Belgium has committed itself to phase out nuclear power. The declared nuclear plants shut-down is planned to begin only after 2014, and so it will not create additional difficulties for reaching the national Kyoto target. But it will be a challenge for the years afterwards. The AMPERE Commission, which was established by royal decree to investigate policies for future electricity generation, recommended that the government keep its nuclear options open. It advised maintaining nuclear expertise through participation in national and international research on new nuclear choices. The commission also noted that closing down fully depreciated nuclear power plants will be more costly than extending their lives. The findings of the AMPERE Commission are under peer review that will be completed by the end of 2001.

RECOMMENDATIONS

The Government of Belgium should:

General Energy Policy

- Strengthen the capacity of CONCERE/ENOVER to develop detailed conditions for market liberalisation, and to set quantitative targets and concerted measures to reduce greenhouse gas emissions.

- Increase co-operation between CONCERE/ENOVER and the new federal institutions established to support sustainable development.
- Consider the possibility of employing consultants or other outside help to assist the federal and regional governments to efficiently carry out present and future activities.
- Maintain close co-operation between the federal and regional governments so that they can take concerted action to liberalise markets. Measures taken by the regions should be consistent.
- Review the need for five independent regulators in the electricity and gas sectors. If multiple regulators are needed, Belgium should ensure strong co-ordination among them.
- Ensure that CREG (the Commission for Electricity and Gas Regulation) has enough regulatory power and resources to discharge its increasing responsibilities.
- Ensure that cross-shareholding in the electricity and gas sectors does not distort competition.
- Ensure that industry is well informed about future market developments through participation in policy discussion with the federal and regional governments.
- Develop effective tools for timely monitoring of developments in energy markets, including the prompt availability of high-quality energy data.
- De-couple price setting for captive markets from prices in neighbouring countries.
- Phase out subsidies to low-income consumers and instead use social policy instruments to tackle fuel poverty. Energy should not be provided free of charge in order to avoid inefficient energy use.

Energy and the Environment

- Give priority to environmental aspects of the national energy policy, bearing in mind the large gap between Belgium's Kyoto target and current greenhouse gas emissions.
- Speed up the development of a national plan for reducing GHG emissions.
- Consider introducing co-operation agreements between the federal and regional governments for sector-specific projects on the rational use of energy, renewable energy sources, CHP, and on research technology, research and demonstration.

- Initiate a consultative procedure involving federal and regional authorities and industry to define a set of concerted actions to reach the national Kyoto target.
- In the National Climate Plan, give precedence to measures – on both the supply and demand sides – according to their potential to help meet the Kyoto target in a cost-effective manner.
- Ensure that future policy measures, including green certificates, standards for energy efficiency improvement, subsidies, tax abatement and energy taxes are effective in meeting their policy objectives. The green certificate system should be introduced in the different regions at the same time as a nationwide trading system. Tools should be developed to monitor the performance of these policies.

Energy Efficiency

- Promote better co-ordination between the regions and with the federal government in all areas of energy efficiency.
- Establish an effective monitoring system, in collaboration with the regional governments, to achieve national energy policy objectives, in particular energy efficiency targets.
- Review the policy of promoting energy efficiency through subsidies or tax abatements.
- Promote effective measures for reaching energy efficiency targets in all end-use sectors, including industry, the public and private sectors, and transport.
- Reduce the number of building code violations.
- Define more clearly the role energy industries can play in the implementation of energy efficiency policies. Ensure that industry carries out its duties effectively.
- Eliminate obstacles to increased use of third-party financing for improving energy efficiency.
- Ensure that those who have the best knowledge in particular areas are chosen to improve energy efficiency in their respective areas.

Electricity

- Set a clear time-frame for electricity market liberalisation.
- Consider further liberalisation, to include all customers and to ensure that the market is fully opened in all regions.

- Actively pursue competition, encourage new entrants by increasing cross-border competition, limit the dominance of existing players and possibly establish an electricity trading pool.
- Set up as soon as possible the necessary regulatory institutions, including court and arbitration systems.
- Nominate the national grid operator as soon as possible; ensure its independence by effective unbundling.
- Ensure that the planned unbundling is effectively carried out in generation, transmission and distribution.
- Ensure that distribution companies do not misuse their monopoly position by cross-subsidising.
- Ensure transparency and efficiency in electricity price-setting. Assess the possible benefits of price differentiation for distribution companies in different geographical areas while they are still part of the captive market. Also ensure that the captive market, especially residential consumers, benefits from increased competition and the expected reduction of prices.

Co-generation

- Phase out financial support to CHP. Establish instead a more sustainable back-up capacity pricing scheme and ensure that buy-back tariffs for electricity are set at a level that does not distort the competition between CHP and other generation methods.

Nuclear

- Act to preserve the nuclear option until reliable quantitative analysis can be conducted comparing the various technological options to replace nuclear energy – including their environmental and economic aspects. The quantitative analysis should be conducted promptly, bearing in mind the long-term nature of investment in power generation.
- As liberalisation of the electricity market progresses, review the availability and security of funds currently administered by Electrabel and its subsidiary Synatom to pay for decommissioning nuclear power plants and spent fuel management.

Natural Gas

- Set a clear time-frame for completion of pending legislation.
- Set up as soon as possible the necessary regulatory institutions, including court and arbitration systems.

- Take steps to develop cross-border competition in gas supply. Facilitate the arrival of newcomers by ensuring that licensing procedures and technical regulations are not barriers to entry.
- Ensure that the commercial conditions governing access to the grid and the licensing systems are transparent and non-discriminatory.
- Ensure that the planned unbundling is effectively carried out in transit, transmission and distribution.
- Make sure that the distribution companies do not misuse their monopoly position by cross-subsidising other activities.
- Ensure transparency and efficiency in gas price-setting. Assess the possible benefits of price differentiation for distribution companies in different geographical areas while they are still part of the captive market. Also ensure that the captive market, especially residential consumers, benefits from increased competition and the expected reduction of prices.

Oil

- Continue regular checking of oil quality to avoid fraud and develop methods to reduce fiscal fraud.
- Consider eliminating the remaining price ceiling mechanism to achieve full liberalisation of oil prices.

Renewables

- Study carefully the costs of renewables. Develop policies for promoting renewables that are cost-effective, market-oriented and consistent (as much as possible) with policies in neighbouring countries.
- Ensure that the environmental costs of energy use are adequately reflected in final costs, with a view to promoting environmentally and economically sustainable energy options, such as renewables.
- Study the possibility of using biomass as a supplementary fuel in CHP.

Research and Development

- Clarify the objectives of R&D so that they are consistent with federal and regional energy policies, and ensure that R&D programmes are adequately planned and implemented to meet these objectives.
 - Develop tools to assess the performance of R&D activities in this regard.
-

CONDUCT OF THE REVIEW

REVIEW TEAM

The International Energy Agency (IEA) 2001 in-depth review of the energy policies of Belgium was undertaken by a team of energy policy specialists drawn from the Member countries of the IEA. The team visited Belgium from 6 to 10 November 2000 for discussions with representatives from federal and regional energy administrations, energy industries and research organisations.

Members of the team were:

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Director

Department of EU Co-ordination Affairs

Ministry of Energy and Natural Resources

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OECD Nuclear Energy Agency

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Head, Country Studies Division

International Energy Agency

Ms Lea Gynther

Desk Officer – Belgium, Country Studies Division

International Energy Agency

Lea Gynther managed the review and drafted the report. Monica Petit and Bertrand Sadin prepared the figures.

The team held discussions with the following organisations:

- State Secretary for Energy and Sustainable Development
- Ministry of Economic Affairs, Energy Administration
- Cellule CONCERE/ENOVER (Concertation Etat-Régions en matière d'Énergie/Energie-overleg Staat-Gewesten)
- Ministry of the Flemish Community – Department of Natural Resources and Energy (Ministerie van de Vlaamse Gemeenschap – Afdeling Natuurlijke Rijkdommen en Energie)
- Government of the Walloon Region, Departmental Staff of the Minister of Transport, Mobility and Energy (Gouvernement Wallon, Ministre des Transports, de la Mobilité et de l'Énergie)
- Ministry of the Walloon Region, General Directorate of Technology, Research and Energy, Energy Division (Ministère de la Région Wallonne, Direction générale des technologies et de la recherche, Division de l'Énergie)
- Brussels regional energy administration at the Brussels Institute for the Management of the Environment (Institut Bruxellois pour la Gestion de l'Environnement, Brussels Instituut voor Milieubeheer IBGE/BIM)
- CCEG – Control Committee for Electricity and Gas
- CREG – Commission for Electricity and Gas Regulation
- Electrabel
- CPTE – Company for the Co-ordination of the Production and Transport of Electricity
- BFE – Federation of the Electricity Companies in Belgium (Beroepsfederatie van de Producenten en Verdelers van Elektriciteit in België, FPE)
- Inter-Regies
- Distrigaz
- Gaz Naturel
- SOLVAY – Direction Centrale Recherche & Technologie
- FEBELIEC – Federation of Belgian Large Industrial Energy Consumers (represents also industrial autoproducers)

- IWT – Institute for the Promotion of Innovation by Science and Technology in Flanders (Instituut voor de aanmoediging van innovatie door wetenschap en technologie in Vlaanderen)

The assistance and co-operation of all participants in the review are gratefully acknowledged.

REVIEW CRITERIA

The *Shared Goals* of the IEA, which were adopted by IEA Ministers at their 4 June 1993 meeting, held in Paris, provide the evaluation criteria for in-depth reviews conducted by the Agency. The *Shared Goals* are set out in Annex B.

GENERAL ENERGY POLICY

BACKGROUND

Country Overview

Belgium has been a federal country since 14 July 1993. It consists of three regions, Flanders, Wallonia and Brussels-Capital.

In 1999, the population of Belgium was 10.2 million. It is the third most densely populated country in the OECD, with 335 inhabitants per square kilometre. During the last ten years average population growth has been 0.2% per year.

In recent years, Belgium has enjoyed steady economic growth. The Gross Domestic Product was US\$ 247 billion¹ in 1999 at current market prices and using current exchange rates. Per-capita GDP, measured using current purchasing power parities, is about 10% higher than OECD or EU averages. Other macro-economic indicators show healthy development. Inflation has remained low, the current account surplus has widened and employment has increased.

After the national election of 13 June 1999, the liberal, socialist and green parties formed the government together.

Table 1
Belgium and its Regions in 1999

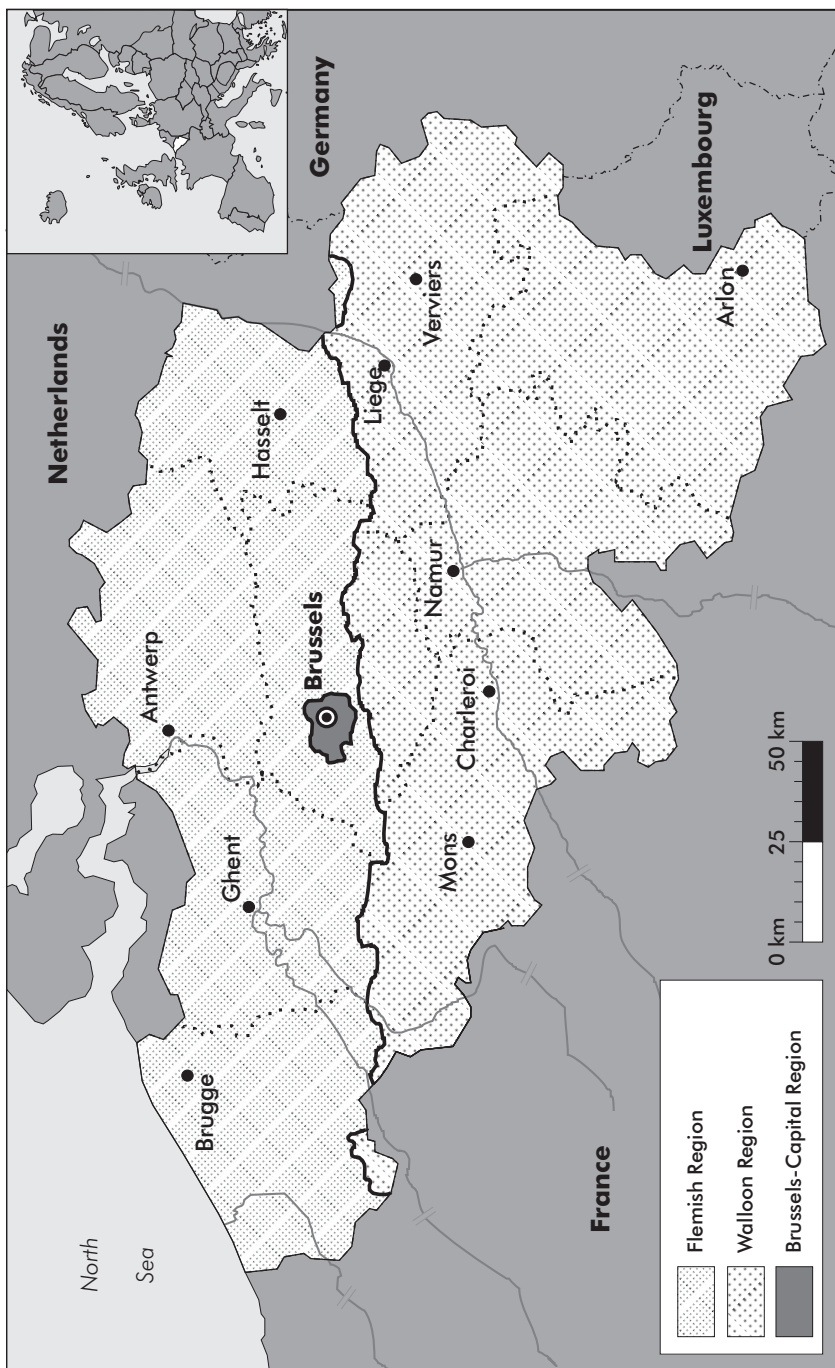
		<i>Belgium</i>	<i>Flanders</i>	<i>Wallonia</i>	<i>Brussels-Capital</i>
Land area	Km ²	30,287	13,413	16,713	161
Population	Million	10.2	5.93	3.33	0.95
Population density	Inhabitants/km ²	335	442	199	5,900
GDP	Billion US\$	247	..	..	..

.. = not available.

Sources: *Main Economic Indicators*, OECD Paris, 2000; *Labour Force Statistics 1978-1999*, OECD Paris, 1999; *Environmental Performance Reviews, Belgium*, OECD Paris, 1998.

1. On average in 2000, the Belgian franc (BF) = US\$ 0.023 or €0.025.

Figure 1
Map of Belgium



Source: Belgian Ministry for Economic Affairs, Energy Administration.

Belgium and Sustainable Development

In 1997, the federal government approved the Law Concerning the Co-ordination of the Federal Policy on Sustainable Development, which created two new bodies: the Federal Council on Sustainable Development² and the Inter-departmental Commission for Sustainable Development³. The former is a platform for different interest groups to exchange opinions on sustainable development. The latter is responsible for the preparation and implementation of the Federal Plan for Sustainable Development in the different federal ministries and public entities. Every four years, the Federal Council of Ministers issues a Federal Plan for Sustainable Development. The first plan was published in 2000.

In early 1999, the Commission for the Analysis of Methods for the Generation of Electricity and the Re-evaluation of Energy Vectors (the AMPERE Commission) was created to project future electricity demand and investigate different options for electricity generation. The commission was composed of sixteen members from academia with different backgrounds. It was mandated to develop a rational vision for future electricity production that takes into account environmental and economic challenges and the decision to phase out nuclear power. The commission was dissolved after it published its report in October 2000. The report is being assessed in an international peer review that will be completed by the end of 2001.

GENERAL ENERGY POLICY

Federal, Regional and Municipal Responsibilities

The three regional governments of Flanders, Wallonia and Brussels-Capital have major responsibilities for designing and implementing energy policies while the federal government is responsible for those issues which need to be dealt with at national level (see Table 2).

The municipalities have a legal monopoly in distributing electricity⁴. Almost all of them have transferred the distribution of electricity to intermunicipal companies. These utilities, called *intercommunales*, partially finance the communes. The annual contribution of energy-related revenues to municipal budgets can reach 10%.

2. Federale Raad voor Duurzame Ontwikkeling / Conseil Fédéral du Développement Durable (FRDO/CFDD).

3. Interdepartementale Commissie Duurzame Ontwikkeling / Commission Interdépartementale du Développement Durable (ICDO/CIDD).

4. Law of 10 March 1925 concerning the distribution of electricity. The monopolistic position that municipalities have in gas distribution is not based on legislation.

Table 2
**Division of Responsibilities for Energy Policy between
 Federal and Regional Governments**

<i>Federal Government</i>	<i>Regional Governments</i>
<ul style="list-style-type: none"> • indicative programme for the electricity sector; • nuclear fuel cycle and related R&D programmes as well as research in the field of nuclear fusion; • large infrastructures for storage, transport and production of energy; • setting tariffs. 	<ul style="list-style-type: none"> • distribution and transport of electricity through networks with a maximum voltage of 70 kV; • public distribution of gas; • use of methane and blast furnace gas; • district-heating equipment and networks; • use of waste products reclaimed from coal tips; • new and renewable sources of energy; • recovery of waste energy from industry or other uses; • rational use of energy.

Source: Country submission.

Energy Policy Objectives

The objectives of Belgium's overall energy policy have not changed since the early 1970s. They include security of supply based on diversification of geographical sources and fuels, energy efficiency, transparent and competitive energy prices, and environmental protection. Currently, the main energy policy goals of the federal government are rational use of energy, progressive phasing-out of nuclear energy⁵ and the accelerated liberalisation of the energy market.

Regional energy policies put more emphasis on energy efficiency and the introduction of renewables. The Flemish government intends to increase budgets for energy efficiency, CHP, rational use of energy in buildings, and renewables. The Walloon government emphasises energy efficiency, CHP and renewables. A Brussels-Capital declaration mentions three points: coherent energy policy is needed to improve the air quality in the region; use of solar energy in the public sector will be promoted; policies for the rational use of energy will be continued.

5. The Federal Government's Declaration of July 1999 states that nuclear power plants will be decommissioned when they reach 40 years of age.

INSTITUTIONAL FRAMEWORK

Federal Level

According to the Royal Decree of 6 December 1999, three different ministers have responsibilities in the field of energy. The State Secretary for Energy and Sustainable Development, under the Minister of Mobility and Transport, is responsible for most energy issues. The tasks also include co-ordinating national climate change negotiations among the regions. The Minister of Economic Affairs can set price ceilings for electricity and gas and, together with the State Secretary for Energy and Sustainable Development, for oil products. The Minister of Environment is responsible for issues such as energy labelling, energy efficiency standards and legislation on the safety of electric and gas appliances.

Although the State Secretary for Energy and Sustainable Development is under the Minister of Mobility and Transport, at the administrative level, the Energy Administration, under the Ministry of Economic Affairs, deals with energy matters. The staff dealing with environmental issues in the portfolio of the State Secretary for Energy and Sustainable Development are in the Ministry of Social Affairs, Health and the Environment.

The Control Committee for Electricity and Gas (CCEG) is an autonomous public body that monitors the electricity and gas sectors, and regulates the non-liberalised segment of the electricity and gas markets. It is composed of representatives of the gas and electricity industries, trade unions and national and regional authorities, and it operates by consensus. The recommendations of the CCEG to producers and distributors of electricity and gas are not binding, but in fact they are always accepted since all the committee's members have reached a consensus to implement them. The CCEG contributes to the federal government's Indicative Programme (see Chapter 6) and various other plans by advising on electricity generation methods, on the development of the electricity grid and on the supply of natural gas.

The former Commission for the Regulation of Electricity (CRE) was converted by law into the Commission for Electricity and Gas Regulation (CREG) in 1999. By law, it is an advisory body that carries out regulatory tasks in the liberalised part of the electricity and gas markets. However, despite its advisory legal role, CREG has some real powers such as accepting transmission tariffs and powers of arbitration.

The National Oil Board (NOB) is in charge of the supply and distribution of crude oil and oil products during emergency situations. The NOB was created by the Royal Decree of 1981 with a mandate to restrict demand and share available supplies in the event of an oil supply shortage. The NOB is also responsible for activities related to Belgium's international commitments in energy crisis management.

The National Energy Committee was an official body that formulated general energy policy objectives and recommended ways to achieve them. It was dissolved in 2000, with the newly established CREG taking over some of its tasks and others being transferred to the federal Energy Administration.

Federal-Regional Co-operation

The Cellule *CONCERE/ENOVER* (Concertation Etat-Régions pour l’Energie/Energie-overleg) is a formal forum for discussion on all energy matters. It became operational in 1992. Its main tasks are to:

- Gather information and promote information exchange between the regions and the federal government and internationally.
- Support all policy measures, including those involving both federal and regional authorities, in a spirit of internal cohesion and respect of the participants’ responsibilities.
- Select representatives in Belgian regional delegations for international meetings.

The Cellule respects the autonomy of all parties. It gives advice and makes recommendations, but these are not binding. Plenary sessions are held monthly. Several working groups on thematic subjects have been created. The Energy Administration provides secretarial assistance to the Cellule, which does not have an independent budget or permanent staff.

Regional Level

The Ministry of the Flemish Community has a Department of Economy, Employment, Internal Affairs and Agriculture. The department's Administration of Economy includes a Division of Natural Resources and Energy, which is in charge of energy matters. In the Department of Environment and Infrastructure, the Administration of the Environment deals with environmental matters. The Flemish Institute for Technological Research (VITO) and the Institute for the Promotion of Innovation by Science and Technology in Flanders (IWT) play important roles in energy technology, research and development.

In Wallonia, the Directorate-General for Technology, Research and Energy deals with energy policies, including research and development issues. The Directorate-General for Natural Resources and Environment is responsible for environmental matters. The Ministry of Equipment and Transportation also contributes to the development of R&D policy in transportation.

In Brussels-Capital, the Brussels Institute for the Management of the Environment (IBGE/BIM) is responsible for all energy-related issues in the region.

PRIMARY ENERGY SUPPLY⁶

Belgium's only indigenous energy resource is coal. Because of the high cost of domestic production, the government decided in 1986 to phase out coal mining gradually. The last mines were closed in 1993. The cessation of domestic coal production has not been compensated by increased imports because coal demand decreased to the same extent as previous indigenous production had. Belgium has no oil or natural gas resources, and the use of renewables is still limited. So the only significant source of energy produced in Belgium is nuclear power, with a 93% share in 1999 (see Figure 2).

In 1999, oil accounted for 41.2% of total primary energy supply, natural gas 22.7%, nuclear 21.8% and coal 12.8%. The proportion of renewables was 1.3%, whereas the share of fossil fuels totalled 76.7%. Belgium is a net importer of all fuels, but electricity imports have been decreasing and are currently marginal. The transit⁷ volume of natural gas, counted neither as import nor as export, has been growing strongly.

Primary energy supply is illustrated in Figures 3 and 4. The proportion of oil decreased significantly from 60.5% in 1973 to 38.7% in 1990, but grew in the 1990s because of a significant increase in consumption in the transport sector. Nuclear power was first introduced in 1975. Natural gas was a major fuel in the 1970s, but was partly replaced in the 1980s by nuclear energy and oil. Since the 1990s, it has regained importance.

FINAL ENERGY CONSUMPTION

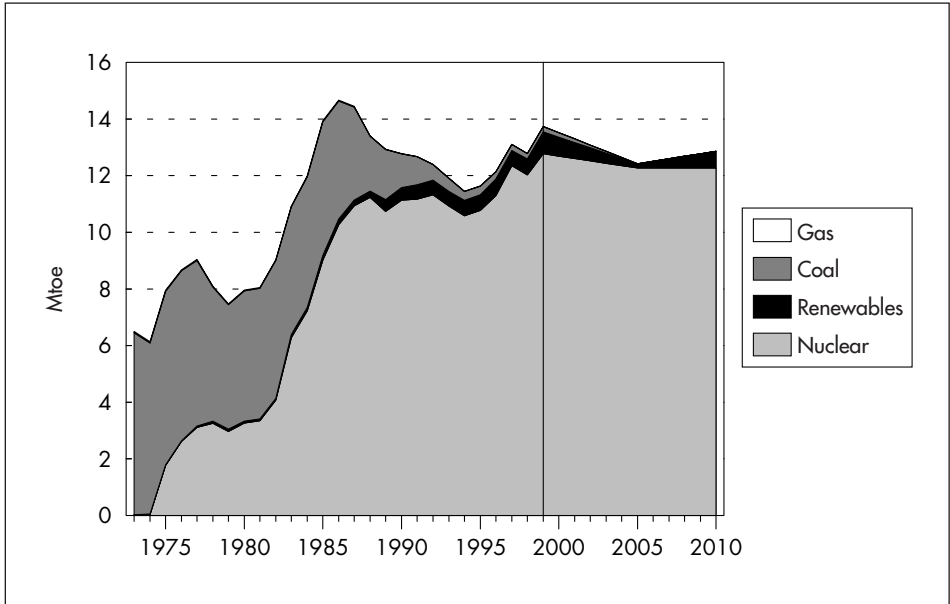
Total final energy consumption was 41.3 million tonnes of oil equivalent (Mtoe) in 1999. Since 1990, when total final energy consumption was 32.9 Mtoe, the annual average growth rate has been 2.5%. In 1999, industrial consumption of energy was 15.9 Mtoe, non-industrial 24.1 Mtoe, and non-energy use 1.3 Mtoe⁸. Past trends and future forecasts of final consumption by sector are shown in Figure 5.

6. Information on Belgium's energy balances and key statistics are presented in Annex A.

7. Transit is not recorded in import or export statistics.

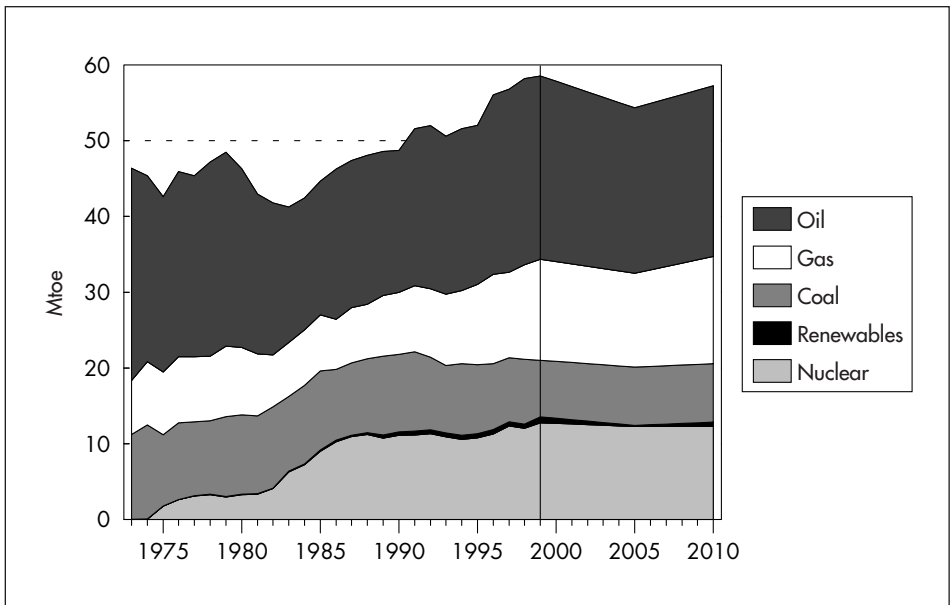
8. Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2001. If naphtha, used as feedstock by petrochemical industries, is not included in industrial consumption (method used by Eurostat and the Belgian Energy Administration), total final consumption was 43.3 Mtoe in 1999, and the share of industrial use was 13.2 Mtoe, non-industrial use 24.8 Mtoe and non-energy use 5.4 Mtoe. Consequently, the share of industry in total final energy consumption was 30.5%. The shares of the different fuels in final energy consumption were: oil 50.2%, gas 27.2%, electricity 14.8%, solid fuels 7.8% (heat is included in the shares of the different fuels).

Figure 2
Energy Production, 1973-2010



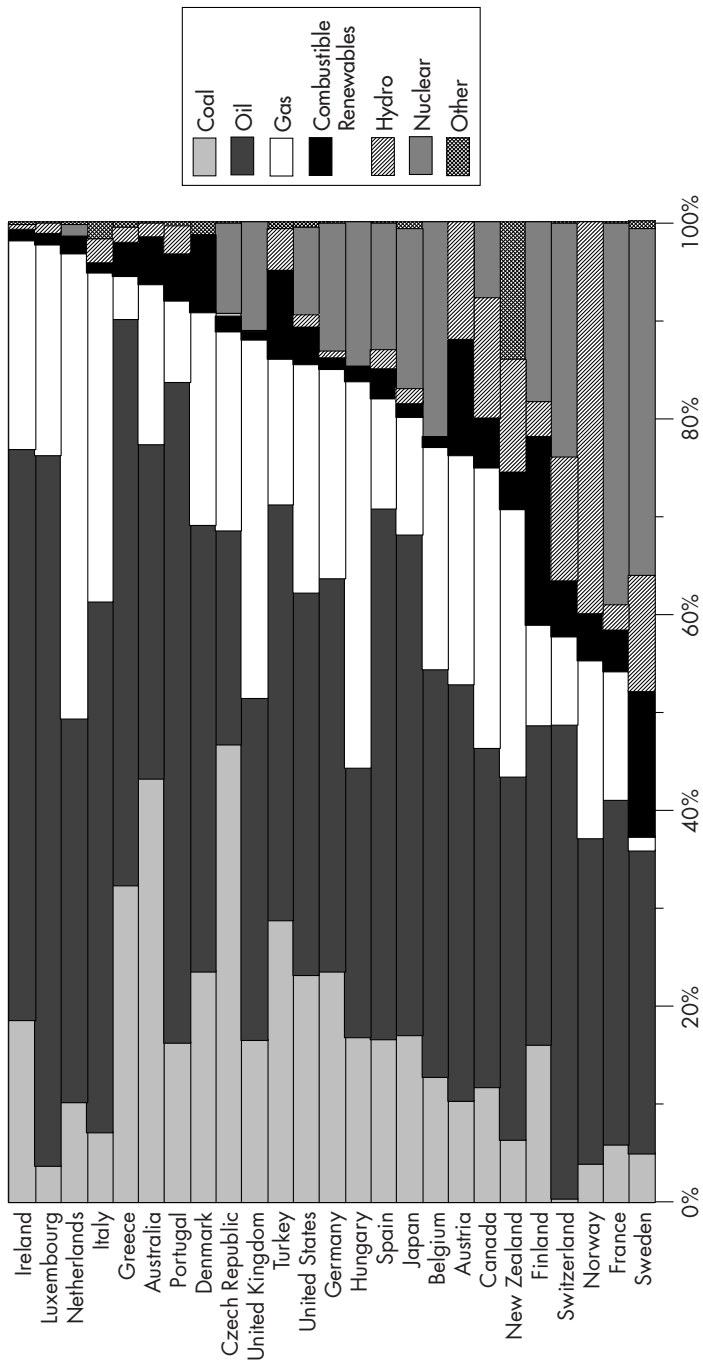
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2001, and country submission.

Figure 3
Total Primary Energy Supply, 1973-2010



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2001, and country submission.

Figure 4
Total Primary Energy Supply in IEA Countries, 1999



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2001, and country submission.

In 1999, the industrial sector (including non-energy use) had the biggest share of total final energy consumption, 41.6%. In 1973, it was 46%. It reached the current level in the early 1990s. In volume, industrial consumption grew by 29% from 1990 to 1999.

In 1999, the residential and commercial sectors' share in final energy consumption was 34.5%. Consumption in the residential sector grew by 29% from 1990 to 1996 but fell by 7% in 1997-1998 because of an exceptionally mild winter, and stabilised thereafter.

Energy consumption in the transport sector has shown the most rapid long-term growth, increasing its share from 14.6% in 1973 to 23.8% in 1999.

While total final consumption decreased from the 1970s to the early 1980s, in the wake of two international "oil shocks", it has grown since then, except for the early 1990s when there was a recession. In 1999, oil accounted for 53.2% of total final consumption, gas 23.5%, electricity 15.5%, solid fuels 6.8% and heat (produced in CHP and heat plants) 0.9%. Oil is still dominant in final energy consumption. In addition to its importance in the transport sector, it is as important a fuel in space heating as natural gas. The long-term trends in total final consumption of fuels are illustrated in Figures 6 and 7.

ENERGY TAXES AND PRICES

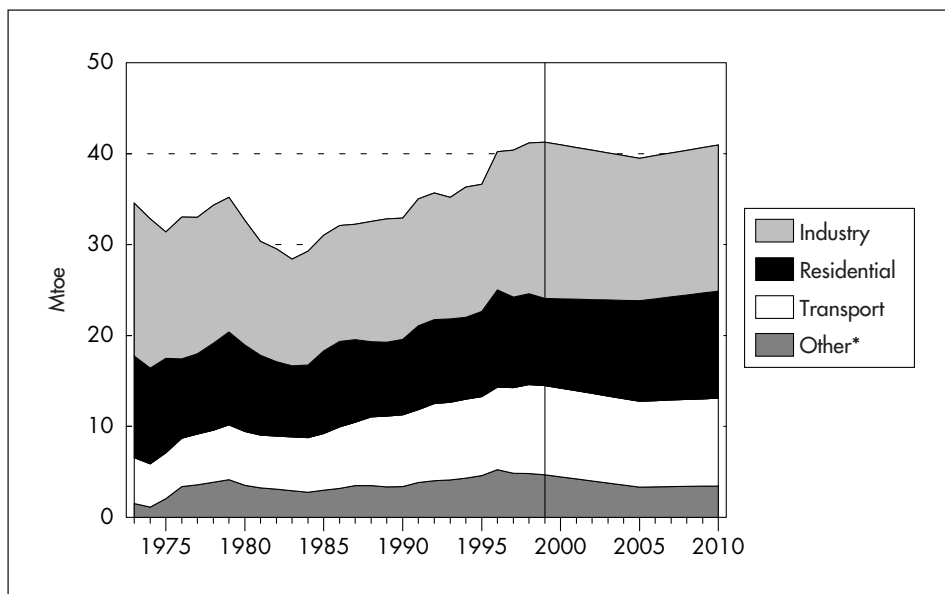
Energy Taxes

Energy pricing and taxation are a federal competence. Since 1993, there has been an energy levy (*cotisation sur l'énergie*), a special tax on domestic energy products. The tax is based on the energy component, not the CO₂ content, of each product. In 1993, an excise tax was imposed on heavy fuel oil for industry and electricity generation, based on its sulphur (S) content. Additional excise taxes were placed on motor fuels in 1996.

In 1999, various taxes were levied on electricity for households, but not for industrial users. There are no federal taxes on coking coal, steam coal and natural gas for industry and electricity generation or on electricity for industry. A reduced value-added tax (VAT) rate of 12% is applied to steam coal for households.

Natural gas is subject to some local taxes that are not imposed on other energies. The taxes for natural gas are payments to the municipalities for granting concessions ("intangible dividends") and specific local taxes levied by some municipalities (such as storage tax).

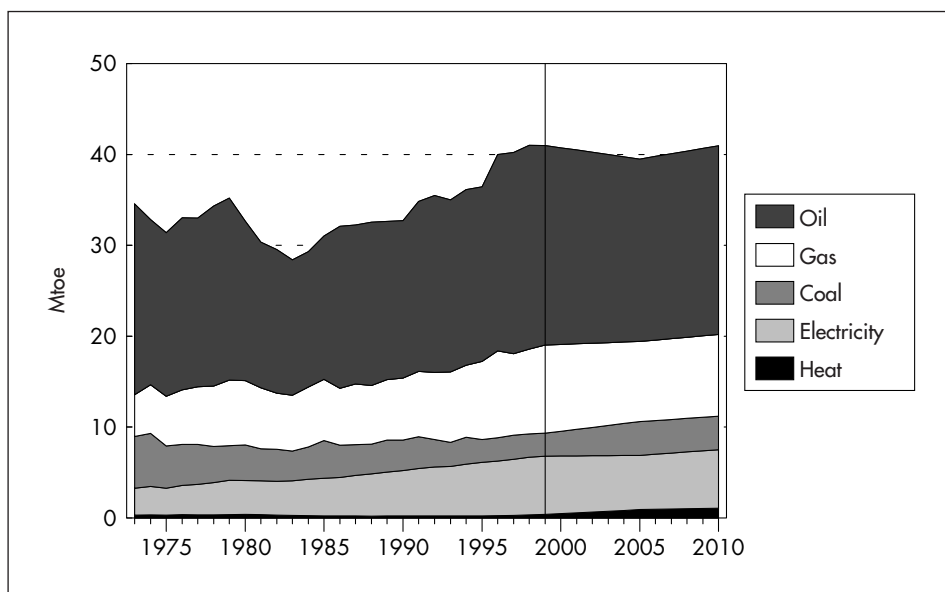
Figure 5
Total Final Consumption by Sector, 1973-2010



* includes commercial, public service and agricultural sectors.

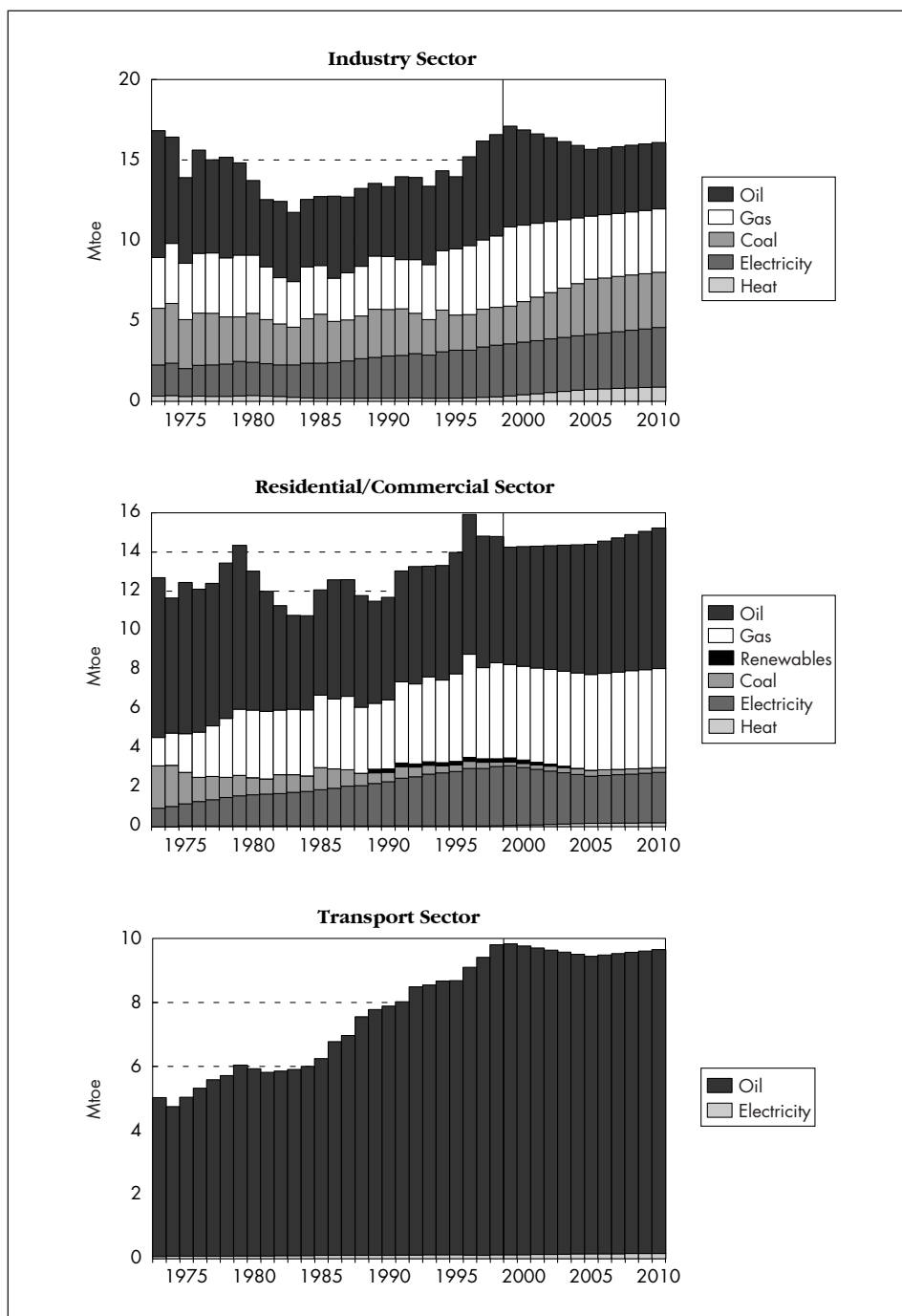
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2001, and country submission.

Figure 6
Total Final Consumption by Fuel, 1973-2010



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2001, and country submission.

Figure 7
Final Consumption by Sector and by Fuel, 1973-2010



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2001, and country submission.

Table 3
Energy Taxes in Belgium in 1999

<i>Consumer/energy</i>	<i>Energy levy</i>	<i>Excise taxes</i>	<i>VAT</i>
Households/electricity	BF 55/MWh*		21%
Households/natural gas	BF 13.67/GJ*		21%
Households/light fuel oil	BF 0.34/litre	BF 0.21/litre	21%
Households/coal	Exempted		12%
Households/liquified petroleum gas, butane	BF 0.69/kg		21%
Households/liquified petroleum gas, propane	BF 0.70/kg		21%
Households/gasoline, leaded	BF 0.55/litre	BF 22.26/litre	21%
Households/gasoline, unleaded	BF 0.55/litre	BF 19.91/litre	21%
Households/diesel	Exempted	BF 11.70/litre	21%
Industry/electricity	Exempted		0
Industry/natural gas	Exempted		0
Industry/light fuel oil	BF 0.34/litre	BF 0.21/litre	0
Industry/heavy fuel oil	Exempted	BF 750/tonne (> 1% S) BF 250/tonne (max. 1% S)	0
Industry/coal	Exempted		0
Industry and commercial/diesel	Exempted	BF 11.7/litre	0

* low-income households are exempted.

Source: Belgian Ministry of Economic Affairs, Energy Administration.

The tax formerly levied by the federal government on the electricity producers, Electrabel and SPE (*Société Coopérative de Production d'Electricité*), but which was not applied to autonomous producers, has been replaced by the standard corporate tax. Specific taxes levied on electricity include local taxes levied by the municipalities and regional authorities, for example on the use of water in nuclear or thermal power plants.

Both gas and electricity distribution companies are subject to a special withholding tax on income earned.

The fuel taxes on both gasoline and diesel are lower in Belgium than in neighbouring countries, except Luxembourg, but higher than the European average.

Energy Prices

Once the markets are liberalised, the prices of electricity and gas will be set by the market, but the Ministry of Economic Affairs can define price ceilings. The regulator, CREG, gives recommendations on tariffs. Transmission tariffs, proposed by the transmission operators, are subject to approval by CREG. Distribution tariffs, proposed by the distribution grid managers, are subject to approval by the regional regulators. The pricing of oil products is free, but prices have to be below the price ceiling set daily by the Programme Contract (see Chapter 10).

Uniform prices for gas and electricity, set by the federal government, are applied for captive consumers throughout the country. CCEG proposes tariffs that are subject to approval by the Ministry of Economic Affairs. Legislation stipulates the conditions for setting price ceilings for captive markets. Cross-subsidies are not allowed. Increased efficiency following market liberalisation is expected to lower prices for residential consumers and for small and medium-sized companies.

Subsidies

The energy laws of 1999 not only prohibit cross-subsidisation but also require increased productivity and lower tariffs. Tariffs are to be aligned with those in other EU member states. Achieving these goals at the same time will not be an easy task. CCEG and CREG monitor the markets to ensure that no cross-subsidisation between different consumer groups exist. But two types of cross-subsidy remain: “social” electricity and gas tariffs, and “energy grants” for low-income households. The effective income transfer from the lower electricity and gas tariffs to low-income households is about €100 for each of some 190,000 low-income households annually. In addition, low-income consumers pay no fixed charges and receive 500 kWh of electricity and 2,000 MJ of natural gas free per year. Some 500 to 1,000 litres of “free” heating oil per year are granted to poor households, about 20-40% of their average annual consumption.

A grant of a fixed amount of “free” energy to all residential consumers, not just the poorest of them, has been introduced in Flanders where all low-voltage consumers receive 100 kWh of free electricity every year. Following a recommendation by the CCEG, all low-voltage consumers throughout Belgium were given a reduction of BF 500 on their electricity bill for the year 2000. The income loss is made up by charging a higher price for each additional unit of energy consumed above the granted amount, thus penalising larger consumers.

DATA PROCEDURES

On 20 July 2000, the federal government approved a draft law on the organisation of the electricity market and the collection of data on energy. The draft law modifies the framework law of 29 April 1999 and provides a legal basis for speeding up the collection of data on Belgian energy balances. At this date (June 2001) the law has not been passed but should be by the end of the year.

CRITIQUE

Belgian energy policy formulation is inevitably complex in that it has to deal simultaneously with the new federal-regional governmental structure, with the introduction of competition in both the electricity and gas markets, and sustainable development issues, including global climate change.

Cellule CONCERE/ENOVER co-ordinates inter-regional and federal-regional co-operation, but its task has become larger as more policy issues and technical details have to be considered. For example, the Cellule has to ensure that the regions do not set different schedules and conditions for market liberalisation since this could distort competition at the national level. Compliance with the national Kyoto target requires close co-operation among regions because reduction targets will be allocated to sectors, not regions. Also, energy efficiency measures are taken mainly at the regional level; the three regions should share their expertise and lessons learned. Currently, the Cellule has no permanent staff or budget, and this hampers its effectiveness.

The lack of resources in regional energy administrations has delayed the implementation of some measures. The energy administration of the Brussels-Capital region employs only three people. As more and more energy issues call for timely action and expertise in specific fields, resource constraints are felt at the federal level. One way to compensate for insufficient internal resources in government would be to seek external help from energy consultants or other sources.

Consistency in actions taken at the federal and regional levels is an important condition for achieving an effective competition environment in Belgium. Currently, each of the three regions is developing its own policies for market liberalisation, and this has resulted in inconsistency and inefficiency. Furthermore, regional legislation has not been completed. This is partly because federal legislation is also incomplete and the regions are waiting for it to be finalised.

In the electricity and gas markets, there will be two federal regulators in the transition phase (CREG and CCEG). In addition, the three regions will have their own regulatory bodies. Close co-operation between these regulatory bodies is necessary in order to avoid segmentation of the market and complex regulatory procedures. Ideally, they should be integrated. One concern is that the regulator of Brussels-Capital is not independent, for this function is carried out by the energy administration and the government. The regional government has yet to make a final decision on the arrangement of the regulatory functions.

The responsibilities of the new federal regulator for liberalised markets (CREG) and the regulator for captive markets (CCEG) are well defined and not overlapping. CREG is independent and has enough resources to carry out its current tasks. However, it is only an advisory body. The Ministry of Economic Affairs holds the power of decision. At present, the responsibility to ensure that there are no cross-subsidies is entrusted to CCEG, not CREG. Transferring certain responsibilities, such as tariff-setting for captive consumers, from CCEG and the Ministry to CREG would

boost confidence in the independence of decisions. Though the assignment of responsibilities between CREG and the regional regulators is clear in principle, problems may arise in practice. For example, CREG deals with regulation regarding the transmission network down to the 70-kV level, whereas CPTÉ⁹, the likely future grid manager, operates networks down to the 30-kV level, which are overseen by regional regulators.

There is no plan at the moment to split up the incumbents in the electricity and gas markets, so effective competition may be brought about only through their exposure to international competition. Many challenges may discourage a new supplier willing to enter the market, starting with the commercial conditions set by the network owners. Further technical problems include a complex establishment process, including reciprocity requirements, supply licences and grid codes. This process is likely to take a long time and there is no guarantee that the transmission tariffs for trans-boundary operations will be non-discriminatory. The electricity transmission network is highly congested, possibly limiting entry. Further, cross-shareholding among energy companies may become an obstacle to competition and remains a concern.

Because of the complexity of the government structure and the many changes resulting from regulatory reform in the electricity and gas sectors, it is not easy to ensure that all parties are adequately informed. Effective information-sharing is essential for transparency and for sending the right signals to industry so that it can prepare for a new business environment. Currently, actors in the different energy sectors, including those in government and industry, are having difficulty in following recent developments and preparing for the future.

Steps have been taken to improve the availability of data. One factor that has slowed down these efforts was the reluctance of companies to provide data in a more competitive business environment. The government has addressed this problem in new legislation, but there is still room for improvement. In mid-2000, information on electricity prices and taxes for 1998 was pending. At the end of 2000, the 1999 statistics were not yet completed. While Belgium is not unique in this regard, more rapid data processing and availability would improve monitoring and competitive conditions in the energy sector. More frequent forecasts of energy consumption, production methods and CO₂ emissions would assist subsequent monitoring.

By law, electricity tariffs for small consumers are coupled with electricity prices in other countries of the EU. It is not economically efficient to tie prices in Belgium to those in other countries. Generation, transmission and distribution costs are usually specific to each country and prices should be based on cost.

Even though cross-subsidisation is prohibited by law, it exists between household energy users to meet a social objective. The government should strive to rectify this situation. Social objectives are better achieved by direct support to the needy.

9. Company for the Co-ordination of the Production and Transport of Electricity.

Granting “free” energy, electricity and gas to small end-users raises concerns about energy efficiency. The amount currently granted is small, but once such a system is in place, it may be irreversible. The government sees this approach as a means to promote energy efficiency: electricity consumed above the granted amount will cost more per kilowatt-hour than the average price, and this higher price for additional units will, it is argued, reduce consumption. Consumers, however, generally use energy more rationally if prices accurately reflect costs. The grant of free electricity was introduced to extend the benefits resulting from market liberalisation to smaller consumers who cannot yet buy from the open market, and to help low-income households. For better cost-reflectiveness and transparency, it would be advisable to reduce the tariffs for captive markets rather than giving grants.

RECOMMENDATIONS

The Government of Belgium should:

- Strengthen the capacity of CONCERE/ENOVER to develop detailed conditions for market liberalisation, and to set quantitative targets and concerted measures to reduce greenhouse gas emissions.
- Increase co-operation between CONCERE/ENOVER and the new federal institutions established to support sustainable development.
- Consider the possibility of employing consultants or other outside help to assist the federal and regional governments to efficiently carry out present and future activities.
- Maintain close co-operation between the federal and regional governments so that they can take concerted action to liberalise markets. Measures taken by the regions should be consistent.
- Review the need for five independent regulators in the electricity and gas sectors. If multiple regulators are needed, Belgium should ensure strong co-ordination among them.
- Ensure that CREG (the Commission for Electricity and Gas Regulation) has enough regulatory power and resources to discharge its increasing responsibilities.
- Ensure that cross-shareholding in the electricity and gas sectors does not distort competition.
- Ensure that industry is well informed about future market developments through participation in policy discussion with the federal and regional governments.

- Develop effective tools for timely monitoring of developments in energy markets, including the prompt availability of high-quality energy data.
 - De-couple price setting for captive markets from prices in neighbouring countries.
 - Phase out subsidies to low-income consumers and instead use social policy instruments to tackle fuel poverty. Energy should not be provided free of charge in order to avoid inefficient energy use.
-

ENERGY AND THE ENVIRONMENT

ENERGY AND SUSTAINABLE DEVELOPMENT

In Belgium, energy and environmental policies are discussed in the broad context of sustainable development. Energy is recognised to be crucial for economic and social well-being, but is also seen as creating obstacles to achieving sustainable development.

The sustainable development law of 1997 obliges the government to prepare a Federal Plan for Sustainable Development every four years. The first such plan (for 2000-2004) was adopted by the federal government on 20 July 2000. It defines federal policies concerning production and consumption, poverty, agriculture, the marine environment, bio-diversity, energy, transportation, ozone and climate change. The plan includes many suggestions drawn from public consultation and has a chapter on sustainable energy wherein:

- Reducing primary energy consumption by 7.5% in 2010 compared to 1990 is a priority.
- Agreements should be concluded between the federal government and the regional governments to promote renewables.
- If no agreement at EU level is reached, Belgium will unilaterally take steps to introduce energy/CO₂ taxation.

TRENDS IN CO₂ EMISSIONS

In 1998, CO₂ emissions from both the transformation and use of energy in Belgium reached about 122.5 Mt compared to 106.2 Mt in 1990 (international marine and aviation bunkers excluded). The proportion of energy-related CO₂ emissions out of total CO₂ emissions has remained at 90-91% during the last ten years, and the proportion of energy-related GHG emissions was 79% of the total. In the energy sector, CO₂ emissions represent 97% of total GHG emissions, suggesting that non-CO₂ GHG emissions are marginal in the sector.

Energy-related CO₂ emissions declined in the early 1980s, remained stable in the late 1980s, and increased in the 1990s. CO₂ emissions from coal have decreased slightly, whereas those from oil and natural gas have increased (see Figure 8). This growth in emissions cannot be attributed to specific sectors as they all

Belgium and Sustainable Development (SD)

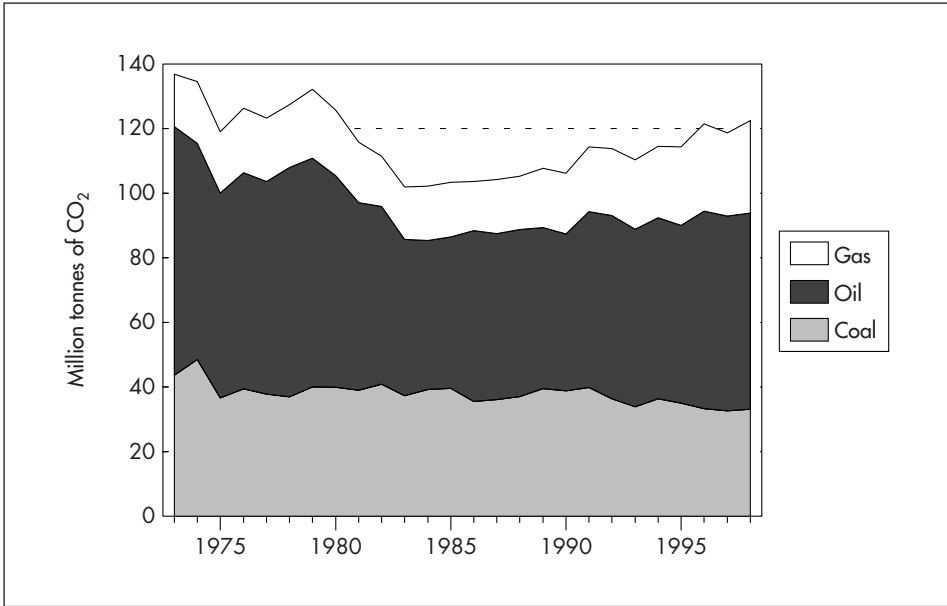
The Federal Planning Bureau prepares a Federal Report on SD every two years that explains what the current environmental, social and economic issues in Belgium are and which SD policy measures have been taken. It describes which developments might be expected under a business-as-usual scenario compared to one where SD policies are introduced or strengthened.

The report serves as a basis for the Federal Plan for SD which defines the measures and actions that need to be taken at the federal level to achieve SD objectives. The plan is prepared by the Federal Planning Bureau and is based on recommendations from the Inter-departmental Commission for Sustainable Development (ICDO-CIDD) and from public consultation. ICDO-CIDD is a new body with high-level representatives from the federal government, the Federal Planning Bureau and each region and community. It produces an annual progress report on SD policies and the implementation of the federal plan.

Another new body established by the law of 5 May 1997 is the Federal Council on Sustainable Development (FRDO-CFDD). It represents civil society organisations such as environmental and development groups, consumers and trade unions, employers' federations, energy producers and scientists. Federal and regional government representatives can express only an advisory vote at FRDO-CFDD meetings. The FRDO-CFDD gives policy advice to federal authorities at the parliament's request and on its own initiative. In addition to playing an advisory role, it acts as a forum to encourage the sustainable development debate, for instance by organising symposiums where experts, representatives of government and civil society, and the general public can give their points of view and engage in a dialogue. Results from these meetings are included in the council's recommendations. It has also been given the task of making organisations and citizens aware of sustainable development issues. The FRDO-CFDD reports on its activities annually.

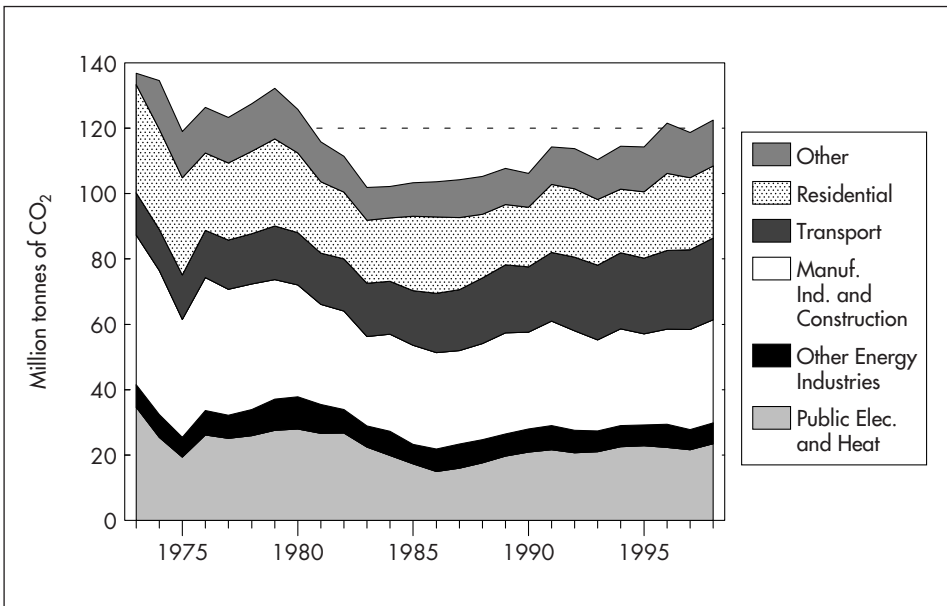
have slightly increased their CO₂ emissions during the last ten years (see Figure 9). Energy-related CO₂ emissions per GDP in Belgium are slightly higher than in its neighbours Germany and the Netherlands, and significantly higher than the IEA average for Europe (see Figure 10). Between 1990 and 1998, energy-related CO₂ emissions per capita have increased in Belgium by 12.7%, from 10.65 to 12 tonnes of CO₂ per capita.

Figure 8
CO₂ Emissions by Fuel, 1973-1998



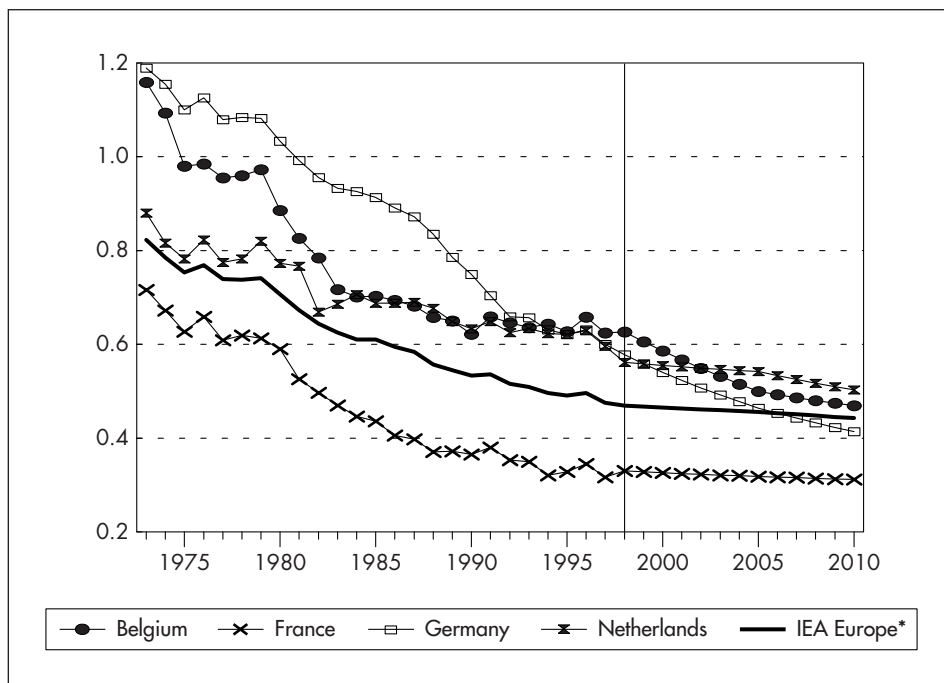
Source: *CO₂ Emissions from Fuel Combustion*, IEA/OECD Paris, 2000.

Figure 9
CO₂ Emissions by Sector, 1973-1998



Source: *CO₂ Emissions from Fuel Combustion*, IEA/OECD Paris, 2000.

Figure 10
**Energy-Related CO₂ Emissions per GDP(PPP) in Belgium
 and in Other Selected IEA Countries, 1973-2010**
 (kilogrammes CO₂ /US\$ using 1990 prices and purchasing power parities)



* excluding Norway from 1999 onwards.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2000; *National Accounts of OECD Countries*, OECD Paris, 2000, and country submissions.

CO₂ EMISSIONS REDUCTION TARGETS

In June 1991, the Council of Ministers adopted a target for achieving by 2000 a reduction in CO₂ emissions of 5% compared to 1990 levels. No specific target was set for the energy sector. Belgium ratified the UN Framework Convention on Climate Change (UNFCCC) in January 1996. Under the Burden-Sharing Agreement, the European Union has made a commitment to reduce, individually or jointly, GHG emissions to 8% below their 1990 level by 2008-2012. Belgium has agreed to reduce its GHG¹⁰ emissions by 7.5% by that period.

Belgium is currently preparing a National Climate Plan that identifies reduction targets by sector rather than by region. Several background studies have been

10. The Burden-Sharing Agreement covers CO₂, CH₄, N₂O, PFCs, HFCs and SF₆.

conducted to estimate future GHG emissions under different scenarios. The Ministry of Economic Affairs recently commissioned a study¹¹ to examine the potential for reducing CO₂ emissions by introducing additional measures in the electricity sector. This comprehensive study was completed in 2000 and was used to prepare the National Climate Plan. After the regional governments criticised some of the basic assumptions of the study (e.g. those concerning transport), some estimates were revised, but regional governments still harbour reservations.

The study discusses four different scenarios, each assuming that CO₂ emissions would not be affected by the planned phase-out of nuclear power which is scheduled to start two years after the Kyoto target period of 2008-2012. The reference (baseline) scenario takes into account the impact of existing policies on renewables, energy efficiency and CHP. CO₂ emissions from energy transformation and use alone are estimated to increase slightly above the current level. The second scenario assumes the introduction of EU-wide energy taxation, and expects emissions to remain approximately at the current level. The third one, the “3B energy tax scenario”, assumes Belgian energy taxation at the same level as average energy taxation in France, Germany and the Netherlands. In this scenario, a slight reduction in emissions is expected compared to current levels, but the emissions would still exceed the 1990 level by 4.8%. Both the EU tax scenario and “3B scenario” assume that industry would be subject to CO₂ taxation; with current energy taxation, industry is mainly exempted. The fourth scenario assumes the introduction of a CO₂ tax set at a significantly higher level and applied to all consumer groups. As neither a European energy tax nor the alignment of Belgium’s energy taxes on those of its neighbours would be sufficient to achieve a 7.5% reduction in emissions, a CO₂ tax would be needed along with domestic measures. Table 4 describes the estimated emissions reduction under each scenario (including adjustments made by the federal government).

Table 4
Change in Belgium’s CO₂ Emissions under Different Scenarios

<i>Scenario</i>	<i>Excess in 2010 compared to 1990 level</i>
Reference (baseline) scenario	+10.2%
European energy tax scenario	+7.8%
“3B energy tax scenario”	+4.8%
Kyoto scenario (CO ₂ tax scenario)	-7.5%

Source: *Projet de Plan Climat National*, Cabinet of the State Secretary for Energy and Sustainable Development, Belgium, 2000.

11. *How to Achieve the Kyoto Target in Belgium, Modelling Methodology and Some Results*. Katholieke Universiteit Leuven. Working Paper Series No 2000-9.

CURRENT RESPONSES

National CO₂ Programme and the National Climate Plan

To meet the target set in 1991, the Council of Ministers and regional governments approved the National CO₂ Programme in 1994. It selected 14 categories of measures concerning essentially energy conservation and quantified expected emissions reductions. The implementation of the programme was not successful for several reasons. First, the target assumed the implementation of European carbon and energy taxes, which never occurred. Second, the status of the programme was not well defined and the division of responsibilities among the main actors was unclear. Third, progress was not monitored.

In 1996, it was already evident that the target set in 1991 would not be achieved. After the Kyoto commitment, a decision was taken to replace the CO₂ Programme with the National Climate Plan which will be completed by mid-2001. The plan will cover all greenhouse gases, not only CO₂. The government intends to introduce operational targets by sector, taking into account the economic structure of the regions, but without setting specific regional targets. Both national measures and Kyoto flexible measures will be considered according to their cost-effectiveness.

The Commission for the Analysis of Methods for the Generation of Electricity and the Re-evaluation of Energy Vectors (the AMPERE Commission) has formulated recommendations and proposals for future power generation options. This work is carried out in the context of the national Kyoto commitment and the progressive phase-out of nuclear power, and takes into account the need to increase demand-side management efforts and to develop renewable energy schemes. The findings were published at the end of 2000. The commission considers energy conservation to be crucial for meeting the national Kyoto target. It underlines the importance of consumer information, labelling and standards, energy audits, third-party financing, and transparent full-cost pricing of electricity that reflects the environmental externalities of different forms of energy. On the supply side, the report is favourable to combined-cycle gas turbines, renewables and co-generation, and discourages the use of coal considering the current level of technology.

Regional Policies for Reducing GHG Emissions

Flanders

About six million people - more than half the population of Belgium - live in Flanders which, in terms of land area, is slightly smaller than Wallonia. In 1998, the share of different CO₂ emitters in total emissions in Flanders was: final energy users, 59.5%; energy transformation, 31.6%; and non energy-related sources, 8.9%. About 70% of Belgian chemical industries, the largest industrial sector in the country, are located in Flanders.

The national emissions reduction target has not been allocated to the regions yet, but Flanders has set its own target to reduce CO₂ emissions in 2010 by 7.5% compared to 1990. In 1998, total CO₂ emissions (82 Mt) in Flanders exceeded the 1990 level by 18%. In a business-as-usual scenario, the emissions would exceed the target level by 26.6 Mt (*i.e.* 30%) in 2010.

Flanders decided to revise its Plan for CO₂/Rational Use of Energy (*CO₂/REG Beleidsplan*) in 1999 to take into account the observed growth in CO₂ emissions. The major change to the original plan, introduced in 1994 and revised in 1996, was the inclusion of quantitative targets. The present plan examines the cost-effectiveness of various measures and suggests different policy options.

The proposed measures and the estimated reduction potential are presented in Table 5. In total, Flanders has already identified a reduction potential of 12.2 Mt of CO₂ emissions. Slightly more than half the total reduction is estimated to come from increasing the use of renewable energy and CHP. As regards renewable energy, the objective is to increase its proportion in the primary energy supply from 0.5% in 1996 to 5% in 2010; for CHP, the goal is to install 1,200 MW additional capacity during 1995-2005. Flanders recognises the need for additional measures in the industrial and transportation sectors.

According to the plan, effective measures tend to be costly. Energy efficiency can be improved by reducing standby losses for audio-visual equipment, increasing the use of energy-efficient appliances, promoting passive solar heating, and enforcing insulation standards in buildings. These measures may be cheaper than introducing renewables and CHP, but their overall impact is modest.

Table 5
CO₂ Reduction Measures in Flanders

<i>Measure</i>	<i>Reduction potential, Mt</i>
Renewables target (5% in 2010)	3.9
CHP target (1,200 MW _e new capacity 1995-2005)	3.3
50% replacement of electrical heating by gas in new houses	1.0
Use of energy-efficient bulbs in residential and service sectors	0.44
Replacement of old heating installations	0.28
35 other measures studied, together	3.28
Total	12.2

Source: Plan for CO₂/Rational Use of Energy (*CO₂/REG Beleidsplan*), Ministry of the Flemish Community, Department of Natural Resources and Energy.

Wallonia

The region of Wallonia, which covers more than half of Belgium, has a population of 3.3 million. It has a strong tradition of energy-intensive industries producing iron, steel, glass and cement, but the number of small enterprises in light industry is growing.

The Environment Plan for the Sustainable Development of the Walloon Region (PEDD) of 1995 includes a section on energy and the environment. In accordance with the Belgian National Programme for Reducing CO₂ Emissions of 1991, the region adopted a target to reduce CO₂ emissions by 5% during the period 1990-2000, but emissions in 1998 still exceeded the 1990 level.

Wallonia is elaborating a programme (the Air Framework/*Plan de l'Air*) which will set emissions reduction targets for all air pollutants. It will come into force in 2002. At present, working groups are being set up to address each major atmospheric pollutant; priority will be given to reducing greenhouse gases.

Wallonia considers that a rational use of energy, increasing the use of renewable sources and promoting co-generation are important policy measures for CO₂ emissions abatement.

Brussels-Capital

Energy use in buildings and the transport sector represents 95% of energy consumption in Brussels-Capital. The region has very few large production facilities, but a great number of small and medium-sized enterprises. It does not have a specific plan for reducing GHG emissions and instead uses an approach based on overall emissions, and air quality management. In 1998, the Brussels government adopted an order related to the assessment and improvement of air quality. It includes measures for the transport sector that aim to reduce fuel use and, consequently, CO₂ emissions. In general, improving energy efficiency is the main tool used for reducing CO₂ emissions in Brussels-Capital (see Chapter 5).

CRITIQUE

In 1998, CO₂ emissions from energy transformation and use in Belgium were 15.3% above the 1990 level. A number of factors can explain this increase. First, energy consumption has increased by more than 20% in all sectors since 1990, and both transportation and industrial activities have grown significantly. Second, low prices of some energy products may have stimulated consumption. Third, government policies have been heavily dependent on the implementation of a European carbon tax that has not yet been introduced. Last, the growth of electricity consumption has more than offset the CO₂ emissions reduction per unit of electricity generation achieved in the power sector.

Currently, the national Kyoto target has no breakdown by region or sector. However, regions have voluntarily introduced their own targets. The National Climate Plan will be completed in mid-2001, a year and a half behind the original schedule. The government has announced that the plan will identify reduction targets by sector rather than by regions. Since most emissions reduction measures are taken at the regional level, it is important that such targets are set so that the regional governments can easily monitor achievements. Both the federal and

regional governments should take note that the lack of monitoring was one of the fundamental reasons for the limited success of the National CO₂ Programme introduced in 1994. They now need to work together to develop effective monitoring.

To reduce CO₂ emissions, regional governments are already adopting a variety of measures, including promoting efficiency in energy supply (e.g. CHP) and end-use (e.g. insulation standards, energy auditing and voluntary agreements), and are increasing the use of fuels with no or low emissions (renewables and natural gas). Many of the initiatives are too recent for their benefits to be assessed. However, achieving the GHG emissions reduction targets is likely to be very challenging, and the existing and planned measures do not seem sufficient. The federal and regional governments will thus have to increase their efforts. Their close co-operation is essential to share experiences, develop new cost-effective measures and pool resources to address common problems. The federal and regional governments will have to analyse the cost performance and potential of different measures, and include the most effective ones under the new National Climate Plan. They need to share this information nationwide, particularly in the area of renewables and CHP, where regions are taking independent action at present. Establishing co-operation agreements between the federal and regional governments may be useful. It is also important that the federal and regional governments develop close communication with the industrial sector in order to be better informed and able to implement cost-effective and practical measures, and to provide a more secure policy environment in which industry can take long-term investment decisions.

Certain supply-side measures have been implemented effectively. The use of CHP has grown and the increased use of natural gas has reduced emissions from electricity generation. Such measures should be facilitated and more market-oriented; for example, subsidies for CHP need reassessment (see Chapter 7 on co-generation).

More attention should be paid to demand-side measures. It will be extremely difficult to meet the national Kyoto target of a 7.5% GHG reduction below 1990 levels by 2010. Emissions reduction potential exists in all sectors and it should be explored vigorously. For example, the number of building code violations with respect to energy efficiency is huge and the majority of new buildings do not comply with standards. Unless legislation is strictly enforced, energy efficiency improvement and consequent emissions reduction will not be achieved. In the industry sector, voluntary agreements and increased auditing may prove to be cost-effective methods for reducing energy consumption and increasing efficiency. Strong individual preferences related to the use of private vehicles reduce the price elasticity of demand and make it more difficult to exploit the potential for emissions reduction. Improving the energy efficiency of transport and developing attractive alternatives to using private vehicles should be encouraged.

The Federal Plan for Sustainable Development states that if no European carbon tax is introduced, Belgium will take steps to establish its own taxation scheme. According to recent studies, existing programmes are not effective enough to meet emissions reduction targets. Therefore, Belgium is considering introducing

stronger measures. A new carbon tax for gasoline, diesel and heavy fuel oil will come into force in 2002. The tax will be extended to other fuels but the details have not yet been announced. Belgium is currently applying one of the lowest taxes on energy within the EU, and energy prices for the industrial sector are approximately at the same level or lower than in neighbouring countries. Belgium should be able to introduce a carbon tax without seriously jeopardising its industrial competitiveness, even though neighbouring countries do not have such a tax.

The prevailing energy taxes have been set only for fiscal purposes and do not reflect externalities of the fuels, such as their environmental impact. For more transparency, it would be better to levy separate environmental taxes rather than adjust energy taxes to reflect environmental targets.

The Federal Plan for Sustainable Development fixes a national target for energy sources, of which renewables will represent 3% by 2004, compared to the current 1.3%. The regions will introduce green certificate systems (see Chapter 11) to increase the share of renewables in their energy balances and, as a hoped result, reduce CO₂ emissions. Flanders will be the first to implement a green certificate system in 2001, and the other regions are in the process of defining their own systems. A complementary federal system will be developed for offshore wind power. A collaboration agreement for co-ordinating the different systems has been signed. However, unless nationwide green certificate trading is introduced, the uniform national target for renewables will not be economically optimal. The regions have different resources and the cost of renewable energy use varies among them. These cost differences could be levelled by nationwide green certificate trading. The introduction of fines, along with existing subsidies which are supposed to encourage the development of renewable energy throughout Belgium, may in fact lead to the construction of power plants that are not economically viable.

A practical approach for achieving the national Kyoto target would be to ensure the effectiveness of each policy measure – including green certificates, subsidies, standards for energy efficiency improvement, tax abatement and energy taxes – that has been taken now or will be taken in the future. It is therefore important that the federal and regional governments monitor closely the progress that has been made in each area of their responsibilities to determine whether or not the measures are effective.

RECOMMENDATIONS

The Government of Belgium should:

- Give priority to environmental aspects of the national energy policy, bearing in mind the large gap between Belgium's Kyoto target and current greenhouse gas emissions.

- Speed up the development of a national plan for reducing GHG emissions.
 - Consider introducing co-operation agreements between the federal and regional governments for sector-specific projects on the rational use of energy, renewable energy sources, CHP, and on research technology, research and demonstration.
 - Initiate a consultative procedure involving federal and regional authorities and industry to define a set of concerted actions to reach the national Kyoto target.
 - In the National Climate Plan, give precedence to measures - on both the supply and demand sides - according to their potential to help meet the Kyoto target in a cost-effective manner.
 - Ensure that future policy measures, including green certificates, standards for energy efficiency improvement, subsidies, tax abatement and energy taxes are effective in meeting their policy objectives. The green certificate system should be introduced in the different regions at the same time as a nationwide trading system. Tools should be developed to monitor the performance of these policies.
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ENERGY EFFICIENCY

POLICY FRAMEWORK

Responsibility for energy efficiency, including related R&D activities, belongs fully to the three regional governments. The federal government's role is confined to co-ordinating regional activities. Policies relating to energy efficiency are co-ordinated through the regular meetings of the Cellule CONCERE/ENOVER.

The federal target for reducing energy consumption is stated in the Federal Plan for Sustainable Development. The plan calls for a reduction in energy consumption of 7.5% below the 1990 level by 2010.

Flanders has formulated two policy objectives for energy efficiency: reducing energy consumption in the residential sector and increasing energy efficiency in the industrial and service sectors. The Flemish Energy Policy Document for the Period 2000-2004 sets targets for both objectives but without specifying quantitative targets. First, energy consumption in the residential sector should be lower in 2004 than in 1998. Second, energy efficiency in the industrial and service sectors should be improved by 2004 compared to 1998. In the residential sector, emphasis is put on energy performance standards for new buildings and on informing the public about the importance of efficient insulation. Benchmarking methods are applied for energy-intensive industries, and financial support is given to industry to take energy efficiency measures, including energy audits. The Flemish government is trying to develop standards for the rational use of energy.

Wallonia aims to reduce energy consumption, improve energy efficiency and, at the same time, reduce prices. Energy efficiency is regarded as an important instrument for keeping industry competitive. The regional government has voluntary agreements with industry to improve energy efficiency; other initiatives include energy auditing, promotion of R&D and increased use of CHP. CO₂/Energy meetings are held periodically with industry and the public to promote the rational use of energy.

Brussels-Capital is the only region that has adopted the federal energy efficiency improvement target (*i.e.* reducing primary energy consumption by 7.5% in 2010 compared to 1990). Emphasis is put on the energy efficiency of buildings in Brussels-Capital, where the household and service sectors are the greatest energy consumers. Mandatory insulation standards were set for buildings at the beginning of 2000.

INSTITUTIONAL FRAMEWORK AT THE REGIONAL LEVEL

Co-ordination and monitoring of energy efficiency programmes in Flanders are the responsibility of VIREG (Flemish Institute for Rational Use of Energy/*Vlaamse Instelling voor het Rationeel Energiegebruik*), created in 1997. VIREG works as a

platform for co-operation among the Flemish government, energy production and distribution companies, and industrial and residential energy users. It encourages various stakeholders in energy efficiency policy to actively interact. VIREG co-ordinates regional initiatives in the field of rational energy use and ensures that funds are used effectively to meet the region's policy objectives. The institute's tasks include monitoring regional energy consumption, estimating energy-saving potential, planning and executing actions related to energy use and monitoring their effectiveness.

The overall co-ordination of energy efficiency efforts in Wallonia is carried out by the Walloon Region Energy Department. It monitors energy efficiency through annual regional energy balances and by using a detailed energy consumption "monitoring board", which is a statistics-reporting method integrated with forecasts.

In Brussels-Capital, the co-ordination of energy efficiency measures is carried out by the energy administration. It monitors the development of energy efficiency efforts at the macro level through energy balances.

Based on the 1996 recommendation of the Control Committee for Electricity and Gas (CCEG), two funds were established to finance regional energy efficiency programmes. Electricity distributors pay BF 0.01 to the RUE¹²/Electricity Distribution Fund for each kWh sold. The fund is used for promoting energy audits, investments in thermal solar energy, more efficient lighting, and installing heat pumps, solar boilers, condensation boilers and CHP units, *etc.* Funds collected in the three regions for the CCEG totalled BF 442 million in 1999. In Flanders, activities financed by the fund are defined and adopted within the framework of the VIREG. In Wallonia, the use of funds is decided jointly by the energy administration and the electricity sector. In Brussels-Capital, the energy administration and the *intercommunales* will determine how the funds will be used once a co-ordinator has been nominated.

The second fund, the RUE/Electricity Generation Fund, was established mainly to promote efficiency in electricity generation and to finance demand-side management (DSM). The annual contributions by electricity producers to the fund have varied between BF 200 million (1996) and BF 300 million (1998). The total budget available for the year 1999 was BF 350 million out of which BF 43 million were used to finance DSM. The fund is managed jointly by the electricity generators and the federal Energy Administration.

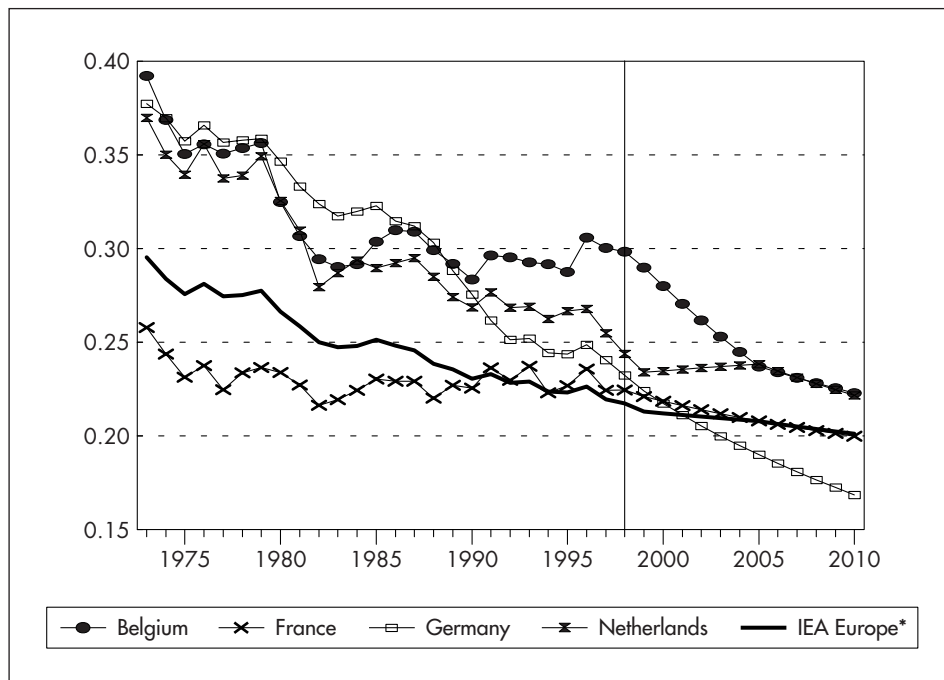
ENERGY DEMAND AND TRENDS

Energy demand is growing in both absolute and relative terms. Energy intensity as measured by total primary energy supply per GDP (measured in toe per 1990 US\$) in 1998 was about the same as in 1990. However, electricity consumption per GDP grew by 9.9% between 1990 and 1998.

12. RUE - Rational Use of Energy.

Figure 11

Energy Intensity in Belgium and in Other Selected IEA Countries, 1973-2010
 TPES (Toe)/GDP (thousand US\$ at 1990 prices and purchasing power parities)



* excluding Norway from 2000 onwards.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2000; *National Accounts of OECD Countries*, OECD Paris, 2000, and country submissions.

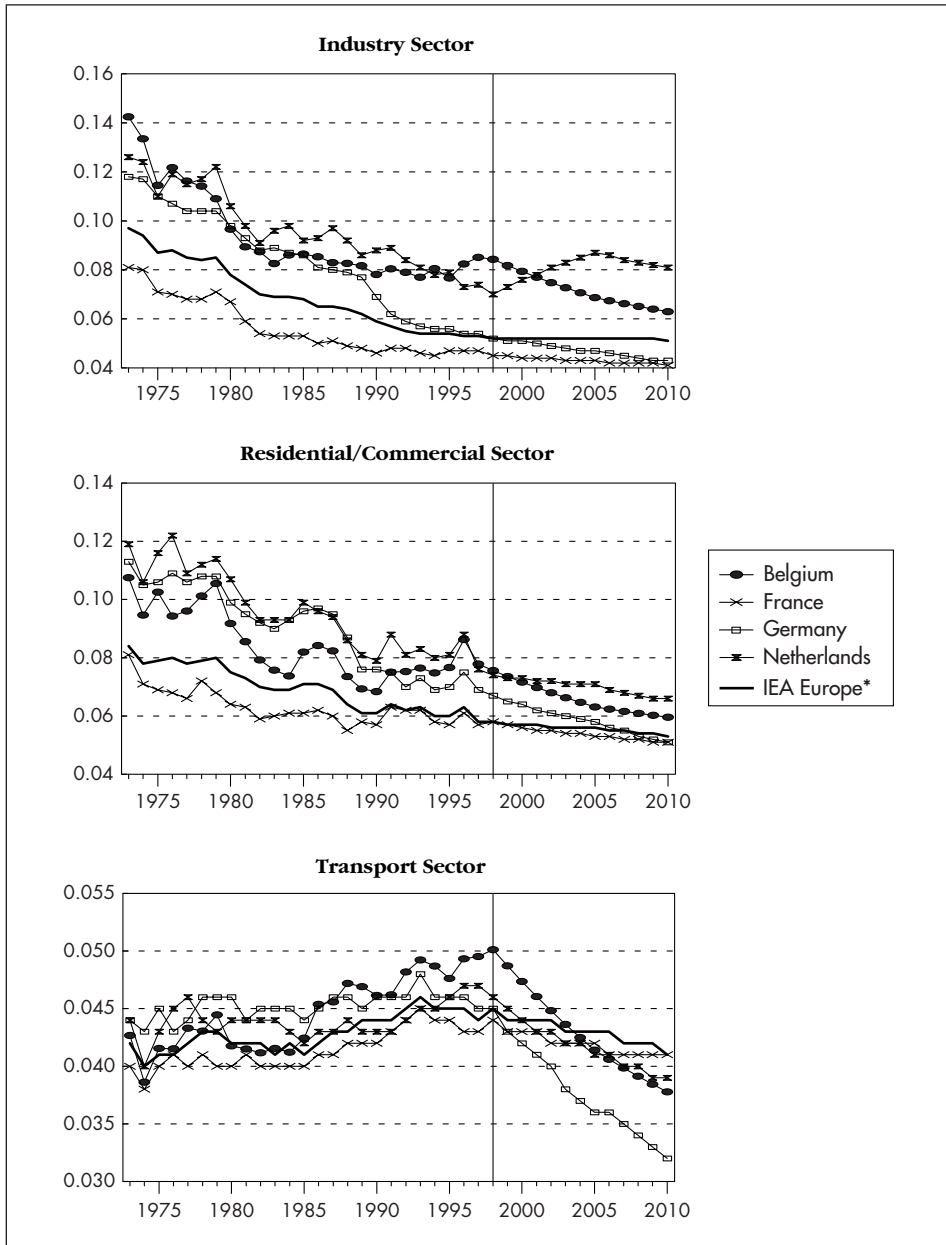
SECTORAL TRENDS AND POLICY INITIATIVES

Industrial Sector

The industrial sector accounted for 41.6%¹³ of final energy consumption in 1999. The most energy-intensive industries are petrochemical, chemical, and iron and steel industries, accounting for 65% of total industrial energy consumption. Industrial energy consumption grew by 24.2% from 1990 to 1998. During the same period, industrial production increased by 9.7%, leading to increased energy intensity in the sector. Because of measures already taken – or to be taken in the near future – by regional governments, the Belgian government expects a 25% improvement in energy intensity for this sector by 2010 over 1998 levels.

13. Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2001. If naphtha, used as feedstock by petrochemical industries, is not included in industrial consumption (method used by Eurostat and the Belgian Energy Administration), the share of industries in total final energy consumption is 30.5%.

Figure 12
Energy Intensity by Sector in Belgium
and in Other Selected IEA Countries, 1973-2010
 Final consumption (Toe)/GDP (thousand US\$ at 1990 prices and purchasing
 power parities)



* excluding Norway from 1999 onwards.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2000; *National Accounts of OECD Countries*, OECD Paris, 2000; and country submissions.

Measures taken by the regions include information dissemination and technical assistance, voluntary agreements, energy efficiency obligations for electricity generators, energy audits, tax abatement and direct subsidies for energy efficiency investments. However, practices vary from region to region.

In Flanders, VITO (Flemish Institute for Technological Research/*Vlaamse Instelling voor Technologisch Onderzoek*) provides various information and technical assistance services to raise the energy efficiency awareness of industry and the general public. Wallonia has introduced a free consulting service, the RUE Broker, for small and medium-sized enterprises. The RUE Broker analyses the energy balance of the enterprise, detects major problems, proposes solutions and advises on financing, including the use of subsidies and other incentives available in the region.

Flanders will introduce voluntary agreements for energy-intensive industries - such as the chemical, metallurgical and paper industries - in 2001. These agreements will be based on benchmarking, and on a commitment by the larger companies to bring their energy efficiency up to par by 2012. Smaller companies will be requested to make energy-saving investments with a pay-back time of less than five years. Periodical energy audits will define suitable investment programmes. Wallonia has already taken first steps to introduce voluntary agreements for different industrial sectors. The first sectors to sign a letter of intent were the chemical and paper industries in July 2000. Within twelve months of signing these letters of intent, the industries will sign the actual voluntary agreements to reduce energy consumption by 2010. In Brussels-Capital, as the industrial sector is small, instead of voluntary agreements the region has introduced a voluntary labelling programme called Eco-dynamic Enterprise. In order to receive the label, a company must sign a charter committing itself to respect a number of principles of ecological management, several of which are closely linked to a rational use of energy.

Energy efficiency obligations will be set for electricity suppliers in the liberalised electricity markets. Flanders will impose minimum energy efficiency standards for Flemish electricity suppliers in 2001. Wallonia will introduce incentives for electricity suppliers to promote rational energy use among their clientele, and Brussels-Capital has made a proposal for an ordinance with public service obligations for rational use of energy.

In 1999, the Walloon government adopted a decree concerning environmental permits¹⁴. Permit applicants will be obliged to perform energy audits and carry out

14. The IPPC Directive 96/61/EC (Integrated Pollution Prevention and Control Directive) of 1996 sets common rules on environmental permits for industrial installations of facilities and equipment. Almost all installations, except for only the smallest units, are required to obtain an environmental permit from the environmental authority. "Integrated" means that the permits must take into account all aspects of environmental performance of the plant: emissions to air, water and land; generation of waste; use of raw materials; energy efficiency; noise; prevention of accidents; risk management, *etc.* As from October 1999, the directive applies to all new installations, and eight years later it will apply to all existing installations that intend to carry out changes that may have significant negative effects on people or the environment.

energy accountancy. However, the procedure does not include energy efficiency requirements and the permits cannot be refused because of low energy performance.

Energy audits are carried out in different facilities and are subsidised in all the regions. However, practices vary. Flanders provides a 15% subsidy for small and medium-sized enterprises if the audit is carried out in connection with an investment project, and a 10% subsidy for all other industrial energy audits. In addition, the Flemish government employs five energy consultants who carry out pre-audits free of charge. Furthermore, small companies receive 50% financial support for the use of energy efficiency advisory services. Wallonia promotes energy audits by covering 75% of cost, and also intends to promote CAFE (*Comptabilité Analytique des Fluides et des Energies*), a tool for industrial energy management. It is an analytical accounting system for fluids and energy used in industrial processes, consisting of data collection, analysis, reporting and communication. Brussels-Capital subsidises 50% of the cost of energy audits and of feasibility studies for energy efficiency investments.

Since 1982, Belgium has applied a system of fiscal depreciation for energy efficiency investments made by industrial, commercial and agricultural businesses. Currently, 13.5% of the cost of these investments can be deducted from taxable income. Wallonia and Brussels-Capital apply the same percentage for energy efficiency investments, but Flanders applies its own additional 10% abatement for investments that aim to improve the efficiency of energy use in industrial processes.

All regions subsidise energy efficiency investments under legislation related to financial support for “economic expansion”. The level of subsidy varies according to the type of enterprise and other factors, such as the introduction of new energy-efficient processes, the promotion of R&D and the development of employment opportunities.

- In Flanders, subsidies are available to cover up to 20% of the energy saving investment costs for small and medium-sized enterprises, and 10% for large enterprises.
- In Wallonia, subsidies and soft loans are granted for energy efficiency investments.
- In Brussels-Capital, subsidies are provided to cover up to 20% of the cost of investments that increase energy efficiency and environmental protection.

Residential and Commercial Sectors

In 1999, energy consumption in the residential and commercial sectors represented 34.5% of total end use. Between 1990 and 1999, energy consumption increased by 21.9% in these sectors. Energy efficiency in buildings is very important, especially

in Brussels-Capital where the residential sector accounts for 42%, and the service sector for 21%, of total final energy consumption.

In both sectors, energy intensity was about 10% higher in 1998 than in 1990, although it is still significantly lower today compared to levels before 1980. The Belgian government expects strengthened regional policies to improve energy efficiency by more than 20% by 2010 compared to 1998 levels.

In the residential and commercial sectors, actions undertaken before 1998 – such as using more efficient electric appliances and bulbs, economic showerheads, solar boilers and heat pumps – are estimated to have brought 42.8 GWh in electricity savings during 1996-1998. This represents an annual average reduction of 14.3 GWh, or 0.06% of annual electricity consumption in the two sectors.

Several regional measures have been taken to disseminate information among the public and professionals to enhance energy efficiency. Energy information agencies and kiosks have been set up to provide practical information to the general public, and training programmes have been organised for key professionals such as energy managers in public buildings, architects and vocational school teachers.

Different financial incentives have been introduced by the three regions to improve energy efficiency in buildings. For example, Brussels-Capital gives a subsidy covering 20% of costs for energy efficiency investments made by municipalities, local public bodies, schools and hospitals. The region also subsidises energy audits in buildings to cover 50% of the cost with a maximum limit of BF 50,000. Wallonia grants a subsidy of maximum BF 55,000 to low-income households for energy efficiency improvements. It also allocates subsidies to municipalities for the replacement of inefficient public lighting, which can cover up to 70% of the investment cost. Energy efficiency investments in the residential sector will become eligible for tax abatement following a decision taken by the Federal Council of Ministers in October 2000. The estimated total cost of the measure that should enter into force by 2002, is BF 1.5 billion.

Inter-regional collaboration on building standards – including the inspection of insulation and ventilation regulations – takes place within the framework set by the Belgian Building Research Institute¹⁵. Its objectives are to prepare a manual for uniform inspection in Belgium and to elaborate a national Energy Performance Standard¹⁶. Implementation will be the task of the regions. Currently, all regions apply certain standards for insulation in new or retrofitted old buildings, and efforts have been made by the regions to harmonise their different standards, but some

15. The Belgian Building Research Institute (BBRI) is an applied scientific research and information institute for the Belgian construction sector. It was established in 1960.

16. Energy Performance (EP) standardisation is an approach for achieving a more energy-efficient built environment. The standards determine the calculation methods to be used for achieving a given indoor climate by optimising overall energy consumption and by addressing design, component and execution performances.

differences remain¹⁷. Severe problems are associated with the enforcement of building standards. According to a study carried out in Flanders, only one-eighth of individual houses and one-third of apartment buildings constructed after building standards had been introduced meet with the requirements. To address the problem of poor energy efficiency achievement, the number of inspections has been increased and additional measures are under consideration to enforce standards rigorously.

Several new initiatives have also been taken recently at the federal level. The federal government has been trying to introduce energy certification¹⁸ in buildings. The European directive on energy labelling of appliances¹⁹ has been transposed into Belgian law. Although metering of heating in apartments is applied on a voluntary basis, it has been installed very widely. As a result, energy costs are now allocated to each household to reflect actual consumption in 85% of all multi-family buildings with collective heating systems.

By the Royal Decree of 1997, the EU directive on energy efficiency and CE-labelling of boilers²⁰ was made into Belgian law. Federal and regional legislation for boiler inspections is becoming stricter with respect to emissions limits and more comprehensive in terms of boiler types. The models for energy planning in buildings and an energy/environment manual that are in preparation will be useful tools to enforce legislation. The Cellule CONCERE/ENOVER is co-ordinating implementation of these new measures.

Transport

During 1990-1999, energy consumption in the transport sector grew by 24.7%, and in 1999 transport accounted for 23.8% of final energy consumption. Energy intensity in the sector increased by almost 9% between 1990 and 1998. The Belgian

17. Flanders applies a tighter standard (K55) for new buildings in the public services sector than the other regions (K65). All three regions apply the same standard for new residential buildings (K55), but a new standard (Be450) that takes into account the free inputs of solar thermal energy is only applied by Wallonia. Brussels-Capital is the only region with a standard for offices (new built K65 + a standard for retrofitted offices). Standards for retrofitted buildings also vary.

18. The EU Directive 93/76/EEC of 13 September 1993 to limit carbon dioxide emissions by improving energy efficiency (SAVE) requires member States to draw up and implement programmes on energy certification of buildings, and to provide prospective users with information on a building's energy characteristics. In 1994, a study determined how to introduce building certification in Belgium by establishing the general conditions for building certification. The test phase was completed in 1999 and the implementation phase covers the period 1999-2001.

19. EU Directive 92/75/EEC of 22 September 1992 (and later amendments) on the indication (by labelling and standard product information) of the consumption of energy and other resources by household appliances.

20. EU Directive 92/42/EEC of 21 May 1992 on efficiency requirements for new hot-water boilers fired with liquid or gaseous fuels. According to the directive, before boilers are placed on the market they have to be labelled with an EC conformity marking (CE-label) to indicate that they conform with the provisions of the directive.

government expects the energy intensity of transport to decrease by almost 25% by 2010 compared to 1998 thanks to federal and regional measures and technological progress. For example, energy savings are expected from greater fuel efficiency of car engines and technical innovation resulting from voluntary agreements between car industries and the European Union.

The share of different transport modes in the transport sector's energy consumption in 1998 were: road transport, 78.4%; air transport, 16.6%; inland waterway transport, 3.1%; and railway transport 1.9%. Energy consumption by air transport has been growing. Over the past 10-15 years, the volume of road traffic (in vehicle-km) has been increasing dramatically, on some motorways by more than 100%. Traffic growth in Belgium was six times the OECD average in 1990-1995, and road density²¹ is the highest in any OECD country.

Only a few federal measures have been introduced to reduce energy consumption in transport. Vehicle taxes were originally implemented for solely fiscal reasons, but because they are progressive and based on engine power, they can also enhance energy efficiency. Examples of federal measures are:

- All employees who use a bicycle to go to work are rewarded BF 6 per kilometre on their way to work and back.
- Stricter speed controls with more stringent enforcement and increased fines.
- A vehicle registration fee that is very progressive based on engine power.
- An annual road tax on cars that is steeply progressive based on engine power.
- In 1996, a special tax on diesel-fuelled private cars was levied in addition to the annual tax to compensate for the differences in tax levels between gasoline and diesel.

Most of the initiatives for reducing car use and promoting alternative modes of transport are taken at the regional level. Some of these include developing transport plans and establishing mobility centres, promoting public transport, reducing the need for travel and introducing car-pooling.

The regions have introduced transport plans as a means of making employers and their employees more aware of their work-related transport needs and behaviour. A transport plan is composed of accessibility and mobility profiles (company characteristics having an impact on mobility); of a survey on employee preferences; of action and implementation plans; and of success evaluation. The objectives of transport plans are to increase awareness of fuel consumption and polluting emissions, and to make a contribution towards reducing congestion and,

21. Road density is an indicator showing the mean length of roads per unit of land. The indicator is expressed in km of roads per km². The road density in Belgium is 460 km/km².

consequently, time losses. The federal government has taken initiatives to introduce transport planning throughout the country, resulting in slightly postponed legislative action in the regions. Also, companies have noticed that preparing transport plans is bureaucratic and that they are too costly to implement. A more limited approach is now being sought.

Draft regulation concerning transport plans was drawn up by the Flemish region in 1997. Under this regulation, companies with 100 employees or more must draw up a transport plan. The initiative is being tested in the Flemish administration, and as a first step all employees are entitled to free train travel to and from work. Mobility Centres (*i.e.* advisory offices for transport planning) have been established in each of the nine provinces to inform companies of the advantages of transport plans and to provide support in preparing them. During 1994-1998, Mobility Centres prepared only 15 transport plans, which is far less than the government had expected. This may be because planning was carried out on a voluntary basis. Also, the evaluation of the impact of one transport plan indicated only a 3% reduction in the number of people driving to the office alone. Brussels-Capital has initiated transport planning in connection with its ordinance for improving air quality; each private or public employer with more than 200 employees per site must introduce transport planning. Wallonia intends to introduce it in the industrial and administrative sectors.

Since 1996, Flemish municipalities and public transport companies have signed mobility agreements that aim to promote public transport and improve communication between the partners. The agreements oblige municipalities to prepare mobility plans, which represent an integrated approach to mobility and accessibility in relation to land use, environmental protection and urban life quality. One constraint to this approach is that the plans are prepared by individual cities while the issues they deal with go beyond the city limits. However, a few cities in Flanders have implemented joint mobility plans in the hope that they might increase efficiency and bring economic benefits. In Wallonia, twenty pilot communities have signed mobility charters (*chartes de mobilité*) which are similar to the mobility agreements in Flanders.

The Flemish government is also investigating the feasibility of decentralising some regional services to reduce the need for mobility and hence decrease fuel consumption.

In January 1998, the Flemish government signed a contract with Taxistop, a private company that has organised car-pooling for decades, to encourage the practice. The service is free for individuals but companies have to pay from the second year on. ICARO, a demonstration project co-funded by the European Commission and Brussels-Capital, aims to develop a car-pooling centre in Brussels.

Brussels-Capital has taken a number of initiatives in the transport sector. The region requires that an action plan to promote the use of public, energy-efficient and environmentally sustainable transport be prepared for events drawing over 3,000 participants. The region is developing its train network. Also, if a regional public

body or institution has a car fleet of more than 50 vehicles, 20% of these should be “environment-friendly” in a few years from now, and 5% of the fleet of public transport companies operating at least 50 vehicles must be “environment-friendly”. However, the term “environment-friendly” still remains to be defined.

CRITIQUE

Both the federal and regional governments consider that reducing energy consumption and improving energy efficiency are important measures to reduce CO₂ emissions. However, until 1998, both energy intensity and CO₂ emissions in different sectors have been growing. In the past decade, Belgium has not been able to de-couple the growth of energy use from economic growth. While in the 1970s and 1980s energy intensity decreased in the industrial and residential sectors, it has increased in the 1990s. In the transport sector, energy intensity has grown, though not steadily, throughout the period between 1973 and 1998. Energy efficiency measures implemented during the 1990s have had only a modest impact.

It will be extremely challenging for Belgium to meet the 7.5% reduction target in energy consumption compared to the 1990 level by 2010 as stated in the Federal Plan for Sustainable Development. Depending on the sector, this is equivalent to a 20-30% reduction in consumption from 1999 to 2010. Despite a constant increase in energy intensity in the transport sector over the past two decades, a dramatic – and bigger than in most other European countries – decrease in energy intensity is projected for this sector. This will be very difficult to achieve because Belgium has not introduced a plan or profoundly changed its policies to address the problem.

Reducing energy consumption is mostly the responsibility of the regional governments. This means that effective policy should be developed at the regional level. However, the targets set by Flanders and Wallonia for energy conservation and energy efficiency are less ambitious than the federal target. It will be very difficult to meet the federal target unless the federal and regional targets are harmonised.

Most practical measures are introduced at regional level but a few initiatives have been taken at the federal level. The European directives on energy efficiency of appliances and boilers have been transposed into Belgian law. Two funds have been established for financing regional energy efficiency measures. The federal government is making an effort to standardise practices for improving energy efficiency. Energy performance standards and energy certificates for buildings, and a manual for uniform inspection of insulation and ventilation, will be introduced in the near future. In the transport sector, the federal government intends to implement standardised transport plans. Progressive vehicle taxation based on engine power and the introduction of CO₂ taxation both favour more efficient vehicles. Other measures in the transport sector include financial incentives for cycling and more efficient speed controls with higher fines.

Examples of the most recent regional measures are tighter building codes, increased information dissemination and technical assistance for energy users, voluntary agreements in the industrial sector, subsidies for energy audits and tax exemptions for energy efficiency investments. All regions have introduced new building codes to enhance thermal efficiency in space heating, with a few exceptions for certain types of buildings in some regions. As there is no particular reason to justify regional differences in building codes, these should be harmonised. Also, because building code violations are rampant, enforcement should be systematic and effective.

A voluntary agreement system with industries has been recently established. Currently, energy prices for industry are generally low and do not provide an incentive to improve energy efficiency. Tax abatement and direct subsidies have been given to the industrial sector to improve energy efficiency but it is not clear how effective these measures have been. An effective monitoring effort is essential in this respect. Introducing new financing mechanisms for energy conservation and energy service companies could reduce the need for these subsidies. Third-party financing has already been successfully implemented in some pilot cases in the public sector. It is likely that the non-exploited market for energy service/saving companies is large because energy efficiency has not improved over the last decade and Belgium has energy-intensive industries that are interested in improving energy efficiency.

Subsidies for energy efficiency investments are also available for the residential sector, and the public and private services sector. Compared to subsidies to industry, these may be better justified because the initial investment cost may be significant and become a barrier to investment, especially for domestic consumers. However, electricity, gas and heating oil that is given “free” to low-income households may reduce energy efficiency (see Chapter 3).

It seems that Belgium has already implemented – or is considering – most of the commonly used sectoral measures, and some new and innovative ones, to improve energy efficiency. However, more can be done. The role of energy industries in improving energy efficiency could be more clearly defined. Distribution companies are already contributing to demand-side efficiency by providing various advisory and other services. Also, funds have been established to promote energy efficiency on both the demand and supply sides, but a clearer definition of objectives and targets would enhance the efficient use of these resources. Possibilities for improving efficiency on the supply side should also be analysed.

As many of the federal and regional measures in the different sectors were introduced recently, or will be in the near future, their effectiveness will become evident only later. From now on, the main emphasis should not be on elaborating new programmes, but on effectively implementing and enforcing existing measures. Also, owing to the lack of an effective monitoring programme, it is difficult to assess the performance of energy efficiency measures taken so far. Because of this, priority areas or policy focus are not easily determined. It is essential that the federal and regional governments develop effective tools to monitor the performance of policy measures. For example, the cost-effectiveness of various

subsidies cannot be assessed without performance monitoring. Such measures should be consistent with the national energy policy objectives, including the national CO₂ emissions targets, and concerted efforts are needed at the federal and regional levels to further co-ordinate policies taken by the governments.

The regions would benefit from intensified inter-regional co-operation. As different economic sectors and industries are distributed over the regions, energy efficiency measures could be successfully implemented by identifying the most competent institution to be responsible for a given sector, regardless of regional boundaries.

RECOMMENDATIONS

The Government of Belgium should:

- Promote better co-ordination between the regions and with the federal government in all areas of energy efficiency.
 - Establish an effective monitoring system, in collaboration with the regional governments, to achieve national energy policy objectives, in particular energy efficiency targets.
 - Review the policy of promoting energy efficiency through subsidies or tax abatements.
 - Promote effective measures for reaching energy efficiency targets in all end-use sectors, including industry, the public and private sectors, and transport.
 - Reduce the number of building code violations.
 - Define more clearly the role energy industries can play in the implementation of energy efficiency policies. Ensure that industry carries out its duties effectively.
 - Eliminate obstacles to increased use of third-party financing for improving energy efficiency.
 - Ensure that those who have the best knowledge in particular areas are chosen to improve energy efficiency in their respective areas.
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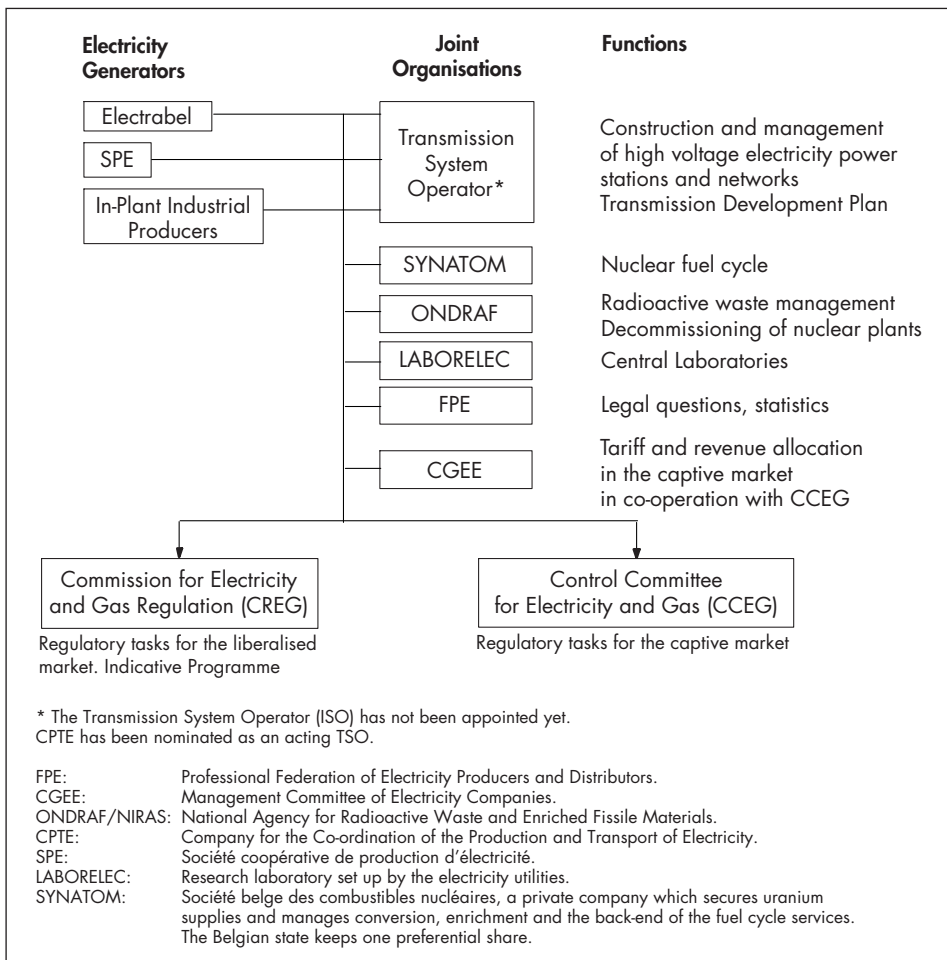
ELECTRICITY

INDUSTRY STRUCTURE

General

The electricity sector is going through significant changes as a result of ongoing market liberalisation. New regulators are being established both at the federal and regional levels, the roles of existing institutions are changing and the market players are reorganising their operations (see Figure 13).

Figure 13
Organisation of the Electricity Sector in Belgium



Source: Control Committee for Electricity and Gas (updated).

Generation

The trends in electricity supply in the 1990s include a rapid increase in generation after the 1993-1994 recession and a decrease in net imports. In 1999, total net electricity generation was 80.9 TWh. Electricity generated by Electrabel²² and SPE²³ amounted to 71.9 TWh and 6.2 TWh respectively, representing 96.6% of electricity generation in Belgium. The remaining 2.8 TWh were produced by autoproducers.

Total net maximum electricity generating capacity was 15,400 MW at the end of 1998. The share of private and public utilities was 14,800 MW, and of autoproducers 620 MW. Power stations vary in age from less than one year to around forty years. Nuclear power stations entered into service in the 1975-1985 period. The youngest power stations are combined-cycle gas turbines and co-generation installations that have replaced old units using coal and oil.

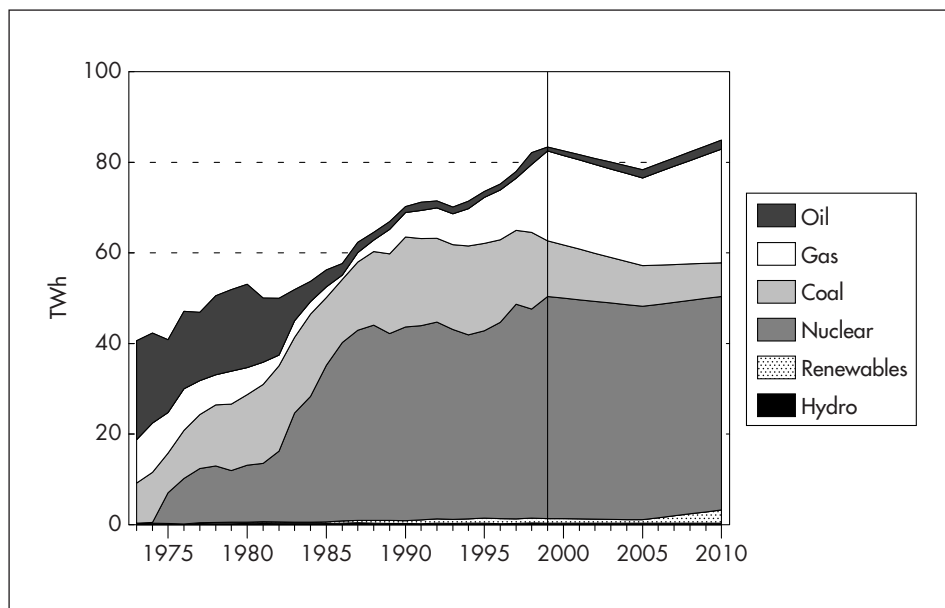
In 1999, nuclear was the main source – with a share of 58.8% – of gross electricity production. The second most important source was thermal power with a 39.3% share, including coal (15%), natural gas (23.1%) and oil (1.2%). Biomass and waste amounted to 1.4% and hydropower to 0.4%. During recent years, the share of nuclear has grown slightly, mostly because of better availability. The most dramatic change has been the rapid increase in the use of natural gas to replace coal. The proportion of oil in electricity generation has remained marginal since the late 1980s. Currently, the same applies to renewables but the federal government has set targets to increase their share.

Table 6 illustrates the forecast prepared in 1996 for future electricity generation. It was prepared before the government's decision to phase out nuclear, and before the AMPERE Commission published its report on future electricity generation options in October 2000. In the 1996 forecast, the share of coal is expected to be reduced by half between 1998 and 2005, and continue to decrease thereafter. Coal will be replaced mostly by natural gas. The present small share of oil will decrease by 2005 but stabilise thereafter. Electricity generation based on combustible renewables and waste was estimated to increase more than twofold by 2010. However, in 2000 the federal government has set a higher target for renewables, at 3% in 2004 and 5% in 2010, and the regional governments have established even more ambitious targets. The strategy for reaching these targets is based on the implementation of a green certificate system (see Chapter 12), and the Flemish decree foresees the introduction of such a system as of 2001.

22. At the end of 1999, Electrabel's shareholders were Tractabel (40.2%), municipalities (4.7%) and Fortis (3.4%), and the proportion of free floating shares was 52.7%. The free floating shares are likely to be subject to stock exchange transactions. Most of these shares are owned by large foreign institutional investors.

23. SPE (*Société Coopérative de Production d'Electricité*) was transformed from a registered association into a public company in 2000. In mid-2000 its shareholders were SCRL Publilec (63%), Dexia (17.0%), Socofe (13.7%), SMAP (0.6%) and VEH (6.0%).

Figure 14
Electricity Generation by Fuel, 1973-2010



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2000, and country submission.

Table 6
Projections of Fuel Shares in Electricity Generation
(percentages)

<i>Fuel</i>	<i>1998</i>	<i>2005</i>	<i>2010</i>
Coal	20.6	11.5	8.7
Oil	3.1	2.3	2.3
Gas	18.3	24.7	29.6
Combustible renewables and waste	1.3	1.0	3.5
Nuclear	56.2	60.1	55.5
Hydroelectric power	0.5	0.4	0.4
Geothermal	-	-	-
Solar, wind and other renewables	0	0	0

Sources: IEA/OECD statistics and country submission.

The AMPERE Commission report does not specify the generation mix for any given year but investigates the economics and emissions of different generation options, and estimates the potential for co-generation and renewables. The commission recommends that when the nuclear plants and coal-fired power plants reach the

end of their life, they should be replaced mainly by combined-cycle power plants. The commission estimates that only 1,000 MW of coal-fired capacity will be used in 2010; however, it recommends that the coal option be kept open in case technological development makes possible the use of coal with smaller emissions. The commission recognises the dangers of being too dependent on natural gas and considers that less economic generation methods, such as co-generation and renewables, should be used for diversification. According to the commission, CHP capacity can be increased by 700-1,500 MW_e to reach 1,700-2,300 MW_e in 2020. Current electricity generation from renewables could be quadrupled by exploiting wind energy and biomass potential during 2010-2020. Wind capacity could be expanded by 1,500 MW (of which 1,000 MW offshore) by 2010, and waste combustion could cover 4% of the country's power supply by 2020. On the whole, decentralised generation would amount to 22-25% of total capacity by 2020. However, the commission recommends that the impacts of decentralisation on the development of electricity transmission be studied.

Transmission

The Belgian transmission network²⁴ consists of 380 kV, 220 kV, 150 kV, 70 kV, 36 kV and 30 kV lines and cables. The length of the transmission network is 8,095 km, of which 5,617 km of overhead lines and 2,478 km of underground cables. Transmission by 70 kV or below is subject to regional legislation and regulations.

The 380 kV lines are connected with the networks of neighbouring countries at five points. The electricity transmission network is at present heavily congested in some areas, and the problem is expected to be aggravated because of new large consumers such as the TGV (high-speed train) network to the Netherlands and Germany. Construction of new high-voltage aerial lines has been postponed because of environmental concerns. Underground cables are under consideration, but because of environmental concerns and higher costs, these have not been built.

In July 1995, Electrabel and SPE created the Company for the Co-ordination of the Production and Transport of Electricity (CPTE)²⁵ to harmonise and manage their activities in electricity production and transport. CPTE has been responsible for the construction and management of the main grid system and international exchanges. In liberalised energy markets, the grid has to be operated by a grid manager, or Transmission System Operator (TSO), who is only allowed to operate the transmission grid. Generation and distribution will therefore be completely separated from transmission in accordance with the unbundling principle. If CPTE becomes the TSO, then this will lead to its reorganisation.

24. This description of the transmission network is from CPTE. Generally, in many countries voltage levels of 70 kV, 36 kV and 30 kV are considered to belong to the distribution networks.

25. CPTE was created by restructuring a former limited company which owned the national dispatching centre at Linkebeek, and Gecoli, the co-operative which owned the 380 kV, 220 kV and 150 kV transmission networks.

Distribution

In Belgium, municipalities have a legal monopoly over the distribution of electricity in their area for customers with up to 1 MW load connected to 30 kV or lower voltage networks. Four different types of distributors can be identified:

- **Municipal utilities:** municipalities organise and manage their distribution activities alone (8 utilities at the beginning of 2000).
- **Inter-municipal companies:** municipalities own the companies together with other municipalities (8 companies at the beginning of 2000).
- **Mixed inter-municipal companies:** municipalities join forces with a private company, namely Electrabel (16 companies at the beginning of 2000).
- **Generators:** direct sales by the generator (such as Electrabel) to consumers.

In 1999, the shares of these four types of distributors in total market sales were: municipal utilities, 1%; inter-municipal companies, 12%; mixed inter-municipal companies, 49%; and Electrabel, 38%. The size of the distribution companies varies from a few employees to several hundred. The distribution companies are currently reorganising their operations in response to changing legislation on electricity distribution.

The influence of Electrabel on the mixed inter-municipal companies is significant. The average share of Electrabel in these companies is 40%; but, more important, it has a 49% voting right and veto right in their general meetings. In addition, Electrabel is in charge of the daily operation of these companies and the sole supplier of electricity.

During 1994-1997, just before the new legislation on market liberalisation was introduced, the mixed inter-municipal companies negotiated with Electrabel to get more freedom in choosing their supplier. They reached agreements by which each mixed inter-municipal company will have the right – from 2006 and after giving four years notice to Electrabel – to buy electricity from third parties. However, the amount they will be able to purchase from third parties is limited to 25% of their total purchases. Electricity purchased from the third party should be for base load, and Electrabel will continue to cover for the medium and peak loads. This condition was introduced to address the distribution companies' concern that it would be more difficult to obtain electricity to cover medium and peak loads than base load. Another condition is that the security of supply by a third party must be guaranteed by the supplier or another producer.

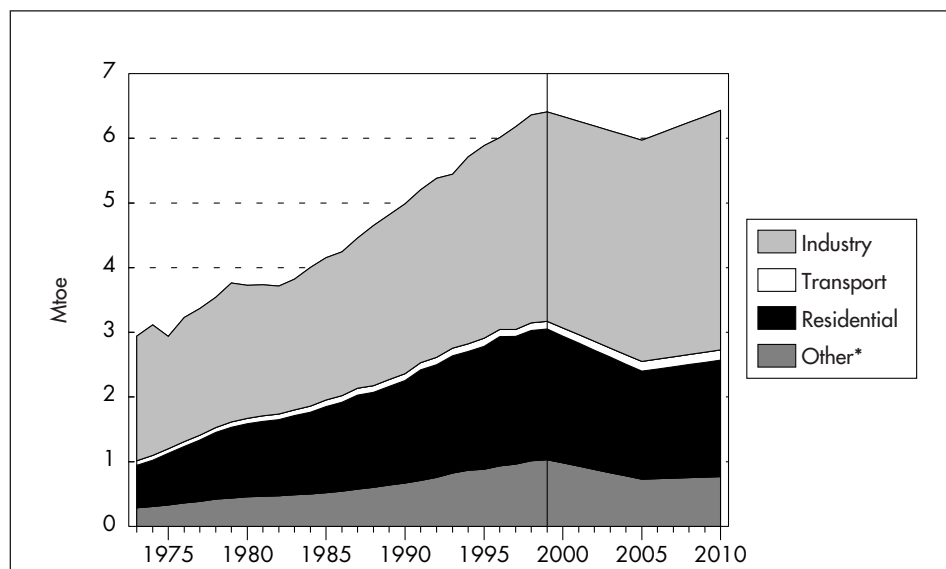
Electrabel's relation with the mixed inter-municipal distribution companies will change after market liberalisation. As of 2007, all distribution companies will be free to buy electricity from the supplier of their choice without limitation. There will be no restrictions regarding the base, medium or peak loads, or the choice of

supplier for back-up electricity. Further, the mixed inter-municipal distribution companies that chose to buy a stake in Electrabel in 1995²⁶ can withdraw from the arrangement after 2011, with full compensation from Electrabel.

Demand

Electricity demand has increased rapidly in the 1990s. During 1990-1998, average annual growth has been 5% in the service sector, 3% in the residential sector, and 2.6% in the industrial sector.

Figure 15
Electricity Consumption by Sector, 1973-2010



* includes commercial, public service and agricultural sectors.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2001, and country submission.

Trade

The total volume of international electricity trade amounted to 17.3 TWh in 1999. Belgium exported electricity to the Netherlands, France and Luxembourg, and also imported electricity from France and the Netherlands.

26. In 1995, Electrabel proposed to the mixed inter-municipal companies that they purchase jointly a 5% stake in Electrabel on condition that they extend their supply contract to cover the next 20 to 30 years. Almost all of the mixed inter-municipal companies signed these contracts. The European Commission pointed out that this arrangement would further strengthen Electrabel's dominant position. Following the criticism by the EC, Electrabel gave up pressing the inter-municipal companies to hold its shares as a condition to the extension of the contract with Electrabel in 1997.

Table 7
Import and Export of Electricity, 1990 to 1999
 (TWh)

	1990	1995	1996	1997	1998	1999
Import	4.79	9.40	9.64	9.98	7.83	9.06
Export	8.51	5.33	5.45	6.71	6.44	8.20
Net import	-3.72	4.07	4.19	3.27	1.39	0.85

Source: *Electricity Information 2000*, IEA/OECD Paris, 2000.

ELECTRICITY PRICES

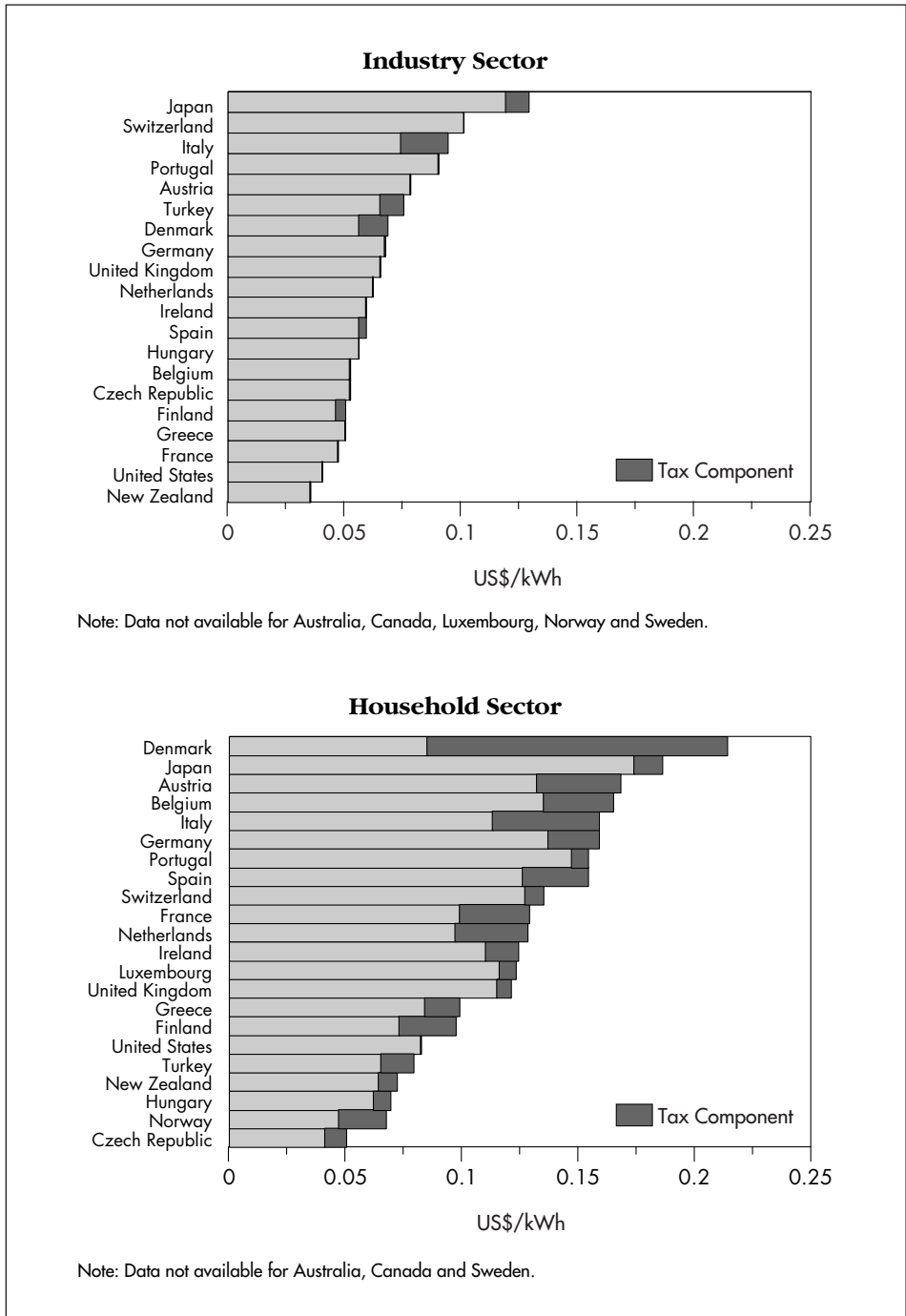
In liberalised markets, prices are set by the markets but cannot exceed the price ceiling set by the federal government. Uniform electricity prices set by the federal government – and recommended by the Control Committee for Electricity and Gas (CCEG) – are applied for captive consumers throughout the country. Furthermore, according to the law, CCEG should “gradually direct the tariffs applied to the customers... to the best tariff practices [applying] to the same segment of the market in the other member States of the European Union, taking into account specificities of the sector of distribution”. In practice, CCEG’s interpretation of the law is that Belgian electricity tariffs should not be higher than average European tariffs. The principle of uniform tariffs across the country is applied to wholesale prices. Currently, wholesale prices are about 20% higher in Belgium than in neighbouring countries. However, there are cases in which discount prices are offered to some municipalities, which means that some distributors can sell electricity below the set price but are not obliged to do so.

In 1998, the average electricity price for households was BF 5.99 per kWh, and for industry, BF 1.90 per kWh. The price for households was the third highest in OECD countries, but for industry it was significantly lower than the average for OECD Europe. Also, the ratio of residential prices to industrial prices is higher in Belgium than in any of the neighbouring countries: the United Kingdom (household price/industry price = 1.8 in 1999), the Netherlands (2.2 in 1999), Germany (2.3 in 1998) and France (2.8 in 1998).

CCEG initiated a study to compare household electricity prices in Belgium with those of neighbouring countries. The report was based on May 2000 tariffs and published in June 2000. According to the study, electricity prices for domestic consumers, excluding VAT, specific taxes and non-tariff-related dividends, are generally higher in Belgium than in other countries. However, significant differences were observed depending on the customer type:

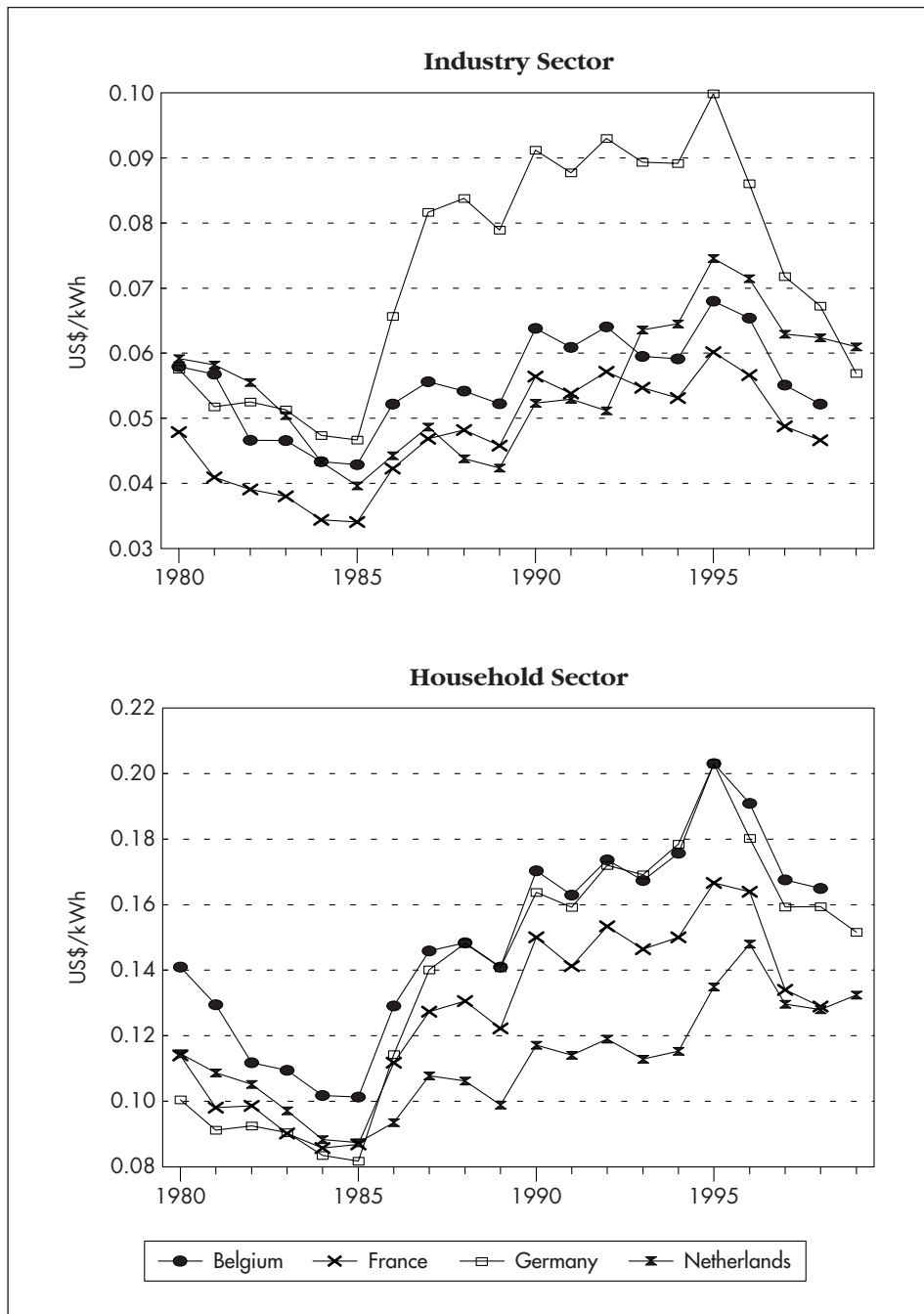
- For small domestic consumers (6 kVA, 1,200 kWh), Belgian prices are 20% higher than in France or in the Netherlands, and 5-10% higher than in Germany and in

Figure 16
Electricity Prices for Industry and Households in IEA Countries, 1998



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2000.

Figure 17
Electricity Prices in Belgium and in Other Selected IEA Countries, 1980-1999



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2001.

the UK. However, there are some cities in Germany²⁷ and in the UK where tariffs are significantly higher than the Belgian average.

- Price comparisons show more or less the same results with other types of domestic consumers. An exception is the largest domestic end-users who consume a significant amount of their electricity at night (20 kVA and 20,000 kWh of which 15,000 kWh consumed at night). In this consumer group, prices in Belgium are lower than in France and Germany, but higher than in the Netherlands and the UK.

INTRODUCTION OF COMPETITION

Federal Legislation

The federal law concerning the organisation of the electricity market was adopted on 29 April 1999. This framework law defines the basic elements for the transposition of the EU directive covering the areas of federal competence, including generation, transmission, pricing, long-term planning and competition issues (but not CHP and renewable energy systems).

To fully comply with the EU directive, the federal framework law and related executive decisions taken at federal level have to be complemented by regional decrees to cover the areas of regional competence. In other words, the regional governments have to address the issues of low-voltage electricity transmission and distribution (*i.e.* below 70 kV), and public service obligations dealing with rational use of energy, renewable energy and social concerns.

The law of April 1999 aims at a progressive opening of the market. The final consumers who consume more than 100 GWh annually, and who constitute 33% of the Belgian electricity market, have been eligible to choose their supplier as from 24 October 2000. The law also guarantees eligibility to distribution companies from 1 January 2007. This initial opening is consistent with the minimum requirement of the EU directive.

The new government elected in July 1999 decided to speed up the liberalisation process. The new schedule was introduced by the Royal Decree of 11 October 2000:

- Final consumers with electricity consumption of 20 GWh or more per site are eligible from 31 December 2000 (*i.e.* about 45% of the market).
- Final consumers with electricity consumption of 10 GWh or more per site are eligible from 31 December 2002.

27. The German case may not be completely comparable with the other countries because pricing there is currently based essentially on variable costs, not full generation cost.

On 5 May 2000, the Inter-ministerial Conference on Energy, grouping the ministers responsible for energy matters at federal and regional levels, decided that the schedule for extending the eligibility of the distribution companies should be accelerated, but no concrete dates have been fixed. The current federal legislation does not touch upon extending liberalisation to residential consumers.

As scheduled by the Royal Decree of October 2000, 45% of the market was opened at the beginning of 2001. Currently, the average duration of industrial contracts with Electrabel is 18 months and all new contracts are subject to a bidding process. Electrabel has calculated that about 8-9% of its clients will change supplier in 2000-2001.

The federal law concerning the organisation of the electricity market requires the elaboration of an Indicative Programme of preferred electricity generation methods and a Transmission Development Plan for the development of the transmission network. The Indicative Programme and the Transmission Development Plan replace the former Equipment Programme (see box).

Belgium has opted for regulated third party access (TPA) for domestic operations and negotiated TPA for international entries. The transmission tariffs for regulated TPA will be calculated by the TSO and are subject to approval by the federal regulator CREG and the regional regulators. In the distribution network, the manager of each distribution grid will publish the tariffs for access to the grid and ancillary services. The formula of negotiated access is applicable to trans-border transit of electricity.

In April 2001, the Transmission System Operator had not yet been appointed by the State Secretary for Energy and Sustainable Development and CPTe has been the acting operator. It has already published its tariffs but these are still subject to approval by CREG.

Regional Legislation

Though most of the legislation at federal level has been completed, regional legislation is still pending. In practice, this delays liberalisation for eligible consumers who are connected to distribution networks at 70 kV or less.

Flanders has revised its legislation, and the decree on the organisation of the electricity market was approved in July 2000. All consumers with at least 20 GWh annual consumption were to become eligible at the beginning of 2001, but implementation was delayed and in January 2001 the regional government set a new date at 1 July 2001. The decree does not set deadlines for further opening of the electricity market but leaves the decision to the Flemish government after consultation with the regulator. In January 2001, the government published a new draft schedule for further opening according to which all consumers with at least 1 GWh annual consumption will be eligible at the beginning of 2002; all consumers with at least 56 kVA connected load will be eligible at the beginning of 2003; and full market opening is to take place on 1 July 2003.

Equipment Programme, Indicative Programme for Electricity Generation, and Transmission Development Plan

The National Equipment Programme for Electrical Energy Production and Transport 1995-2005 was prepared by the Management Committee of Electricity Companies (CGEE) and approved by the Council of Ministers. It is binding in character but has been revised when needed. It identifies the major production units to be closed during 1995-2005, names the new units to be constructed and old ones to be upgraded, and sets objectives for introducing combined-cycle power stations, CHP units, renewable energy and decentralised power production. The Equipment Programme includes several additional objectives for the electricity sector, such as placing more high-tension lines underground and replacing small obsolete power stations with more efficient units. It was intended to be valid until 2005, but following changes in electricity legislation it will be replaced by the Indicative Programme for Electricity Generation and the Transmission Development Plan. The Indicative Programme will come into force at the beginning of 2002 and the Transmission Development Plan will be implemented within 12 months of the appointment of the Transmission System Operator (TSO).

The Indicative Programme for Electricity Generation will be formulated by the Commission for Electricity and Gas Regulation (CREG) in close collaboration with the Energy Administration of the Ministry of Economic Affairs and following consultation with the TSO, the Federal Planning Bureau, the Control Committee for Electricity and Gas (CCEG), the Office for Sustainable Development and the regional governments. The programme, which is subject to approval by the Minister of Economic Affairs, will be prepared for 10 years and revised every 3 years. It will define preferred generation methods based on technical, economic and environmental considerations for power plants with a minimum capacity of 25 MW_e. The Indicative Programme will only be a policy statement, providing no obligations or incentives for market operators to follow it.

The Transmission Development Plan for the transmission grid will be carried out by the TSO in collaboration with CREG and after consultation with the Federal Planning Bureau, CCEG and the grid owner if it is different from the TSO. The plan is subject to approval by the Minister of Economic Affairs. The Transmission Development Plan defines the major changes to be implemented in the transmission network during the 7-year period after the approval of the plan. During this period, the plan is updated every 2 years and will bind the TSO.

The Walloon decree on the organisation of the electricity market was approved in April 2001. As of now, the decree guarantees an open market for consumers with an annual consumption of 20 GWh or more; then, at the end of 2002, for those consuming at least 10 GWh; and at the end of 2004, for all consumers connected to the high-voltage network.

The government of the Brussels-Capital region is studying a draft ordinance to present to parliament; as of January 2001 it had not been accepted. The proposed schedule is similar to that of Wallonia, but Brussels-Capital has decided to go one step further in liberalisation than the other regions by allowing eligibility to all consumers at the beginning of 2007.

The Flemish and Walloon decrees extend eligibility to producers and partly to distribution companies and heat consumers that include:

- Electricity end-users who buy electricity generated by renewable energy systems or CHP installations operating at high fuel efficiency.
- Electricity end-users who produce electricity themselves by renewable energy systems or in CHP installations with high fuel efficiency (in Flanders up to a certain ceiling).
- Distribution companies for the amount of electricity they supply to their eligible customers.
- Heat consumers who buy heat produced by a CHP unit or by a renewable energy system and who will be eligible to buy electricity from the supplier of their choice (in Flanders a maximum of 500 kWh electricity per each GJ of heat purchased).

In order to fulfil the requirements of the EU directive, the governments of Flanders and Wallonia will define new eligible customers annually. They are also closely following the progress of liberalisation in neighbouring countries as it may affect the pace of liberalisation at home.

Both the Flemish and Walloon governments will establish their own independent regulators to regulate the distribution market. The regulators are to be nominated by mid-2001. Brussels-Capital has preferred to do without an independent regulator and will give the task to the Brussels Environment Institute (IBGE/BIM). The same organisation has also been assigned to work as the regional energy administrator of Brussels-Capital.

The electricity markets of Flanders and Wallonia consist of a number of geographically limited distribution grids. Each distribution grid is defined in the regional decree and will be managed by its own manager. In Flanders, grid managers will be appointed for a period of 12 years by the regulator, and in Wallonia for a period of 20 years by the Walloon government. Grid managers will be operationally and legally independent so that no market players will be privileged over others. As the market is gradually opened, grid managers will shift to managing the distribution grid, and will not be allowed to supply eligible customers. In the transitional period, when there are both eligible and non-eligible consumers, grid managers will continue to supply electricity to captive consumers. In practice, the distribution companies in operation today will have to separate their network and sales operations.

The municipal utilities and inter-municipal companies in the Flanders and Wallonia have decided to reorganise their activities because of the changing legislation, and to strengthen their position in the open market. Following reorganisation, there will be two public companies in each region, one selling electricity and the other operating the network. Under the new organisation, the generation, transmission, distribution and sales functions will be separated but the shareholding structure will remain the same. In Brussels-Capital, there are no municipal utilities or inter-municipal companies. The mixed inter-municipal companies are also reorganising their operations by separating network activities from sales. They are negotiating with Electrabel, but it is still not clear how the changes are going to be implemented.

Both in Flanders and Wallonia, supplying electricity to eligible customers through the distribution grid will require a licence. In Flanders, licences will be issued by the regulator based on criteria and procedures established by the Flemish government regarding the technical and financial capability, professional reliability, and capacity of the applicants to meet the needs of customers, public service obligations, and to demonstrate managerial and legal independence *vis-à-vis* grid managers.

Regulation

In the past, the Belgian electricity market was subject to direct government regulation and the government was involved in a continuous dialogue with the market players in the framework of the Control Committee for Electricity and Gas. CCEG, which recommends electricity tariffs for captive consumers, will remain in place to handle regulatory tasks for the captive part of the electricity market until full market liberalisation has taken place.

The Commission for Electricity and Gas Regulation (CREG), which is the regulator dealing with the liberalised part of the Belgian energy market, started its operation in early 2000. By law, CREG is an independent advisory body. However, it has certain decision-making powers in arbitrating disputes, accepting transmission tariffs and authorising the refusal of access to the network. It is composed of six members, appointed for a renewable period of six years by the Council of Ministers. The commission is assisted by a General Advisory Council composed of federal and regional government representatives and representatives of the industry's social and economic interests. In total, the number of permanent staff of CREG is 30, but will be increased to 35 during 2001. Its operational costs are financed by a charge on transmission tariffs.

Restructuring

The unbundling obligations set by EU directive have been transposed to national legislation by the 1999 electricity market law. Starting in 2000, Electrabel has followed this requirement and publishes separate accounts for different operations.

The future Transmission System Operator (TSO), which is likely to be the Company for the Co-ordination of the Production and Transport of Electricity (CPTE), is owned by Electrabel and SPE, but has its own offices and personnel and full responsibility for tariffs and contracts. However, according to CREG, the position of CPTE remains problematic since it is still likely to be influenced by Electrabel. In response to such concerns, Electrabel is considering making CPTE a legally separate entity. This has not yet occurred, which is delaying CPTE's nomination as the TSO.

Many of the electricity distribution companies also distribute natural gas and provide cable television services. Unbundling these different functions is required, but so far no instructions have been given by the governments on practical implementation.

CRITIQUE

Much progress has been observed in the Belgian electricity sector since the last IEA in-depth review in 1997. Belgium is liberalising the market a little faster than required by the EU directive, but the schedule is slow compared to that of some neighbouring countries. Also, all necessary legislation has not yet been completed and some institutions still need to be established.

The initial opening of the electricity market in October 2000 covered 33% of the consumers, and this was expanded to about 45% at the beginning of 2001. The distribution companies will be able to choose their supplier only at the beginning of 2007. The federal government has decided to speed up the market opening process as announced by the Inter-Ministerial Conference on Energy on 5 May 2000. However, the schedule has not yet been clarified, creating uncertainties among market players. Since many European countries, including neighbouring Germany and the Netherlands, have already opened their markets to all consumers, the Belgian government should consider accelerating its liberalisation schedule and full market opening to make Belgian markets consistent with their neighbours as soon as possible. Such efforts will enable Belgium to enjoy the full benefits from trade by making it possible for domestic consumers to choose competitive suppliers in international markets. The expected price reduction should help in phasing out subsidies to some consumers.

Despite the efforts of the Belgian government, it is not certain that sufficient competition will arise in the electricity market after all necessary legislation has been finalised and regulators have been established. Currently, there are only two major producers in the country, and Electrabel remains dominant in electricity generation. Because of nuclear facilities that have been largely depreciated, Electrabel is very competitive and new entrants may find it difficult to compete with the incumbent.

A prerequisite for effective competition is to ensure that the incumbent generator does not abuse its dominant position. A variety of approaches are used in other

countries: the United Kingdom and the United States have applied divestment; Spain has set limits on the generation capacity increases of dominant operators for several years; and the Nordic countries have an active electricity trading pool. Also, in general, international competition is increasing. Breaking down a private company into smaller units that compete with each other may be difficult. In some cases, competition can be enhanced by establishing an electricity trading pool. Making such a pool fully operational calls for many suppliers, which is not the case in Belgium at present. Because Belgium does not have over-capacity, setting limitations on the expansion of generation capacity by current market players could attract foreign investments, and increase competition. However, congestion in the network is a concern as it may limit the potential of international trade. In order for international competition to play a vital role in Belgium, the government should ensure that appropriate investments are made to maintain and/or expand the grids, and that there are no barriers to entry.

There is also a concern that the negotiated TPA formula chosen for international entries may constitute a barrier and lead to higher transmission prices. According to the EU Commission, experience has confirmed that the system of regulated third party access based on published prices is the most appropriate method of access. This system not only prevents discrimination, but also allows companies to plan for their electricity purchases since they will know in advance what tariffs will be. By contrast, the negotiated access system, with its obligation to renegotiate prices and conditions of access each time the contract is to be renewed, places a burden on companies. Besides Belgium, only Germany and Greece have chosen negotiated TPA for international entries.

The management of the transmission grid will be the responsibility of a TSO to be appointed by the Federal Council of Ministers. The TSO is obliged to be independent – both operationally and legally – from other market players. Currently CPTe, a subsidiary of Electrabel and SPE, has been appointed to the task on a temporary basis and is waiting to be nominated. The electricity industry is experiencing uncertainty during this transition period where the final decision on a TSO is pending and some secondary legislation has not yet been completed.

The distribution sector is also undergoing significant changes. The inter-municipal distribution companies, representing 25% of distribution companies and 12% of sales volume, are separating their network operation and other activities from their sales activities, and merging these to form larger regional sales companies. This is not only a response to changing legislation, but also a way to end long-term supply contracts which some of the distributors had signed in the past and an opportunity to have more negotiating power for better contracts in the future. The mixed inter-municipal distribution companies are reorganising their operation in response to new legislation as well. It is not yet clear how the reorganisation will be implemented but some concentration in sales and network operations may take place.

The unbundling of CPTe has been initiated but is not yet completed. In the forthcoming new legislation for the gas sector, the federal government is requiring more effective unbundling than minimum account separation. This should be the

model for the electricity sector as well. In addition, distribution companies will be required to unbundle their different activities, but no rules have been set yet. Unbundling is necessary for the regulator to be able to ensure that the distribution companies are not misusing their position as natural monopolies. As the Belgian energy industry becomes more involved in international markets, effective unbundling of domestic and international operations is a prerequisite to ensure that the electricity suppliers do not subsidise international operations by domestic revenues.

The market players set prices for eligible consumers but the federal government will continue to set price ceilings. This is necessary at present because there are only a few suppliers, and these may misuse their dominant position. In the long term, the practice should be abolished because all prices will be controlled by market forces.

Electricity pricing in the captive markets remains problematic. A single price is applied for captive consumers throughout the country, and it does not necessarily reflect real costs. The prices are high for residential consumers (but not for industrial users), and social tariffs raise a concern regarding inefficiency and cross-subsidies (discussed in detail in Chapter 3). The high prices for residential end-users cannot be explained by the generation structure, labour costs or by energy and environmental taxation. There are cases in which discount prices are offered to some municipalities, which means that they can sell electricity below the price set by the federal government but are not obliged to do so, creating a situation where the distribution company with the highest cost defines the price for all captive consumers. The government should consider replacing this principle with a system that encourages each distributor to reduce its prices.

The current profits of distribution companies tend to be large, which implies that the prices are set higher than costs. However, they finance up to 10% of the municipal budgets, which means there is hidden taxation on energy which takes advantage of the monopolistic status of utilities that are owned by municipalities. Thus, the acceptable level of revenues should be carefully considered. This situation may not be sustainable when competition is introduced and the distributors will have to compete with each other. The federal and regional governments have to consider the impact of liberalisation on present financing where revenues from utilities represent a significant share of the municipal budget. They will also need to address problems which may hinder liberalisation. Moreover, the wholesale price for distribution companies is 20% higher than in neighbouring countries. This indicates either higher generation and transmission costs, or higher upstream revenues, and may call for efficiency improvements.

The Equipment Programme, which defines preferred generation and transmission technology choices, will be replaced by the Indicative Programme and the Transmission Development Plan. Unlike the Equipment Programme, the Indicative Programme will only be a policy statement and not binding; this is good policy because the Equipment Programme may reduce competition in generation. Also, the Transmission Development Plan could be used to incite the TSO to develop the transmission network so as to avoid congestion. Consequently, accelerated introduction of the plan could contribute to increased competition.

RECOMMENDATIONS

The Government of Belgium should:

- Set a clear time-frame for electricity market liberalisation.
 - Consider further liberalisation, to include all customers and to ensure that the market is fully opened in all regions.
 - Actively pursue competition, encourage new entrants by increasing cross-border competition, limit the dominance of existing players and possibly establish an electricity trading pool.
 - Set up as soon as possible the necessary regulatory institutions, including court and arbitration systems.
 - Nominate the national grid operator as soon as possible; ensure its independence by effective unbundling.
 - Ensure that the planned unbundling is effectively carried out in generation, transmission and distribution.
 - Ensure that distribution companies do not misuse their monopoly position by cross-subsidising.
 - Ensure transparency and efficiency in electricity price-setting. Assess the possible benefits of price differentiation for distribution companies in different geographical areas while they are still part of the captive market. Also ensure that the captive market, especially residential consumers, benefits from increased competition and the expected reduction of prices.
-

CO-GENERATION

HEAT AND POWER GENERATION

In the last decade, the number of combined heat and power (CHP) units in Belgium increased from 72 in 1991 to 216 in 1998. These include large CHP plants built by power companies and many small units of 0.5-2 MW_e installed in the industrial and commercial sectors, mainly in chemical industries. Electrabel and SPE operate 22 units, corresponding to 648 MW_e capacity in 1999.

Total CHP capacity was almost 900 MW of electricity and 3,200 MW of heat in 1998. Gross electricity production by CHP plants was 3,600 GWh (3.5% of total electricity generation) and net heat production was 38,030 TJ. The AMPERE Commission estimated in its report of October 2000 that the total potential for CHP in Belgium could reach 1,500-2,300 MW_e in 2020.

CHP plants are economically competitive compared to separate electricity and heat production only if they operate with high fuel efficiency²⁸ and if the heat and electricity loads are balanced. In practice, the limiting factor is the adequacy of the heat load. Today, the most efficient industrial CHP unit in Belgium operates at 89% fuel efficiency, which is a very good efficiency level achieved with balanced loads. There are no comprehensive statistics to estimate the average fuel efficiency of Belgian CHP plants; some typical CHP plants in chemical, food product and tobacco industries operate at 74-83% fuel efficiency.

COST STRUCTURE, TARIFFS AND PRICING

Many benefits are given to so-called “high-quality” CHP installations. The Control Committee for Electricity and Gas (CCEG) defines “high-quality” CHP as being able to save primary energy and significantly decrease CO₂ emissions compared to separate heat and electricity production. The reference technology for electricity production is the combined-cycle gas turbine. The regions are using their own criteria of what constitutes high-quality CHP in their decrees for market liberalisation, and these are not necessarily the same as CCEG’s. For example, the Walloon draft electricity decree requires that the fuel efficiency of CHP installations should reach 95% of combined fuel efficiency for modern heat-only boilers (efficiency 90%) and gas turbine (efficiency 55%).

28. Fuel efficiency is the ratio of electricity and heat production to fuel consumption.

In order to promote CHP, CCEG has made recommendations on prices and tariffs. It has recommended that natural gas prices be reduced for operators of “high-quality” CHP installations by BF 8.6 per GJ if they use more than 33,500 GJ of natural gas annually (representing an 8% discount compared to the 1999 price), and by BF 20 per GJ if they consume less.

In the past, CHP producers had to sell their surplus electricity to distributors at low prices. In July 1998, CCEG decided to increase the buy-back price. The 1999 law on the organisation of the electricity market now makes it possible to set minimum buy-back tariffs for electricity generated by high-quality CHP installations. Moreover, the Federal Council of Ministers (on 5 April 2000) and the Inter-Ministerial Conference on Energy (on 5 May 2000) have taken the following decisions:

- Distribution tariffs should be set more transparently.
- Those who distribute electricity to captive clients must buy surplus electricity generated by autoproducers.
- Distribution companies must publish reasonable buy-back tariffs for electricity produced by co-generators.
- The minimum price for delivering CHP electricity to the captive market must be fixed.
- CHP plants will be given priority for access to the transmission network.
- The transmission system operator should ensure that necessary back-up services for co-generators are available if needed.
- Distribution companies must publish moderate tariffs for supplying back-up and emergency power to co-generators.

Some details regarding the decisions, such as the definition of “reasonable”, “moderate”, or “priority access”, still need to be clarified.

FEDERAL CHP POLICY

The 1995-2005 National Equipment Programme for the electricity sector calls for decentralised power generation of 1,000 MW_e, mainly with industrial CHP, by 2005. This target has almost been achieved. The programme introduced partnership agreements with price opportunities to promote CHP. The agreements were concluded between large co-generators and Electrabel or electricity distributors, and based on a recommended model by CCEG. In these standardised contracts, Electrabel or distributors agreed to buy electricity from “high-quality” CHP with favourable tariffs. Electrabel also agreed that if co-generators needed more power than they could produce, it would be supplied at competitive prices.

The Equipment Programme will be replaced by the Indicative Programme for Electricity Generation in 2002. However, the old partnership agreements will be cancelled as soon as the regional decrees on market liberalisation enter into force. The Indicative Programme puts particular emphasis on production methods with low greenhouse gas emissions, such as CHP installations, but the specific role of CHP in the new programme is not yet known. Nor does the new programme specify any financial or other measures for the promotion of CHP (see Chapter 6).

Since the promotion of CHP is an issue of regional competence, many of the measures envisaged in the programmes mentioned above should be taken at regional level. The role of the federal government is limited to setting prices for electricity and heat generated by CHP.

REGIONAL CHP POLICY

The regions are promoting CHP to increase energy efficiency and reduce CO₂ emissions. The Flemish objective is to install an additional 1,800 MW_e of CHP capacity by 2005. The other two regions have not set numeric targets.

A wide range of regional measures exists for the promotion of CHP. Flanders and Wallonia have each established an organisation to promote CHP, and subsidies are available for CHP installation and R&D. Preferential treatment is given to CHP producers and their customers by awarding them eligibility in liberalised electricity and gas markets sooner than other generators and customers. In Wallonia, CHP producers will be eligible to claim green certificates (see Chapter 11).

In Flanders, BELGOGEN was created in 1997 to increase market penetration of CHP. Half of its funding comes from the Flemish government and half from the private sector. In Wallonia, COGENSUD, a non-profit organisation financed by the private sector and the regional government, promotes co-generation mainly by collecting and providing information for potential users.

In all regions, CHP installations can deduct as much as 13.5% of the cost of their initial CHP investment from their taxable income. The regions can use the RUE/Electricity Generation Fund and the RUE/Electricity Distribution Fund (see Chapter 5) to subsidise feasibility studies and investment cost of CHP. Wallonia supports CHP by other means than direct subsidies.

The regional decrees on electricity market liberalisation include rules to promote “high-quality” CHP. CHP producers will be free to choose the supplier for any additional electricity they may need, including back-up power and, in the case of industrial CHP producers, power that they cannot cover by their own generation. The consumers of electricity and/or heat produced by CHP plants will be eligible to choose their supplier regardless of their annual consumption.

Unlike the Flemish green certificate scheme, in which green certificates are given only to renewable energy installations, the Walloon draft decree on electricity market liberalisation makes it possible to use green certificates to promote CHP. This is done by issuing certificates based on CO₂ emissions that are avoided when using CHP compared to the emissions that would have resulted from heat and electricity produced separately by fossil fuel-fired plants.

CRITIQUE

In the last decade, the number of CHP units in Belgium has continuously grown, but their share of total electricity production remains low, only some 3.5% compared to the average 8.7% in IEA Member countries. The federal target set for CHP by 2005 has almost been met, but the AMPERE Commission has estimated that there is potential for producing an additional 700-1,500 MW_e by CHP. Flanders has its own target to install 1,800 MW_e of new CHP capacity by 2005.

It is not easy for CHP generators to penetrate Belgian energy markets. First, CHP and associated heat distribution systems are inherently capital-intensive and the investments need relatively long pay-back periods. Second, CHP is an economic option only when the heat produced by the plant can be efficiently consumed; the modest average efficiency of Belgian CHP suggests that it is not easy to find matching demands for heat and electricity to operate CHP efficiently. Third, industry has enjoyed cheap electricity, most of which is generated by nuclear plants whose depreciation is almost completed. Fourth, although CHP generators are given priority access to the grid, the back-up tariff is discouragingly high. In addition, there are two problems which may be solved once energy market liberalisation has been fully implemented. One is that CHP producers were not allowed to sell surplus electricity directly to consumers, and instead had to sell it to distributors at low tariffs. Another is that the market players have been taking a "wait and see" stance until the details of the new legislation are clarified.

The federal and regional governments consider that increased use of CHP would be effective in meeting the CO₂ reduction targets as well as enhance energy efficiency. They promoted CHP with various supportive measures, namely tax abatement and subsidies for feasibility studies and investment costs, which did increase the number of installations. If CHP units use biomass as fuel, they are eligible for direct subsidies, the so-called green francs. However, their average efficiency performance so far has not been satisfactory and, to address the problem, the federal and regional governments have targeted their support only to "high-quality" CHP installations.

Policy measures to promote efficient CHP should be carefully designed; efficient CHP should be competitive in nature and need little support while it is not sensible to promote CHP installations that show poor performance. More attention should be paid to preparing an appropriate market environment, including the adjustment of buy-back tariffs and more prompt action on necessary

legislation to reduce uncertainty. It is also important that CHP generators can find cheaper gas, and the planned liberalisation of the gas market should be completed as scheduled. Subsidies to CHP, either direct or indirect, should be phased out. In the Netherlands, for example, subsidies increased CHP capacity fivefold in the 1990s, causing significant over-capacity. This, in turn, led to limiting the output of existing, economic base-load plants so that over-capacity from the expensive new CHP plants could be accommodated, resulting in under-utilised capacity and higher unit costs.

RECOMMENDATION

The Government of Belgium should:

- Phase out financial support to CHP. Establish instead a more sustainable back-up capacity pricing scheme and ensure that buy-back tariffs for electricity are set at a level that does not distort competition between CHP and other generation methods.
-

NUCLEAR

OVERVIEW

Belgium has seven operating nuclear power plants, all pressurised water reactors, with a total generating capacity of 5,632 MW. The reactors are located at two sites: Doel on the Schelde estuary close to Antwerp, and Tihange on the river Meuse between Liège and Namur.

In 1999, the nuclear plants produced 46.7 TWh, supplying 58.8% of the country's electricity needs. The mean availability was 93.3%. Although such performance may be exceptional because of the particular timing of refuelling and maintenance of the plants in 1999, the overall performance of Belgian nuclear plants is generally high, with an average availability of 86.6% during 1996-1998.

Table 8
Nuclear Power Plants in Belgium

<i>Plant</i>	<i>Year of commissioning</i>	<i>Capacity (MW_e)</i>	<i>Owner</i>
Doel 1	1975	392.5	Electrabel
Doel 2	1975	392.5	Electrabel
Doel 3	1982	970	Electrabel 96%, SPE 4%
Doel 4	1985	1,001	Electrabel 96%, SPE 4%
Tihange 1*	1975	931	SEMO, <i>i.e.</i> Electrabel 50%, EDF 50%
Tihange 2	1983	930	Electrabel 96%, SPE 4%
Tihange 3	1985	1,015	Electrabel 96%, SPE 4%

* Belgian share 628.5 MW_e.

Source: Country submission.

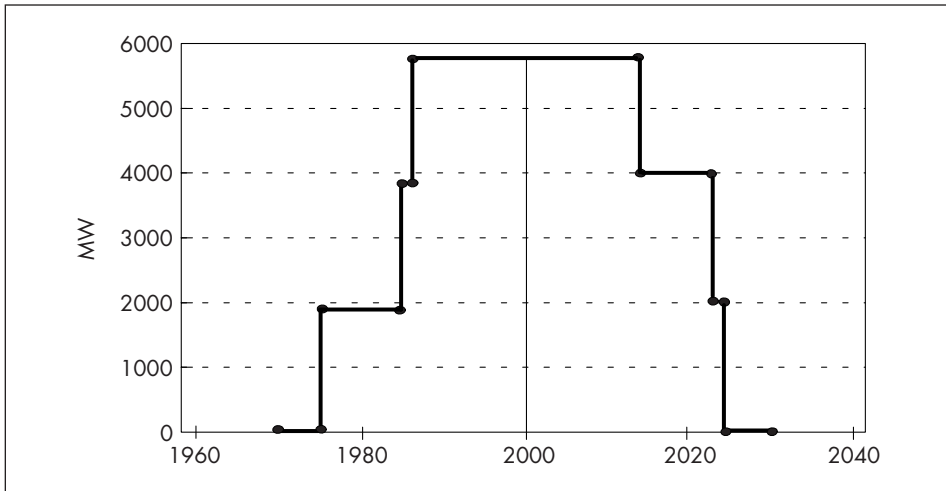
The ownership arrangements of the nuclear sector in Belgium are complex. Tractebel is the main owner of the nuclear power plants either by owning them directly or through Electrabel. Belgian interests own a share of the Chooz B plants in France (close to the Belgian border), and have an entitlement to some of the electricity they produce. Electrabel also owns a share of the Tricastin power plant in France, which is used to supply the uranium enrichment plants of Eurodif.

NATIONAL NUCLEAR ENERGY POLICY

The responsibility for nuclear policy within the Belgian government rests with the Ministry of Economic Affairs and the State Secretary for Energy and Sustainable Development.

Since the national elections in 1999, Belgium's long-established energy policies – *i.e.* security of supply, economic costs and minimal environmental impact – have been supplemented by a new policy to phase out nuclear energy. The current plan is to close down all existing nuclear plants in Belgium over the period 2014-2025 (when each one will have reached the age of 40 years), and not to extend their life, nor replace them with new nuclear units (see Figure 18).

Figure 18
The Commissioning and Decommissioning Schedule of the Nuclear Power Plants



Source: AMPERE Commission.

While the AMPERE Commission does not question the decision to phase out nuclear power, it does consider it to be a very economical method for generating electricity. It compares electricity production costs in 2010 based on non-fuel costs (investment, operation and maintenance), fuel costs, and externalities²⁹ (air pollution, noise, greenhouse gases, ionising radiation, *etc.*). When external costs are taken into account, the price of electricity generated by any existing nuclear

29. The Belgian Parliament has not yet fully approved the data on external costs used by the commission. The report is subject to an international peer review that will be ready by mid-2001.

technology (PWR, AP600 and MHTGR³⁰) is lower than the price of electricity generated by any other existing alternative technology in Belgium. When external costs are not taken into account, PWR and AP600 are cheaper than any other existing generation technology, but MHTGR is more expensive than existing coal technologies, namely pulverised coal technologies and coal gasification.

SECURITY OF NUCLEAR-GENERATED ELECTRICITY

In the 1990s, Electrabel invested an average of BF 4 billion per year to reach high safety standards and good performance in its nuclear power facilities. Because these objectives were achieved, such large investments will no longer be necessary, and from the year 2000 onwards annual investments will amount to BF 1.3 billion for maintaining the facilities in optimum operating condition.

The primary energy resource for Electrabel's nuclear power plants, uranium, is secured by Synatom. As there are no economically feasible indigenous resources, the fuel is procured on world markets. The supply portfolio is well diversified, with supplies being imported from Australia, Canada, and Central and South Africa. Uranium ore accounts for less than 5% of the total generation costs of the nuclear units. All other services to support plant operations, with the exception of enrichment, are either indigenous or obtained commercially from established suppliers in OECD countries. Enrichment takes place mainly in Western European countries and in Russia.

Belgian interests have secured a share in the French Eurodif plant, which is a major supplier of enrichment services. A uranium fuel production plant, with a capacity of 400 tonnes of uranium per year (more than enough to meet Belgian needs), is located at Dessel and operated by a subsidiary of the French company Société Franco-Belge de Fabrication de Combustibles (FBFC). A mixed oxide fuel fabrication (MOX) plant, with a capacity of 35 tonnes per year, is also located at Dessel and is operated by Belgonucléaire.

Irradiated nuclear fuel is currently stored at the nuclear power plant sites following a 1998 government decision to introduce a moratorium on nuclear fuel reprocessing. Sufficient capacity exists for storing the lifetime waste fuel of the Tihange plant locally, and the Doel plant has the capability to store its waste fuel by extending a modular building on site to meet operational needs. Earlier commitments to deliver fuel for reprocessing to the Cogéma plant at La Hague in France have now been fulfilled.

In July 1995, the Ministry of Internal Affairs was named the supervising authority for nuclear safety, taking over this responsibility from the Ministries of Labour and

30. PWR = pressurised water reactor; AP600 = PWR with passive safety systems and simplified design; MHTGR= modular high temperature gas-cooled reactor.

Employment, and of Social Affairs, Health and Environment. The Federal Nuclear Inspection Agency was officially created in 1994 and will become operational in 2001. It combines the functions of the former Service for Protection Against Ionising Radiation and Technical Safety of Nuclear Facilities and the activities of other services working in the field of nuclear safety.

PLANT DECOMMISSIONING AND RADIOACTIVE WASTE MANAGEMENT

Responsibility for all aspects of decommissioning nuclear power plants in Belgium rests with their owners. The two companies responsible for nuclear power plant decommissioning and waste management are Electrabel and Synatom. The costs of radioactive waste disposal are assumed by the waste producer when the waste is transferred to ONDRAF/NIRAS, the national state-owned organisation responsible for nuclear waste disposal.

Currently, all radioactive waste in Belgium is stored pending the availability of facilities for its permanent disposal. Plans for such facilities exist, but the disposal of medium-level (non heat-generating) waste is not planned to start until 2035, and of high-level (heat-generating) waste not until 2050. Low-level waste facilities are expected to become operational in the next decade. Contrary to fossil fuel alternatives, nuclear power is unique in that it generates waste that can be stored over a period of 50 years, if not longer.

MOX FUEL

One consequence of having chosen a management approach for irradiated fuel that includes reprocessing is that separated plutonium is produced, as well as uranium and other radioactive materials (for possible further treatment, vitrification and final disposal). In the absence of fast breeder reactors which are fuelled by plutonium and which were, at one time, expected to use the separated plutonium from pressurised water reactors, a decision has been taken to recycle it in existing plants as mixed oxide (MOX) fuel. Currently, two reactors are loaded with up to one-fifth of this fuel, and one reactor is completely loaded with fuel made from reprocessed uranium. The outcome of this approach is that stocks and supplies of separated civilian plutonium and reprocessed uranium will be exhausted in Belgium by 2003/2004. Thereafter, the reactors will again be loaded with fresh supplies of uranium.

CRITIQUE

The Belgian government has taken the decision to phase out nuclear power when the currently operating units reach the age of 40 years. The decision is political in character and has not yet become law. The economic and environmental

implications of the closure plans are not clear. The AMPERE Commission has addressed these issues in its report, indicating that electricity production costs will increase after the phase-out of nuclear power because the production costs of all alternative power generation methods are higher. As the commission did not make estimates for the future use of base load technologies, it is unclear by how much electricity prices would increase, and by how much polluting emissions would grow. The results of the AMPERE Commission report have been put to an international peer review that will be ready by the end of 2001.

Nuclear power should be replaced with a proven, commercially viable and low-cost technology – or mix of technologies – while not losing sight of the costs of addressing greenhouse gas emissions. This is crucial since more than half of Belgium's electricity is produced by nuclear power plants. As no alternative is currently at hand, a prudent course of action would be to diligently preserve the nuclear option by continuing to operate existing nuclear plants and foreseeing a possible need for replacement or additional nuclear capacity until such alternatives do become practically available. The economic attractiveness of extending the operating lives of fully depreciated nuclear units is already well recognised in many OECD countries. In the United States, for example, the operating licences of some plants have already been extended from 40 to 60 years, and many other countries are expected to take similar action.

The declared nuclear power shut-down is planned to take place after 2014 and so should not create additional difficulties for meeting the national Kyoto target. It will, however, make it more challenging for Belgium to maintain the target for future years.

Within the framework of a regulated electricity market, the administration of funds for decommissioning nuclear power plants and related spent fuel management by private companies has been a satisfactory arrangement. However, as liberalisation of the electricity market progresses, it would be appropriate to review present arrangements for assuring the availability and security of these funds held in the private sector.

RECOMMENDATIONS

The Government of Belgium should:

- Act to preserve the nuclear option until a reliable quantitative analysis can be conducted comparing the various technological options to replace nuclear energy – including their environmental and economic aspects. The quantitative analysis should be conducted promptly, bearing in mind the long-term nature of investment in power generation.
- As liberalisation of the electricity market progresses, review the availability and security of funds currently administered by Electrabel and its subsidiary Synatom to pay for decommissioning nuclear power plants and spent fuel management.

NATURAL GAS

SUPPLY AND DEMAND

Supply Sources

Belgium has no indigenous gas production. Given the country's complete dependence on foreign supplies, constant efforts are being made to find new sources to meet the growing demand for natural gas. Diversifying supply sources is also important for security.

In 1999, 32% of natural gas imports came from Norway, 31% from the Netherlands, 26% from Algeria, 3% from Germany and 8% from short-term purchases on spot markets. The contracts were made on a take-or-pay basis and will expire by 2006. The share of gas (especially liquified natural gas) bought on spot markets may grow slightly in the future, but the Belgian government does not want it to exceed 15% of total supplies. Distrigas, Belgium's gas importer, is considering the possibility of importing natural gas from Russia after 2005, and a framework contract has already been signed. However, the contract may concern only transit to neighbouring countries, and not additional supplies for domestic consumption.

Dutch Slochteren gas has a lower calorific value³¹ than North Sea or Algerian gas. It has to flow through a separate network for domestic distribution and for its onward journey to France. Gas-mixing stations are located at Lillo and Loenhout. During peak demand, nitrogen is mixed with high-calorific natural gas to decrease its calorific value before it flows into the regular gas network. The mixed gas is distributed mainly to residential consumers in Brussels and Antwerp.

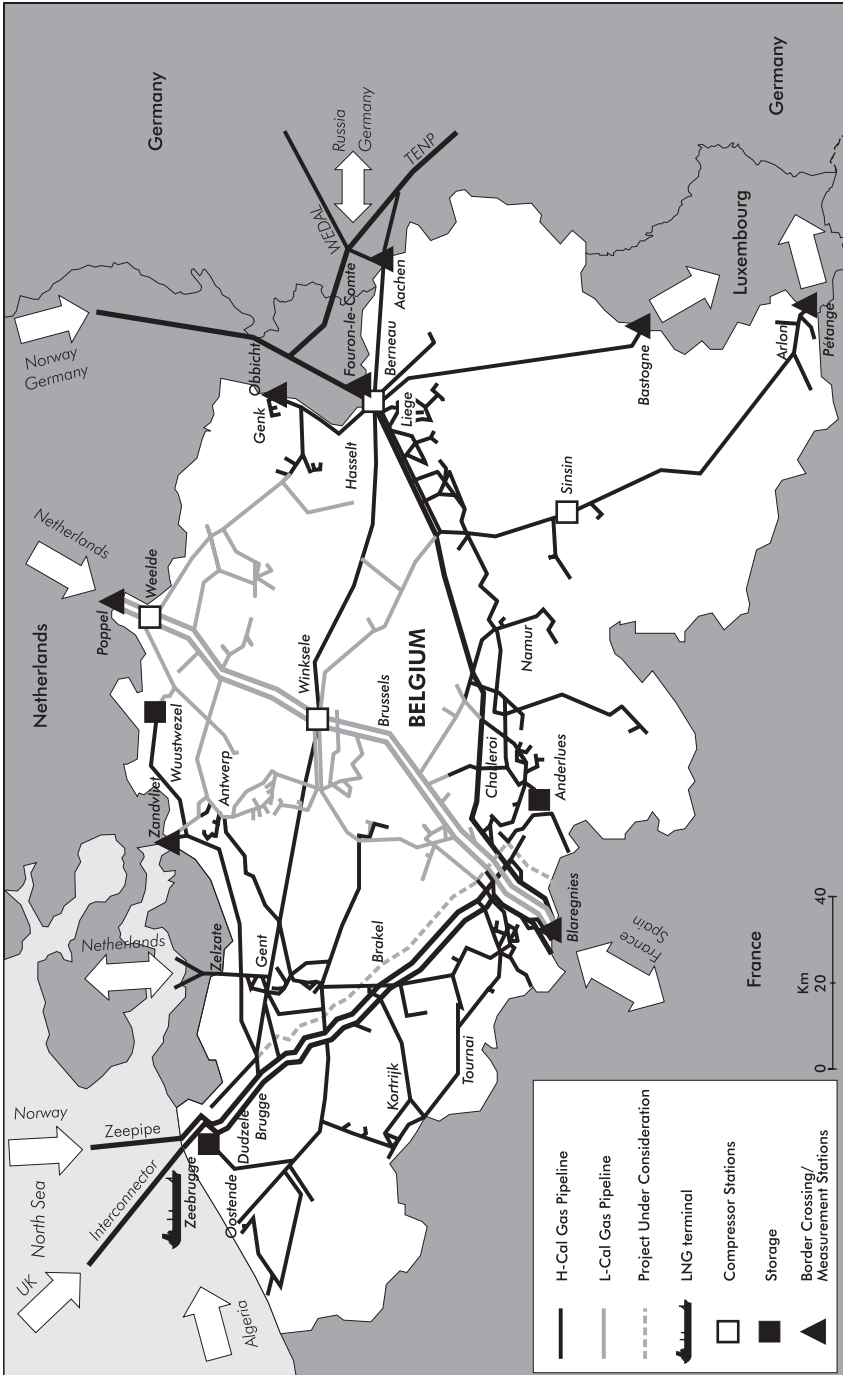
Since the law of 29 July 1983, Distrigas no longer has the exclusive right to import natural gas. In principle, industrial consumers can import natural gas, but in practice Distrigas remains the only gas importer in Belgium.

Gas Transit and Export

Belgium is a strategically important nodal point in the European gas grids, and has become an important transit country for natural gas that flows from the Netherlands and Norway to France and Spain, and from the United Kingdom to Germany. The volume of gas that transits through Belgium to other countries is

31. Rich gas from the North Sea and Algeria has a calorific value of 41,868 kJ/m³ compared to the calorific value of 35,169 kJ/m³ in gas from the Slochteren field in the Netherlands.

Figure 19
Major Natural Gas Transit and Export Routes



Source: *Natural Gas Information*, IEA/OECD Paris, 2000.

48 bcm per year, equivalent to three times the volume of Belgium's own gas consumption (14.8 bcm) in 1999. The government expects the transit volume to increase in the future but the construction of new pipelines is limited by environmental restrictions.

Zeebrugge is important in terms of supply security for European gas markets. Gas is transported there from three different sources: the Zeepipe, Algerian LNG deliveries, and the UK-Belgium Interconnector (VTN/RTR pipeline). For example, about 45% of France's total natural gas imports of 40 bcm in 1999 originated in Norway and the Netherlands and transited through Belgium. In 1999, 27% (or 8.4 bcm) of Spain's total gas imports came from Norway and passed through Belgium.

Figure 19 illustrates the extent and coverage of the current natural gas transmission network and the connections with neighbouring countries. The length of the transmission and distribution pipeline network totals 3,760 km. Distrigas invested €27 million in 1999, of which €12 million for new pipelines.

The Interconnector pipeline was commissioned in late 1998, and 1999 was the first year of full operation. The reserved capacity for the Interconnector natural gas transit pipeline via the VTN/RTR pipeline (from Zeebrugge to Eynatten at the German border) was over 15 bcm in 1999. The 1,100 km undersea Zeepipe links Norway's Troll and Sleipner fields to the Zeebrugge terminal. The Zeepipe has a transmission capacity of 13 bcm per year. Tankers from Algeria arrive at the LNG terminal at Zeebrugge, which can handle the largest LNG tankers (over 130,000 m³).

From 1998 to 1999, natural gas exports from Belgium increased by 12% to 1.2 bcm. The increase was primarily the result of strong trading on the Bacton and Zeebrugge spot markets after the Interconnector entered into service.

Coping with Gas Supply Disruptions

In the event of a disruption in supply, Belgium can call on its underground storage and above-ground LNG stocks which are part of its backup supply agreement signed with Gasunie of the Netherlands. The natural gas stock capacity in Loenhout (Flanders) is 540 million m³ and in Anderlues (Wallonia) it is 80 million m³. The LNG stock near Zeebrugge is 55 million m³.

Demand

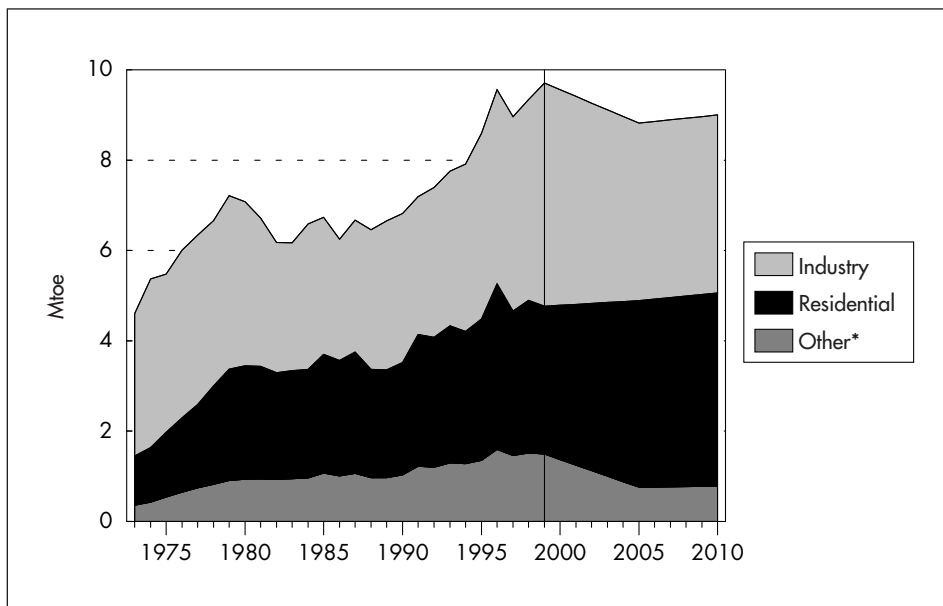
Natural gas demand has been growing continuously, representing a 63% increase from 1990 to 1999. During the same period, the proportion of natural gas in total primary energy supply (TPES) grew from 16.9% to 22.7%. The government estimates that total gas demand will slightly increase and final consumption will slightly decrease after 2000.

The volume of growth in natural gas imports in the 1990s is related mainly to increasing use of natural gas for electricity production. Natural gas has become the second most important fuel for producing electricity, with a 23.1% share in 1999 up from a 7.7% share in 1990. The proportion of electricity generated from natural gas today is about the same as it was in the 1970s, but during the 1980s very little gas was used in electricity generation. Natural gas consumption for power production rose by 23.2% in 1998-1999 when the new 350 MW gas-fired plant at Saint-Ghislain became operational. The government expects that the share of natural gas in power generation will grow to 29.6% by 2010.

Mainly because of strong economic growth in the late 1990s, gas supply to industries grew by 50% between 1990 and 1999 (Figure 20). The government considers that the industrial gas market is now mature and does not expect further growth in gas consumption in that sector.

In the 1990s, natural gas has also become an important fuel for heating in the residential and services sectors, where consumption grew by 35% from 1990 to 1999. Roughly half of the households are heated by natural gas, and the number of individual connections for space heating increased by about 40,000 in 1999. The government estimates that consumption in the residential sector will continue to grow, but moderately.

Figure 20
Natural Gas Consumption, 1973-2010



* includes commercial, public service and agricultural sectors.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2001, and country submission.

INDUSTRY STRUCTURE

Distrigas was created in 1929 as a state-owned enterprise. At the end of 1994, Distrigas was privatised, and its shareholding structure was reorganised following the privatisation of its shareholding company SNI (National Investment Company). SNI's 50% stake in Distrigas was purchased by the Belgian holding company Tractebel S.A.³² (40.91%) and Socogaz (9.09%). The Belgian government holds one specific preferential share, the so-called "Golden Share"³³, and has the power of veto in matters of national energy policy. As a result, the current shareholding structure of Distrigas is as follows: Tractebel S.A. (33.25%), Distrihold³⁴ (16.75%), Belgian Shell S.A. (16.67%), Publigaz³⁵ (16.62%), the stock market (16.71%) and the Belgian State (the Golden Share).

Up to now, Distrigas has had a *de facto* monopoly on supplying gas to distribution companies, obliging them to have Distrigas contracts. The standard Distrigas contract for distribution companies, however, states that if they can obtain continuous and secure supplies, satisfying quality requirements, from another supplier, then the Commission for Electricity and Gas Regulation (CREG) will not object. The same contract also states that Distrigas should be given an opportunity to respond by changing its prices and conditions.

The natural gas distribution market structure is similar to the one for electricity. Responsibility for distribution to households and small customers in the tertiary and industrial sectors lies with the local authority, either directly or through public distribution companies. These are formed by the local authorities themselves (municipal utilities or inter-municipal companies), or co-owned with private companies (mixed inter-municipal companies). Because municipalities have traditionally (but not legally) been responsible for distributing natural gas, they confer exclusive rights on distribution companies to distribute gas in their area. There is a public service obligation to distribute gas, but this is subject to some economic constraints, such as the cost of connecting individual households located too far from the distribution grid.

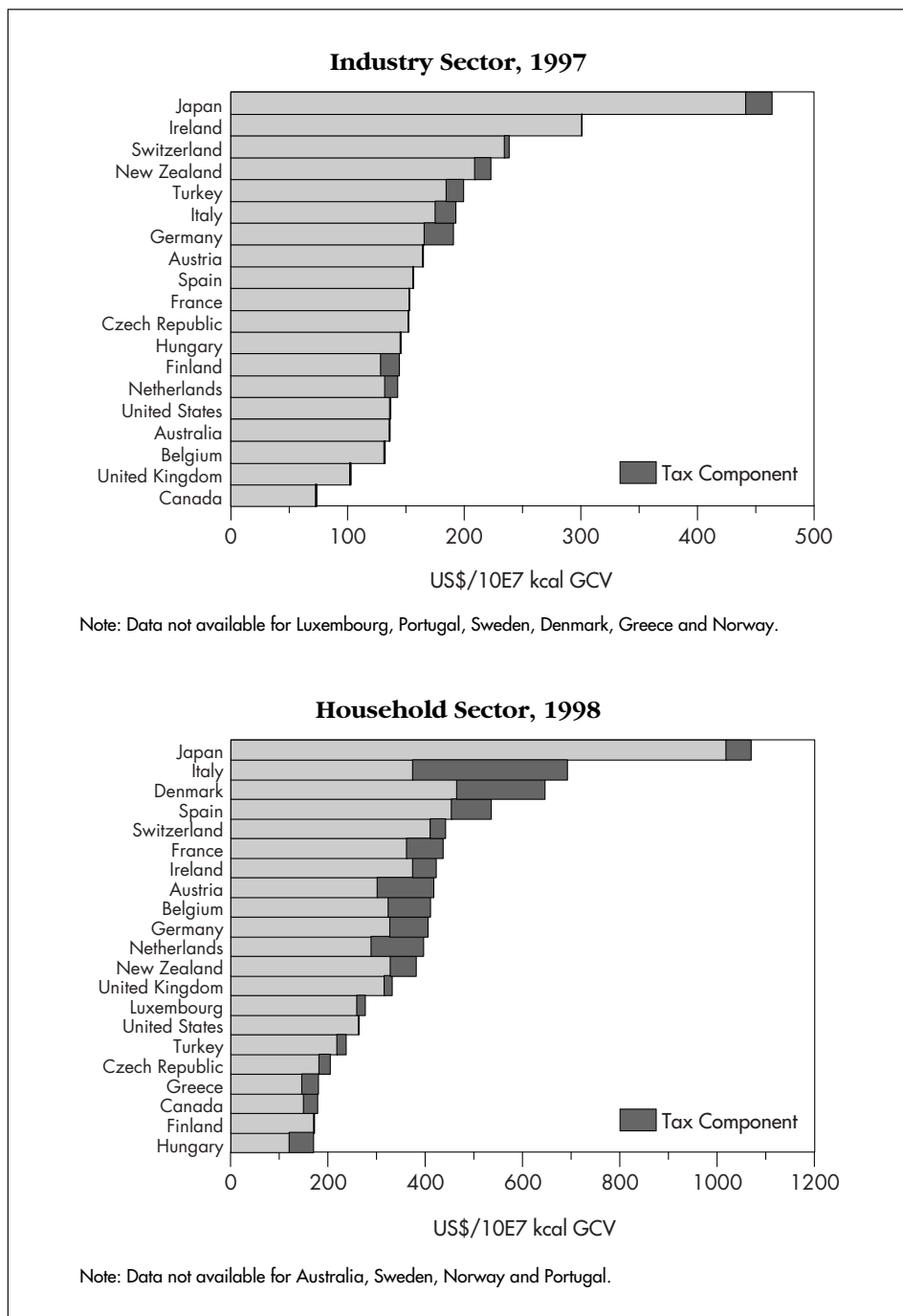
32. At the end of 1998, the shareholding structure of Tractebel was the following: Société Générale/Belgium Group, 50.4%; individuals and institutions, 45.3%; Sofina Group, 2.8%; and personnel, 1.5%.

33. The law of 29 April 1999 abolished the 3% rule associated with the Golden Share which prevented anyone from buying listed Distrigas shares if it enabled that person to acquire more than 3% of the voting rights.

34. Distrihold was created in September 1994 by Tractebel to hold the Distrigas shares. Distrihold's assets belong to Tractebel (50% plus one share) and Publigaz (50% less one share).

35. Publigaz is a financial holding company which holds all the shares of the distribution companies.

Figure 21
Natural Gas Prices for Industry and Households in IEA Countries



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2000.

GAS PRICES

In 1999, the natural gas price for small industrial consumers (consuming 36 TJ/year) was on average just under €3 per GJ (taxes included, VAT excluded) and for large industrial consumers (consuming 1.91 million TJ/year) about €2.3 per GJ. These prices were lower than in any of the neighbouring countries and about the same as in the United Kingdom. Gas prices increased during 1999 because they are pegged to the prices of oil products which rose significantly that year. The weakened exchange rate against the US dollar also contributed to an increase in gas prices.

In 1998, the natural gas price for households was slightly below the average for OECD Europe. In 1997, it was about three times higher than for industrial consumers and electricity producers. Since then, no statistics on gas prices in Belgium have been published. For comparison, the ratio of household prices to industrial prices was 2.2-2.6 in Germany in 1997, 2.8 in France in 1999, 2.8-3.1 in the United Kingdom in 1999, and 2.9 in the Netherlands in 1998.

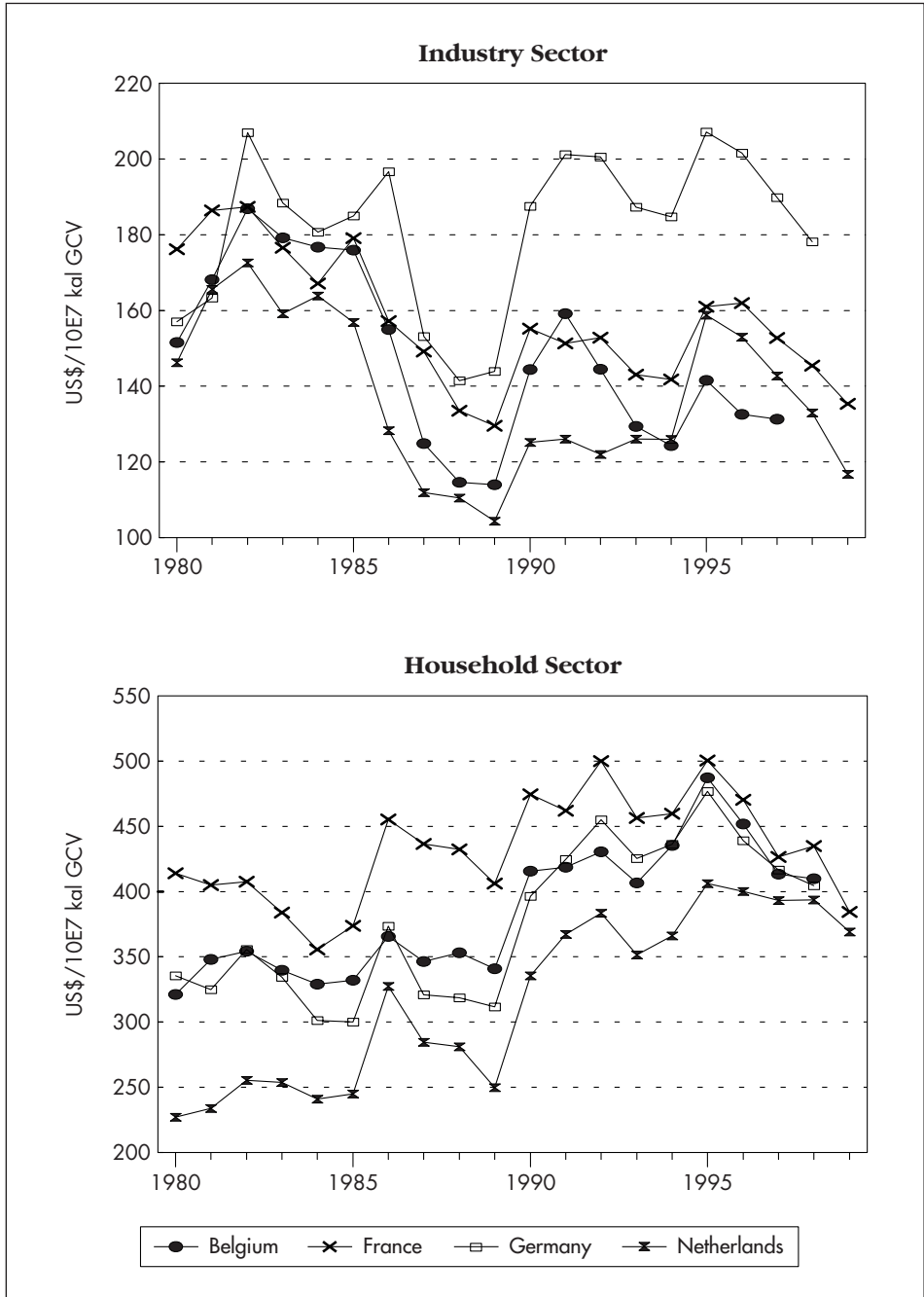
LIBERALISATION OF THE GAS MARKET

The Belgian Gas Law of 29 April 1999 amended the law of 1965 and fully incorporated the European Gas Directive on storage, transmission, distribution and sales into Belgian legislation. In July 2000, the federal government agreed to speed up market opening for industrial clients and distribution companies. Consequently, a new law amending the 1999 law has been drafted and is expected to be introduced in late 2001. The law will accelerate the schedule of liberalisation for some consumer groups, introduce regulated third party access (TPA) to the transmission network (instead of the originally chosen negotiated TPA), and require more effective unbundling in the gas industry.

The initial opening of the natural gas market in August 2000 represented about 47% of the Belgian market, exceeding the minimum requirement of 20% set by the EU directive (See Table 9). Further market opening is scheduled as follows: 49% in August 2003, and 66% in October 2006; the directive calls for 28% in 2005 and 33% in 2010.

When the new law enters into force, all CHP producers and other autoproducers will become eligible immediately, and the eligibility threshold for industry will be reduced from 25 to 5 million m³ per year. All industrial users will be eligible after 1 October 2006, and distribution companies will be able to choose their suppliers on the same date. In the meantime, the amount of gas that distribution companies can purchase from suppliers of their choice is determined by the volume that they distribute to their eligible consumers.

Figure 22
Natural Gas Prices in Belgium and in Other Selected IEA Countries, 1980-1999



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2001.

Table 9
Schedule for Natural Gas Market Liberalisation

<i>Consumer group</i>	<i>From 10.8.2000</i>	<i>From 10.8.2003</i>	<i>From 1.10.2006</i>	<i>From 1.10.2010</i>
Industry	Customers with annual offtake of 25 million m ³ or more per site	Customers with annual offtake of 15 million m ³ or more per site	Customers with annual offtake of 5 million m ³ or more per site	All
Power producers			All	
High-quality CHP and autoproducers	Annual offtake threshold of maximum 5 million m ³ per generating unit may be imposed			All
Public distribution	Only for volumes destined for eligible customers of the distribution companies		Each inter-municipal distribution company for 33% of its supply	Each inter-municipal distribution company for 100% of its supply

Source: Ministry of Economic Affairs, Energy Administration.

The regions have completed their legislation only partially. A draft decree administering the liberalisation of the natural gas market was approved by the Flemish government in 2001. However, it has not yet been approved by the Flemish parliament. Wallonia has also introduced a draft decree but it still has to be approved. These two regional decrees are consistent with the EU directive and federal legislation. Brussels-Capital will not take any steps to introduce new regional legislation until all federal legislation has been completed.

The Royal Decree on establishing a federal regulator has been promulgated. By the law of 29 April 1999 concerning the organisation of the gas market and the fiscal status of electricity producers, the Commission for the Regulation of Electricity (CRE) was converted into the Commission for Electricity and Gas Regulation (CREG). This is an independent advisory body to regulate the liberalised segment of the gas market; it started its operation in early 2000. The Control Committee for Electricity and Gas (CCEG) retains its powers in the non-liberalised segments of both the electricity and gas markets; one of its tasks is to ensure that there are no cross-subsidies between consumer groups.

The broad changes that were introduced to federal legislation in 1999 have led to three Royal Decrees defining the practicalities for organising the liberalised gas market. However, these have not yet been finalised.

The Royal Decree on the publication of commercial terms governing negotiated access to transmission networks will amend the Belgian Gas Law to introduce regulated third party access (TPA) rather than negotiated TPA as the law originally intended. Gas transportation companies will be required to publish the commercial conditions for access to their grid every year. The decree will stipulate what particulars must be included in these conditions, such as minimum technical requirements for grid access, possible natural gas connection points, and guideline tariffs for grid access. The code of conduct that third parties will have to respect to access the transmission networks includes:

- The procedures and rules that network users must follow when requesting access to the network.
- The information that network users must make available to the transportation companies.
- The measures that transportation companies must take to preserve the confidentiality of network users' commercially sensitive information.
- The time period within which transportation companies must respond to access requests.
- The measures that transportation companies must take to prevent discrimination between network users or categories of network users.

The Royal Decree concerning gas supply licences will be issued to make these licences obligatory for those who wish to sell gas to eligible customers. The Royal Decree concerning gas transportation licences will be issued to abolish exclusive rights for transporting and storing gas so that anyone with this licence can enter the natural gas transportation or storage market. The government will award gas supply and transportation licences based on objective, non-discriminatory and transparent criteria. The decrees will stipulate the criteria and procedures for the awarding, reviewing and withdrawal of such licences.

RESTRUCTURING

At the beginning of 2001, Distrigas unbundled its transmission and sales activities by account separation as required by the Gas Law. It will take further action, such as separating the offices and information technology systems for its unbundled activities, as required by the forthcoming 2001 amendments to the Gas Law. In addition, new procedures will be introduced for approving transactions for sales and transmission. CREG recommended that the different

functions of Distrigas be divided into separate companies, but this has not materialised.

Many of the natural gas distribution companies distribute electricity and cable television services. Unbundling these will be required as well, but so far no instructions have been given on the practical implementation.

CRITIQUE

As in the electricity sector, much progress has been observed in the Belgian natural gas sector since the last IEA in-depth review in 1997. Belgium is liberalising the gas market a little faster than required by the EU directive. Some concerns remain about the timing and effectiveness of practical implementation since all necessary legislation and new institutional arrangements, including the establishment of arbitration systems, have not been completed. This also creates an uncertain investment climate for market players.

The initial opening of the market in August 2000 covered 47% of the market, exceeding the minimum 20% requirement by the EU directive. However, until October 2006, distribution companies are allowed to purchase natural gas only to meet the demand of their eligible customers, and have to wait until 2010 for full liberalisation. This may change as the federal government has decided to speed up the market opening process and a new law will be introduced in late 2001. According to the draft decree, the number of eligible consumers will be increased faster than originally planned, and full liberalisation for distribution companies will take place in 2006. This new schedule is in line with that for liberalising the electricity market. This is a welcome move since the two markets are closely inter-related and consistency is essential for market players. It is also important to ensure that the various gas consumers, such as the public power producers, CHP producers and autoproducers, will have equal opportunities to choose their supplier. Currently, public power producers are free to choose their supplier but restrictions in terms of purchased volume apply to CHP producers and autoproducers.

It remains a concern that, despite the new decree, the schedule for market opening for distribution companies is slower than in neighbouring countries. As long as the distribution companies are limited to purchasing gas only to meet the demand of their eligible customers, consumers in the captive part of the market will have little possibility to benefit from market liberalisation.

Despite the efforts of the Belgian government, it is not certain that sufficient competition will arise in the gas market after all necessary legislation is finalised and regulators are established. Currently, there is only one supplier in the country, Distrigas. While it has not had exclusive rights to import natural gas, in practice it has remained the only gas importer and wholesaler in Belgium. One reason for this is that until now there has not been third party access to the transmission network with clearly defined rules and tariffs. At present, potential competitors appear to be

mainly foreign gas suppliers. Fortunately, there is no particular constraint for transmission since capacities are sufficient. But it is important for the government to ensure that licensing and the procedures for gas supply and transport, code of conduct, transmission tariffs and commercial conditions set by the network owners do not become entry barriers and hinder competition.

Belgium had first opted for negotiated TPA for transmission. Now it has chosen to use regulated TPA instead, which is considered to be a sensible decision. While negotiated TPA is a more market-oriented approach where access prices are determined through negotiation by the market players, this process is time-consuming and can be disadvantageous for small market players. Regulated TPA, which has been introduced in most other European countries, is considered more efficient and provides equal opportunities to any potential new entrants to the market, and is likely to be more suitable for Belgium. An important prerequisite for regulated TPA to work effectively, however, is that the regulator has the necessary competence to monitor and regulate the markets, free from political influence. In this respect, there is concern that in Belgium the regulator remains an advisory body to the government.

Distrigas will continue to operate the transmission network. The transmission operation will be unbundled from other activities, but the unbundling will be done by separating accounts. The new draft decree calls for more effective unbundling, such as separate locations with separate information systems for different activities, but does not require divestiture. In 2000, the regulator urged Distrigas to separate its network operations and make it an independent company but this did not materialise. Because Distrigas is increasing its international operations, these should also be effectively unbundled from domestic operations.

The distribution companies are also required to unbundle their gas business from other activities but no instructions for practical implementation have yet been given. This raises a concern of cross-subsidisation among different activities.

The price level of natural gas for residential consumers is no higher in Belgium than in other European countries. However, the difference in prices between industrial and residential consumers is greater than in any of the neighbouring countries. Also, a single price is applied for captive consumers throughout the country, creating a situation where the distribution company with the highest cost defines the price for all captive consumers. The government should consider replacing this principle with a system that encourages distributors to increase efficiency and reduce prices. The current profits of distribution companies are considerable, implying that prices are set higher than costs. In some cases, they finance up to 10% of the municipal budgets, which means there is hidden taxation on energy that takes advantage of the monopolistic status of utilities owned by municipalities. What constitutes an acceptable level of revenue should therefore be carefully considered.

One-third of the gas market is composed of low-calorie gas that is currently supplied by one natural monopolistic company. The Belgian government considers that

when the supply of low-calorie gas peaks out, it should be replaced with high-calorie gas. For both suppliers and consumers, this conversion will require substantial investments, and so a plan must be developed to ensure a smooth transition that may occur in several years from now.

RECOMMENDATIONS

The Government of Belgium should:

- Set a clear time-frame for completion of pending legislation.
 - Set up as soon as possible the necessary regulatory institutions, including court and arbitration systems.
 - Take steps to develop cross-border competition in gas supply. Facilitate the arrival of newcomers by ensuring that licensing procedures and technical regulations are not barriers to entry.
 - Ensure that the commercial conditions governing access to the grid and the licensing systems are transparent and non-discriminatory.
 - Ensure that the planned unbundling is effectively carried out in transit, transmission and distribution.
 - Make sure that the distribution companies do not misuse their monopoly position by cross-subsidising other activities.
 - Ensure transparency and efficiency in gas price-setting. Assess the possible benefits of price differentiation for distribution companies in different geographical areas while they are still part of the captive market. Also ensure that the captive market, especially residential consumers, benefits from increased competition and the expected reduction of prices.
-

SUPPLY, DEMAND AND TRADE

Belgium has no indigenous oil resources and thus all of its oil is imported. In 1999, total crude oil imports were about 32 million metric tonnes. The main crude oil suppliers in 1999 were the Middle and Near East with 29.3%, Norway 29.1%, the United Kingdom 19.3% and Russia 14.1%. The proportion of supplies from the North Sea and Russia has been growing, though not steadily, compared to supplies from the Middle East. Imports from Saudi-Arabia were halved in 1998. Belgium has been successful in diversifying its suppliers of crude oil, and the share of imports from OPEC countries, which represented 86.6% of total Belgian crude oil imports in 1979, dropped to 34% in 1999.

About 30% of total oil imports are oil products, representing some 14 million metric tonnes in 1999. The Netherlands were the biggest exporter of oil products to Belgium, followed by the United Kingdom and Russia.

The share of oil in total primary energy supply decreased significantly between 1980 and 1990, from 51.1% to 38.7%, but stabilised in the 1990s.

The share of oil in total final energy consumption decreased between 1973 and 1990, from 60.7% to 52.6%, but grew slightly thereafter. Transport, the major oil-consuming sector, accounted for 44.8%³⁶ of final oil consumption in 1999, followed by industry with 28.5% and other sectors with 27.3%. Although natural gas has partially replaced oil for heating in the residential sector, its 50% share is expected to remain stable.

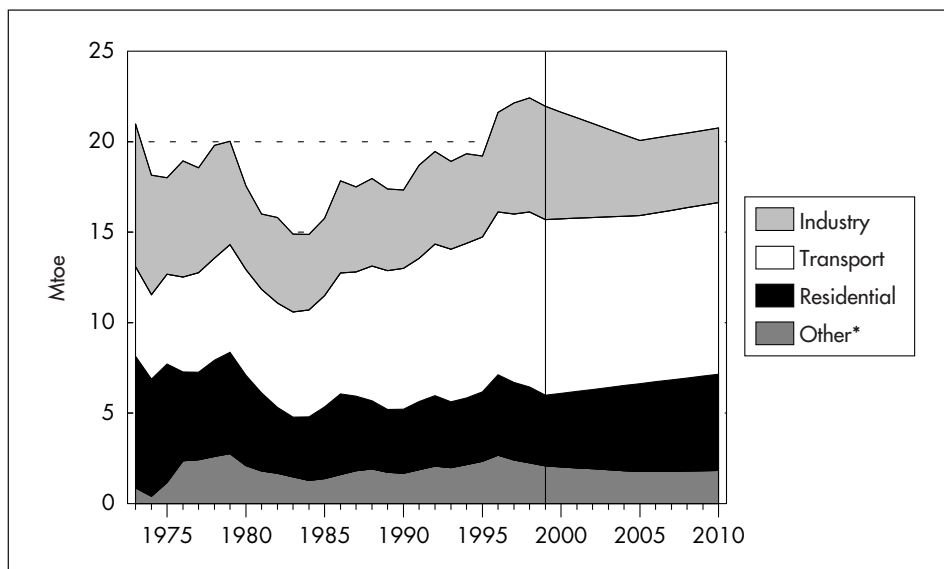
Because of its geographical proximity to the Netherlands and to the canal and river systems of the Rhine, Escault and Meuse, Belgium is the second largest centre for oil product transport in Europe. Belgium is a net exporter of oil products (5 million tonnes in 1999), of which 92% were exported to Western Europe. Germany is the largest importer, accounting for 29% of Belgian total oil product exports.

INDUSTRY STRUCTURE

Belgium has five refineries which are all located in Antwerp. The two large refineries are Fina Raffinaderij Antwerp owned by TotalFinaElf, with a capacity of

36. Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2001. If naphtha, used as feedstock by petrochemical industries, is not included in industrial consumption (method used by Eurostat and the Belgian Energy Administration), the share of the industrial sector in oil consumption was 5.9%, transport 43.6%, residential and commercial sector 30.1%, and non-energy use 20.3% in 1999.

Figure 23
Final Consumption of Oil by Sector, 1973-2010



* includes commercial, public service and agricultural sectors.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2001, and country submission.

15 million tonnes per year, and Esso Belgium owned by Esso, with a capacity of 12 million tonnes per year. There are three smaller refineries, namely Belgian Refining Corporation, Petroplus Refining Antwerp and Nynas Petroleum. Altogether, the capacity of the five refineries is over 34 million tonnes per year. It is not yet clear what impact the Euro 4 Standards³⁷ will have on the Belgian refining industry. The refineries have four years to change their processes to meet with the tighter fuel standards. Petroplus Refining Antwerp has announced that they are investing US\$ 24 million to be able to produce diesel with a very low sulphur content.

The total number of retail outlets (service stations) in Belgium was reduced from 9,280 in 1973 to 4,787 in 1999. Restructuring of the retail sector is continuing.

OIL PRICING

The Programme Contract sets the price ceilings for oil products. First introduced in 1987 for three years, it was extended for two-year periods, and then was finally

37. EU Directive 98/69EC defines emission standards for petrol- and diesel-driven vehicles for 2005 (Euro 4). The standards in all vehicle categories are significantly stricter than the standards introduced for 2000 (Euro 3) by the same directive.

The Programme Contract

The price ceilings for oil products are set on the basis of the following elements:

- Ex-refinery prices in the international markets (principally the Rotterdam market).
- An allowance for mandatory stocks, indexed quarterly, based on the value of the product, interest rates and the cost of rotating stocks.
- Distribution margin, indexed annually, comprising a uniform element for all products and a sales margin (incorporating a fixed profit margin).
- Excise duties and value-added tax.

Prices are calculated daily. If the change in price for each product compared with the previous day, or compared with the moving average for the previous 20 days, exceeds a given threshold, a new tariff comes into effect the following day.

extended indefinitely in 2000. The Belgian Petroleum Federation acknowledges that the Programme Contract is very flexible and does not present an obstacle to free market operation; but it still prefers to let the market determine oil prices.

The federal government has no immediate plans to abolish the Programme Contract, yet this may be considered under certain conditions. First, a fully operating anti-monopoly structure would have to be established and, second, all fraud in commercial procedures would have to be eliminated.

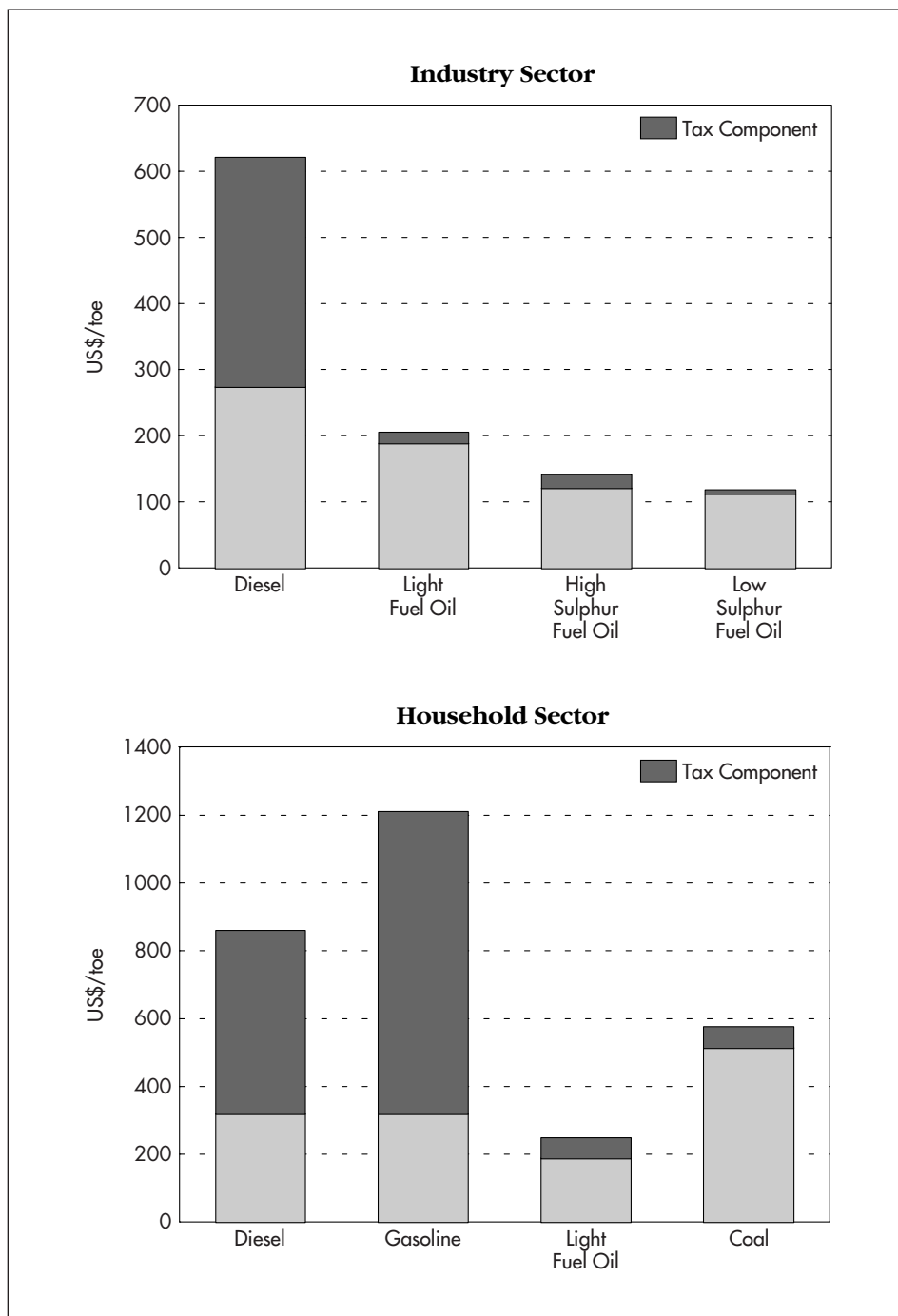
Figure 24 shows the differences in some fuel prices for the industrial and household sectors, and the proportion of taxes for these prices in 1999. The proportion of taxes in diesel and light fuel oil prices for households is clearly higher than for industry. The current gasoline price in Belgium is about average for Europe, but the diesel price is below the average (see Figures 25 and 26).

QUALITY CHECK

The Fund for Analysis of Oil Products (*Fonds d'Analyse des Produits Pétroliers*) was created in February 1995 to carry out systematic on-the-spot quality checks of oil products on the Belgian market. At the beginning, the fund was financed by levying a tax of BF 10 per 1,000 litres of gasoline and automotive diesel oil sold. In 1999, the levy was reduced to BF 1 per 1,000 litres for the following three-year period.

From 1998 to 1999, the Fund increased the number of its quality checks at service stations from 5,760 to 8,710, and will start inspecting the quality of fuel sold directly

Figure 24
Fuel Prices in the Industry and Household Sectors, 1999



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2000.

to the transport sector in 2001. In 1999 only 3.7% – and in 2000 less than 2% – of the samples showed problems, which is a significant improvement over 1995 when inspections first started and 19% of the samples were faulty. About 90% of these revealed the presence of duty-free heating oil and light oil in diesel oil, which is subject to duties, implicating tax fraud. The remaining problems were related more to fuel quality, such as not meeting new specifications (e.g. lower sulphur content), the presence of gasoline in diesel oil (i.e. so called “*point éclair*”) and contamination of fuels during transport. In a few cases, low-grade gasoline was sold as a higher grade. The Belgian Petroleum Federation supports the fund's action and is pressuring the authorities to develop more sophisticated methods of analysis to stop all fraud.

ENVIRONMENTAL ISSUES

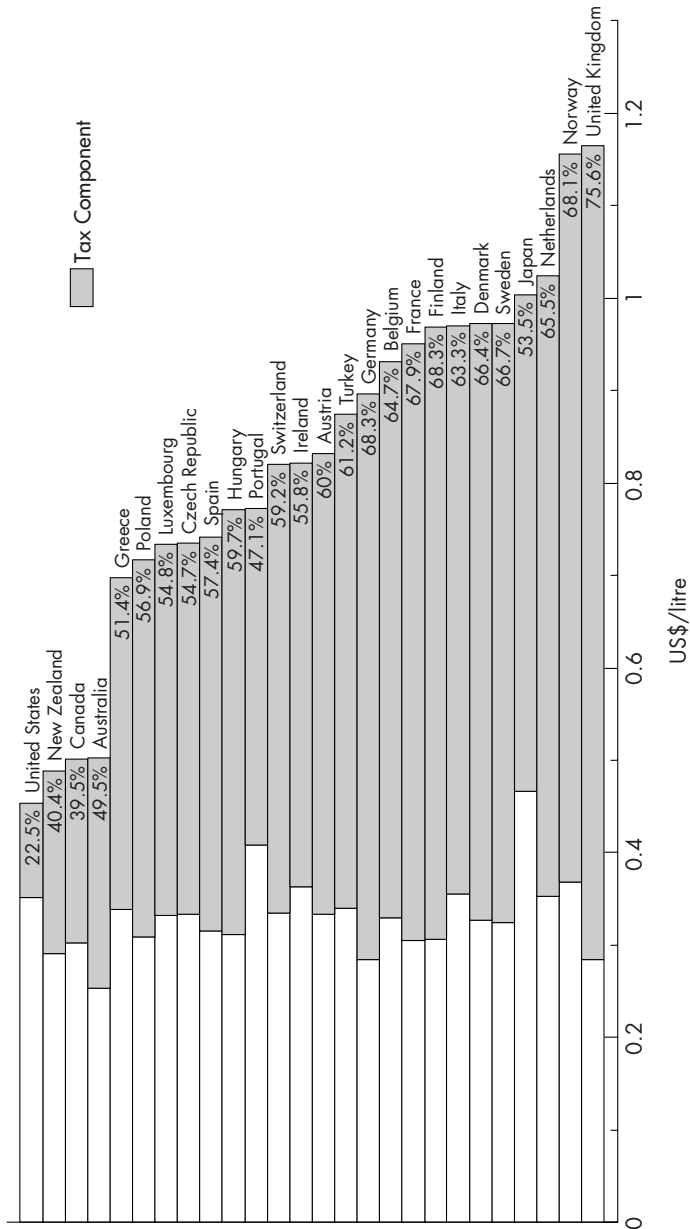
Today, service stations are subject to strict environmental standards. They also have to clean up the soil they have polluted, which is often the case. In its past pricing practices, the petroleum industry took no account of clean-up costs. A Foundation Fund was established through which petroleum industries can finance the clean-up of polluted soil at service stations. If a service station is closed, or if leakage occurs during operation, the Fund will cover up to half the total clean-up cost. The estimated total cost for handling these problems is approximately BF 17-18 billion. The fund is expected to start operation in 2001.

In Belgium, half the population uses petroleum for heating. There are some 750,000 underground storage tanks, some of which have caused a great deal of environmental degradation by contaminating soil and underground water. A project called Premaz was launched in 1998 to prevent such pollution and find solutions for financing clean-up operations. As a first step, 2,000 tanks in six Belgian cities were checked during the last two years. The states of the tanks, the surrounding soil and coating were examined. At the end of 2000, the report was submitted to the regions for consideration of appropriate measures, including new legislation. Many citizens cannot afford to pay for the repairs, and in many cases the State or region provides support for the clean-up. Possible solutions being considered include introducing new insurance policies and establishing a fund.

EMERGENCY RESPONSE MEASURES

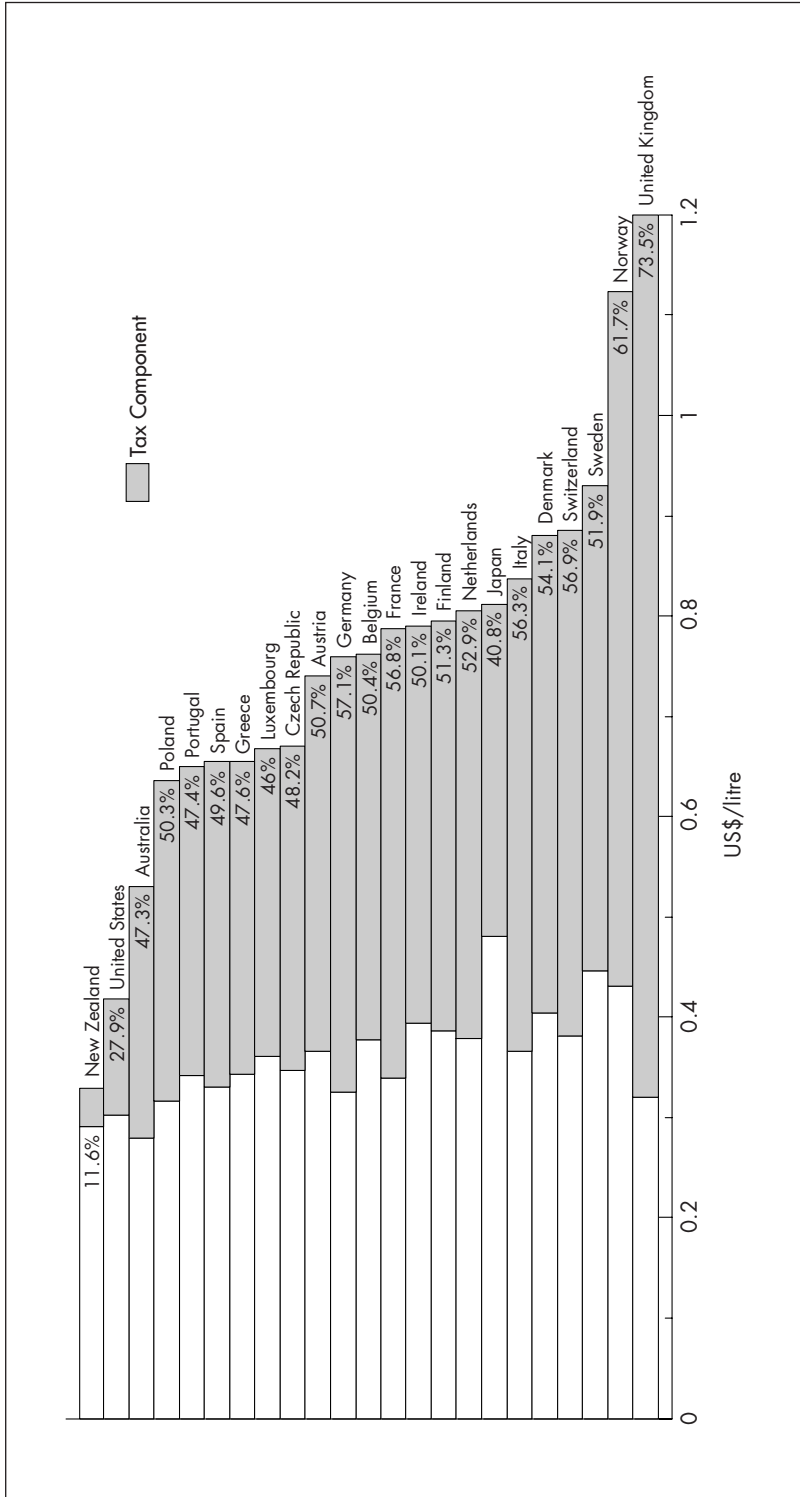
Security of oil supply is an important element of energy policy. The National Oil Board (NOB) is responsible for oil crisis management. It was created by the Royal Decree of 1984 to oversee the supply and distribution of oil and oil products in a crisis, and has a mandate to restrict demand and allocate available supplies among oil companies. When necessary, the permanent staff of NOB can be reinforced with experts from the energy administrations and the oil industry.

Figure 25
OECD Gasoline Prices and Taxes, 3rd Quarter 2000



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2000.

Figure 26
OECD Automotive Diesel Prices and Taxes, 3rd Quarter 2000



Note: Data not available for Canada, Hungary and Turkey.
 Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2000.

The Royal Decree of 1971, which was amended in 1976, provides the legal basis for holding mandatory oil stocks for emergency response. The decree obliges importing companies to keep stocks of three categories of products (gasoline, middle distillates and residual fuel) corresponding to 25% of their internal sales during the previous calendar year. The companies may hold part of their mandatory stocks in crude oil and intermediate products (feedstock). They are also allowed to hold stocks abroad under bilateral agreements and not exceeding 30% of total stocks.

There are no government- or agency-owned emergency oil stocks in Belgium. All of these are held by oil companies, with the costs charged directly to consumers. In a crisis, the administration would encourage companies to draw oil stocks by reducing their stockholding obligations. After consultation with the Council of Ministers, the Minister of Economic Affairs has the power to requisition compulsory stocks owned by oil companies. There is no other legal authority to force companies to release stocks in a crisis. Since emergency stocks are intermixed with commercial stocks, they would be delivered to the market through normal commercial transactions based on market prices.

Belgian emergency stocks have fluctuated, in the past few years, in a fairly narrow band around the 90-day level. Periodic non-compliance with the International Energy Program (IEP) stockholding obligation results primarily from the fact that Belgian legislation reflects EU stock requirements, which are 10% lower than the IEP requirements that take into account unavailable stocks. There has been some reluctance to use penalties for non-compliance as the procedure for obtaining the required court order is complex and lengthy.

In order to improve the stock situation, the administration initiated a process for creating a central stockholding agency in April 2000. The necessary financing mechanism is already in place; the storage fees that currently flow to individual oil companies will be diverted to the stockholding agency. There is also a proposal to introduce a system of penalties for non-compliance that could be imposed directly by the federal administration.

The Belgian response to a crisis would most likely comprise a mix of stockdraw and demand restraint. The initial response would probably be in the form of light-handed demand restraint measures. These could be implemented before the activation of the IEA or EU programmes. As a last resort, more severe measures, including rationing, would require a longer preparation period and consultation with industry, and would probably be taken after IEA and EU decisions. Considerable efforts would also have to be made to co-ordinate demand restraint with neighbouring countries in order to avoid cross-border distortions.

CRITIQUE

The new Euro 4 Standards for oil products will be enforced in 2005 creating a challenge for the Belgian refinery industry. One of the smaller refineries is already

preparing for the forthcoming standards but it is not clear how and when the other refineries are going to follow suit.

The Fund for Analysis of Oil Products, which was established to carry out systematic on-the-spot quality checks of oil products on the Belgian market, has worked very effectively. The share of faulty samples has dropped from 19% in 1995 to less than 2% in 2000. Nevertheless, continuous monitoring is necessary. The government and the Petroleum Federation are working together to improve the means for identifying quality problems and further reducing fraud.

Legislation for reducing the environmental impacts of oil distribution and storage has been strengthened. As this has placed a considerable financial burden on the distributors, new financial initiatives have been taken to finance the obligatory measures.

The Belgian government keeps price ceilings for oil products. These are set to reflect market prices yet aim to avoid sharp price increases in oil products because of speculation. A concern remains that in an emergency situation, such ceilings would create hasty buying by both Belgian and foreign buyers. As the electricity and gas markets are being liberalised, other forms of energy are competing more and more with oil. This will naturally limit the price of oil products, especially those used for heating, reducing the need for price ceilings. Consequently, in this new market situation price ceilings could be phased out.

RECOMMENDATIONS

The Government of Belgium should:

- Continue regular checking of oil quality to avoid fraud and develop methods to reduce fiscal fraud.
 - Consider eliminating the remaining price ceiling mechanism to achieve full liberalisation of oil prices.
-

RENEWABLES AND NON-CONVENTIONAL FUELS

SUPPLY

The share of renewables and waste incineration in the energy balance of Belgium is small. In 1999, their share of primary energy supply was 1.3% compared to the average of 3.3% in IEA countries.

Biomass is the most important renewable with a 90% share, followed by hydropower. The use of renewable energy resources varies among the three regions. Measured in primary energy supply, wood-based biomass accounts for 86% of renewables in Wallonia and for 97% in Flanders. In Brussels-Capital, waste incineration accounts for 74% and wood for 25% of non-conventional fuels.

The AMPERE Commission has tried to come up with a realistic target for the share that renewables could have in energy supply. In the summer of 2000, the commission presented an electricity production target (for the year 2020) of 3 to 4 TWh for renewables and 4 TWh for waste incineration. The new capacity for renewables would be mainly obtained from offshore wind energy and biomass. In 1999, electricity generation by biomass and waste incineration was 1.2 TWh.

Electrabel has initiated a study on the cost of electricity generated from renewables in Belgium. On average, the production cost estimate for the different renewables was: onshore wind, BF 2.8/kWh; hydro, BF 4.0/kWh; biomass (waste), BF 4.2/kWh; offshore wind, BF 4.5/kWh; and biomass (cultivated), BF 5.0/kWh.

POLICY OBJECTIVES AND TARGETS

The federal targets for renewables and future measures are given in the Federal Plan for Sustainable Development. In the plan, the government emphasises the importance of developing co-operation agreements between the regions and the federal government in order to raise the share of renewables (excluding waste) in electricity production from the current level of 1.9% to 3% in 2004. The government wants to see a further increase in the share of renewables thereafter but has not specified a quantitative target. The EU is preparing a new Renewable Energy Directive to promote electricity generation from renewables. In December 2000 it set an indicative target for Belgium to generate 6% of its electricity from renewables by 2010.

In the plan, the federal government indicates that it will introduce a transparent green certificate system. It states that providing financial support for renewables along with the green certificate system is justified for a temporary period when

investments in this field may be risky. The plan also calls for studying the feasibility of imposing a minimum quota for the distribution of energy products (besides electricity) that are less harmful to the environment, such as those obtained from renewable sources, methanol or hydrogen.

In Flanders, the targeted share of energy obtained from renewables is 3% of primary energy supply by 2004 and 5% by 2010. The specific target for electricity generated from renewables is 900 GWh in 2004. During the next few years, two-thirds of electricity generation capacity based on renewables will be from wind power and the rest will be from biomass. Thereafter, biomass is expected to increase its importance.

Wallonia has set a target share for renewables at 12% of primary energy supply by 2010. The target was set taking into account the regional potential for different renewable energy sources. The top priority is to use biomass, including organic waste. The next most important sources are small-scale hydropower (<10 MW), active and passive solar thermal applications, and wind energy. The target is to install 200,000 m² of solar collectors by 2010.

Brussels-Capital intends to increase the use of solar thermal energy. The target is to install 50,000 m² of solar collectors by 2010.

POLICY MEASURES

Federal Policies

Basically, the regional governments are responsible for renewables. However, the federal government is responsible for offshore wind farms, transport of electricity generated from renewables at 70 kV or higher voltage levels, setting electricity tariffs for the captive markets, and preparing the Indicative Programme for Electricity Generation and sustainable development³⁸. The federal-regional and inter-regional coordination for promoting renewable energy is done by CONCERE/ENOVER.

In electricity market liberalisation, particular attention is paid to renewable and non-fossil fuels³⁹. The law on the liberalisation of the electricity market requires that a minimum volume (defined by the federal government) of electricity generated from renewable sources should be purchased by utilities at a reasonable price. The law also stipulates that a mechanism to cover the associated costs should be established, such as a charge placed on electricity transmission or included in electricity prices

38. Sustainable development is to a great extent an issue of federal competence. It is a multi-sector issue and of high national interest. It is therefore one of the main objectives of federal government policy.

In the context of formulating federal policies for sustainable development, the government has announced different objectives for the energy sector, including increased use of renewable energy.

39. Waste incineration is generally not covered by the measures to support renewables, but there are some exceptions which are mentioned in the text.

for consumers. The federal government has decided that all generators who produce electricity from renewables will become progressively eligible to choose their electricity supplier if they need more electricity than they can generate. Also, consumers who buy a significant amount of their electricity from renewable sources will be eligible to choose electricity suppliers freely.

The federal government has acknowledged the need for a system which obliges electricity suppliers to ensure that some part of their electricity is produced from renewables. It has set the minimum requirement on electricity generated from renewables at 3%. The means to meet the target are regional *green certificate systems* and financial incentives, which may coexist temporarily (see box on green certificates in Flanders). Non-compliance is sanctioned by fines.

By the law of 29 April 1999, the Minister of Economic Affairs is given authority to issue licences for offshore wind-powered generators; the Royal Decree that determines the conditions and procedures for such licensing will enter into force in the near future.

Special consideration will be given to renewables in the Indicative Programme, a policy paper that presents new options for choosing different fuels for electricity generation.

Financial Incentives – Federal Level

The federal government subsidises electricity generation by renewables, biogas and organic wastes through the so-called “green franc system”. For a period of 10 years, generators can receive subsidies of €0.025/kWh for generating electricity with these fuels. They can receive an additional subsidy of €0.025/kWh if the electricity is generated by wind and hydro facilities with an installed capacity of 10 MW or less. Electricity generation by small photovoltaics with a capacity of less than 3 kW is subsidised for the lifetime of the operation. As a consequence, the average buy-back tariff of electricity generated with these fuels is estimated to be €0.15/kWh. In 1999, the “green francs” amounted to about BF 110 million and were mainly financed by the RUE/Electricity Generation Fund. The level of subsidies is based on recommendation given by CREG. “Green francs” are temporary measures, and will be reviewed by the federal government in 2003. It will consider the high generation costs associated with renewables and the need to provide a clearer perspective for investors in the future.

The RUE/Electricity Generation Fund is also used to support industrial product development and demonstration projects on renewables. The total amount of support for these projects was BF 202 million in 1999.

Industrial investments in renewable energy systems benefit from a tax abatement of 13.5%, and the Royal Decree of 1983 introduced a 20% federal subsidy for investments in renewable energy installations by hospitals and schools.

Table 10
Investments Subject to 13.5%* Tax Abatement
(million BF)

<i>Region</i>	<i>1994</i>	<i>1995</i>	<i>1996</i>	<i>1997</i>	<i>1998</i>
Brussels-Capital				52	62
Wallonia	741	301	137	461	838
Flanders				2,105	1,276
Total				2,618	2,176

* total for energy efficiency investments and investments in environmental protection, including the use of renewable energy.

Source: Ministry of Economic Affairs, Energy Administration.

Regional Measures

There are a number of regional policy initiatives. The measures can be roughly divided into the following four categories: green certificates, prioritising renewable energy in electricity market liberalisation, financial incentives, information dissemination and research and development (see Chapter 12).

Green Certificates

The three regions have decided to introduce a green certificate system by means of regional decrees. A collaboration agreement between the federal government and the regions has been concluded to co-ordinate the systems. A complementary federal system will be developed for offshore wind farms. Flanders plans to introduce its green certificate system in 2001 but it has yet to be approved by the European Commission. The Commission has raised a concern because imports of green electricity are not accounted for in the number of certificates that electricity suppliers have to provide. Flanders has argued that since foreign suppliers have competitive advantages over regional suppliers, this approach is necessary to ensure that local renewable resources are used. The region expects to receive a decision from the Commission in 2001. The other regions are also planning to introduce green certificate systems but details still need to be elaborated.

Electricity Markets

According to the Flemish decree on the liberalisation of the electricity market, generators can sell electricity freely if it is generated from renewables. They are given priority access to the grid. Consumers can buy electricity from suppliers of their choice if it is generated from renewables. Only when electricity is generated from renewables or CHP can it be delivered directly from generators to consumers. The transmission of electricity generated from renewables through the distribution network will be subject to reduced transmission fees, provided that the European Commission approves the practice.

The Green Certificate System in Flanders

The draft law imposes an obligation on all electricity supply licence holders to provide a certain percentage of electricity generated from renewables. To meet this obligation, the supplier must hold a certain amount of green certificates. If the supplier cannot meet the obligations, a fine of €0.05/kWh will be imposed in 2001, and of €0.125/kWh from 2004 onwards. The fines are progressive because the most economically feasible projects will be implemented first; in order for the less economically feasible projects to be realised, a higher fine is needed. Revenues from the fines will support the Renewable Energy Fund, which will be used to promote renewable energy. Initially, certificates will be given only to suppliers who have green electricity generation facilities in the region or offshore. If an international market for green certificates is established, Flanders will change its system accordingly.

The Flemish regulator will issue green certificates to producers of electricity from renewable sources. One certificate will be delivered per 1,000 kWh generated. To ensure transparency, the certificate will identify the name of the production unit, the technology used and the state support received. To make sure that the information the producer submits is correct, the installation will be inspected by an agency nominated for the task. The supplier has to pay for all costs of certification.

The following renewable energy sources will qualify for certification: solar, wind, hydro, biomass, biogas, geothermal, tidal and tidal wave energy. Electricity from waste incineration will not be eligible.

Trading the certificates will be possible. To avoid fraud, all transactions, ownership and data on the certificates will have to be registered in a Central Registration Database and a Trade Register.

A certificate is valid until the date specified (five years after the issue in Flanders), but can expire when it is submitted to the authorities to determine if the obligation is met, or if it is annulled by the owner.

The draft Walloon decree on the liberalisation of the electricity market intends to increase the use of green electricity by implementing a green certificate system, requiring electricity suppliers to provide a certain amount of electricity generated from renewables. The amount will be defined by the Walloon government. As soon as the decree enters into force, consumers can purchase green electricity from the suppliers of their choice and suppliers can freely sell electricity generated from renewables.

Brussels-Capital's draft ordinance for the liberalisation of the electricity market includes a faster liberalisation schedule for consumers who use green electricity. All the autoproducers using renewable energy sources became eligible in January 2001. In the future, the Brussels-Capital government may also require that suppliers generate a certain share of electricity in their total supplies from renewables (green certificate system).

Financial Incentives

Flanders subsidises investments in renewables. For example, energy demonstration projects can receive a subsidy to cover up to 35% of cost. In 1998-1999, under a programme to promote the use of photovoltaics, schools received a 100% subsidy for PV installations, and other applicants received 50%. The outcome of this support was 340 m² (42 kW_p) of installed capacity in 1998 and 724 m² (78 kW_p) in 1999. In 2000, all applicants (except schools which continued to receive a 100% subsidy) could obtain subsidies covering 75% of investment costs in renewables. New subsidies may become available when the region will have created a Renewable Energy Fund to promote renewable energy. This fund will be supported by fines from the green certificate system. Brussels-Capital, following the regional decree of 1999, provides subsidies that cover 35% of the cost (maximum BF 40,000) of investments for solar boilers for domestic hot water use. Wallonia does not have financial incentive programmes to promote renewables.

Information Dissemination

Flanders has communication policies for renewables aimed at all social groups. The region gives financial support to the Organisation for Renewable Energy in Flanders (ODE-Vlaanderen, *Organisatie voor Duurzame Energie*) which promotes sustainable energy schemes. ODE-Vlaanderen provides a discussion platform for several organisations and research centres active in the development of renewables. It also organises thematic conferences and provides various brochures and newsletters to inform the public.

Wallonia financially supports the Belgian Biomass Association (BELBIOM). This non-profit organisation of research institutes, universities, industries and others that have some interest in biomass aims to increase biomass-based energy production in Belgium. BELBIOM disseminates information and encourages exchanging experiences, participates in international efforts, co-ordinates initiatives of its members, initiates studies, and proposes solutions for a greater use of biomass-based energy.

Wallonia also finances the activities of the ERBE Agency (*Equipe Régionale Biomasse Energie*), a non-profit organisation that promotes the use of biomass in the public and industrial sectors. It initiates research contracts with the private sector in the framework of several European Commission programmes. Further, the regional government actively collaborates with, and gives financial support to, the Association for the Promotion of Renewable Energies (APERe, *Association pour la Promotion des Energies Renouvelables*). The purpose of APERe (a non-profit organisation) is to promote renewable energies and the rational use of energy in the

context of sustainable development, both in Europe and in developing countries. Several organisations and research centres active in the field of renewables belong to APERe. It provides a free help desk for answering questions on renewable energies, a consultancy service, a documentation centre and two newsletters for its members, and also organises conferences on renewable energies. In addition to providing financial support for the activities of these three organisations, Wallonia has directly financed several exhibitions on renewable energies.

In Brussels-Capital, the energy administration has taken several initiatives, such as information campaigns that have included various workshops, and distributing brochures to energy consumers in the public and private sectors. In the near future, the administration plans to launch a promotional campaign for solar collectors. Brussels-Capital also gives financial support to the Brussels Energy Agency (ABEA, *Agence Bruxelloise de l'Energie/Brussels Energieagentschap*), a non-profit organisation that promotes the rational use of energy and renewable energy (mostly solar collectors) through publications, consulting services, energy events, and workshops.

CRITIQUE

Currently, renewable energy accounts for only 1.3% of primary energy supply in Belgium as compared with 3.3% for IEA countries on average. The reasons for limited market penetration include insufficient resources, high cost relative to other energy sources, and total access by all geographical areas to the national grid.

The federal target is to increase the share of renewables in the energy supply from the current level of 1% to 3% by 2004, and to increase it more thereafter. This seems to be in line with the planned Renewable Energy Directive of the EU that defines a 6% indicative target for Belgium in 2010. Regional governments have an important role to play in meeting these targets since substantial responsibilities for promoting renewables rest in their hands. Wallonia has set its own target at 12%, and Flanders at 5%, for 2010. The regional targets are based on assessments of the technical potential of different resources. However, the economic potential of those resources has not been assessed, and the targets set by the regions appear quite optimistic. Brussels-Capital intends to increase the use of renewables, but has not yet proposed numeric targets except for the number of solar collectors to be installed (50,000 m² in 2010).

The federal government recognises the difficulties of increasing renewable energy use and the need for more decisive action to promote it. The regional and federal governments have taken an important initiative, the introduction of green certificates, which is expected to have a significant impact on the market, inciting it to increase the use of renewables. Green certificates should be introduced in the different regions at the same time as a nationwide trading system to avoid uneconomic investment decisions; however, the regional governments still need to define the details of their systems. The level of fines for non-compliance is an

important issue which should be carefully considered because energy suppliers will supply energy from renewable sources only if this is more beneficial than paying fines. The impacts of renewables on the energy trade and competitiveness of domestic industries should also be considered. The policy objective to promote domestic renewables may conflict with another policy objective to efficiently introduce green energies, since imported green energy may be cheaper. The federal and regional governments have to examine carefully how they can balance these two objectives, and should make a reliable assessment of the economy of renewable sources.

At present, electricity generated from renewables is supported by substantial subsidies and tax abatement in some cases. Suppliers of wind and hydro power benefit from a subsidy of BF 2/kWh, which is 6% more than the average electricity price for industry, and 33% higher than the average electricity price for households in 1998. For other renewables, the subsidy was BF 1/kWh, which is equivalent to 53% of the average electricity price for industry, and 17% of the average electricity price for households in 1998. Despite such high levels of financial subsidy, supplemented by tax abatement, the number of installations remains modest. This implies that there are barriers, other than high production costs, which are limiting the use of renewables. For example, there might not be much potential to develop renewables efficiently in Belgium since the country is already extensively covered by grids, and energy demand has been met by traditional energy sources at lower prices. As the initial investment cost of some renewables, such as offshore wind, tends to require substantial capital, producers may consider the investments too risky. Second, the buy-back tariffs might have been set too low and more than offset the subsidies. Third, licensing may also have posed a problem since authorisation for some installations, such as offshore windmills, can only be granted with new legislation.

The financial incentives, subsidies and tax abatement to promote renewables should be progressively replaced by more market-oriented measures. The Federal Plan for Sustainable Development acknowledges that subsidies can be justified only temporarily, until the risk for investments in renewables has been sufficiently reduced. When the details of the green certificate scheme – a more market-oriented approach – have been discussed and its effectiveness for the future assessed, the use of subsidies should be carefully reviewed. The governments should also make sure that the externalities associated with using fossil fuels, such as environmental pollution and GHG emissions, are appropriately addressed so that the cost advantage of renewables can be fairly reflected in the market.

Currently, the green certificate and green franc systems coexist but the governments plan to phase out green franc subsidies when the green certificate system is fully operational. However, as green certificates will cover only installations with over 1 MW capacity, green francs could still be applied for smaller installations provided that certain conditions on their feasibility are met.

The AMPERE Commission has estimated that electricity production from biomass could be increased. It may be possible to use biomass as a supplementary fuel in CHP installations, which is already being done in some other countries. This option is worth investigating.

RECOMMENDATIONS

The Government of Belgium should:

- Study carefully the costs of renewables. Develop policies for promoting renewables that are cost-effective, market-oriented and consistent (as much as possible) with policies in neighbouring countries.
 - Ensure that the environmental costs of energy use are adequately reflected in final costs with a view to promoting environmentally and economically sustainable energy options, such as renewables.
 - Study the possibility of using biomass as a supplementary fuel in CHP.
-

TECHNOLOGY, RESEARCH AND DEVELOPMENT

The administration of existing R&D (research and development) programmes and the implementation and management of new research programmes in the non-nuclear energy field fall within the exclusive responsibility of the three regions, while nuclear-related R&D programmes are pursued at the federal level.

Belgian research centres, universities and companies are active in EU energy and research programmes such as SAVE, ALTENER and the 5th Framework Programme on R&D, and Belgium has been participating in the IEA Implementing Agreements⁴⁰ for several years. All these activities are carried out mainly at the regional level.

The AMPERE Commission made some recommendations concerning R&D priorities in its report published in October 2000. It emphasised that Belgium should keep its nuclear options open and maintain its nuclear expertise by continuing national R&D activities and by participating in international research on new nuclear technologies. The other recommended priority areas were high-temperature materials, on- and offshore wind energy, network management, CO₂ emissions technology, nuclear safety, solar energy (as a potential post-2020 electricity source) and fuel cells.

REGIONAL R&D ACTIVITIES IN NUCLEAR ENERGY

Programmes in Flanders

In Flanders, the R&D budget for energy was BF 565 million in 1999. This represented 62% of total R&D expenditures in the field of non-nuclear energy by the federal and regional governments. Energy conservation received the largest share (37%), followed by renewable energy sources (26%, of which solar energy was 77%), and demonstration (9%).

VITO, the Flemish Institute for Technological Research, is a specialised research centre with a semi-private status that operates under the auspices of the Flemish government. It has a staff of over 400 employees, and carries out market-oriented

40. Belgium participates in the following IEA Implementing Agreements: Alternative Motor Fuels, Bio-energy, Demand-Side Management, Energy and Environmental Technologies Information Centres (EETIC, CADDET Renewable Energy and CADDET Energy Efficiency), Energy Conservation in Buildings and Community Systems, Energy Conservation and Emissions Reduction in Combustion, Energy Storage, Energy Technology Data Exchange (ETDE), Energy Technology Systems Analysis Project (ETSAP), Greenhouse Gases, High Temperature Materials for Automotive Engines, Hybrid and Electric Vehicles, and Solar Heating and Cooling.

technological research, develops innovative products and processes, and provides specialised services in the field of energy, the environment and advanced materials. The Energy Division consists of several research centres covering areas such as the rational use of energy, transport and the environment, and product and process assessment. VITO takes part in European energy research programmes and in several of the IEA Implementing Agreements.

The Institute for the Promotion of Innovation by Science and Technology in Flanders (IWT) manages the Flemish Programme for the Promotion of Energy Technology (VLIET). The initial VLIET programme ran from 1993 to 1996 and had a total budget of BF 800 million. A minimum of 10% of the budget was devoted to projects supporting Flemish energy policy and the Flemish Institute for Rational Use of Energy (VIREG), and a minimum of 25% of the budget was devoted to projects in the field of renewables. As the VLIET budget was not entirely spent, a VLIETbis programme was started in 1997. In mid-1998, under VLIETbis the Flemish government agreed to finance 12 research projects supporting policy formulation and 16 research projects on the rational use of energy and renewables. Of the 16 approved research projects, 12 have been implemented. Budgets for both project categories amounted to BF 84 and 197 million respectively. As the projects typically last two years, they are now being finalised. The new Flemish government currently does not have the intention to launch new technology-driven programmes, so it is unlikely that the VLIET programme will continue.

Demonstration projects are supported financially by the ministry of the Flemish region, with a total annual budget of BF 55-60 million. Projects are eligible for subsidies – covering up to 35% of total cost – if they are innovative and offer economic opportunities for the region. The main project areas are CHP, alternative propulsion systems and fuels for vehicles (e.g. hybrid, natural gas, biodiesel, hydrogen), and renewable energy. In 1995-1998, a large-scale pilot project on electric vehicles that involved the car fleets of some municipalities led to increased use of electric vehicles.

Programmes in Wallonia

In Wallonia, the R&D budget for energy was BF 350 million in 1999. This represents about 38% of total government R&D expenditures in Belgium. The Walloon government does not have stated energy R&D priorities. The major research areas are energy conservation, which received the biggest share (40%), followed by electric power generation and electricity transmission and distribution (32%), and renewables (14%, of which 58% was devoted to solar energy and 34% to hydropower).

The Walloon region operates various research programmes that deal with different energy technologies. The most important programme, the Decree, was introduced in 1990. Its budget is not allocated according to sector or field, and the projects that are selected may concern a variety of interests, not just energy. In addition to this programme, the region launches regular calls for R&D proposals on predefined research areas, such as co-generation.

The regional government supports R&D by providing subsidies or loans to those who conduct it. In 1999, about 50% of the total R&D budget was spent on universities and research centres, 22% was in the form of direct support to enterprises, and the rest (28%) were government loans to enterprises.

Since Belgium's coal resources are located in Wallonia, coal technologies receive sustained support from the region of about BF 35 million per year. The objective is to maintain a knowledge base, participate in the latest research and develop new technologies, such as underground gasification of coal and efficient combustion and conversion of coal products and by-products.

Support to renewable energy technologies has been increasing, with a focus on producing energy from biomass and waste, small hydro generation, climate-sensitive architecture⁴¹, and passive solar energy technology in buildings.

The Action Plan for Preparing Wallonia for the Future (*Plan d'Action pour préparer la Wallonie au futur*) was presented in 1996. It reflects the new R&D policy that the Walloon government intends to promote in the future. Efforts by the regional government will focus on clearly identifying technological niches through consultation with all stakeholders. Support provided by the region will be restructured and regional R&D policy will be more integrated with European research and development programmes.

Programmes in Brussels-Capital

Brussels-Capital does not have a specific R&D budget for energy. Resources formerly spent on R&D projects are now used for studies that support energy policy formulation. Because of a lack of resources and with no R&D budget of its own, Brussels-Capital prefers to informally collaborate with the other regions.

INDUSTRIAL R&D ACTIVITIES

Laborelec is the major Belgian laboratory for scientific and technical research in the electricity sector. Its main shareholders are Electrabel and SPE, and it has a staff of 233. Laborelec was created in 1962 by merging the laboratories of 12 Belgian electricity supply companies. The turnover was BF 1.3 billion in 1999, exceeding the regional governments' combined energy R&D budgets.

41. Climate-sensitive architecture is sometimes referred to as "solar architecture", "climatic architecture" or "bio-climatic architecture". In essence, it is the acknowledgement that the interaction of solar and other climatic factors together with the building envelope will determine the basic internal environmental conditions and thus the extent to which heating, ventilation and air-conditioning services are needed and, ultimately, the comfort level of the occupants.

Laborelec conducts focused R&D, and provides specialised services on a commercial basis. Its areas of activity include energy audits, combustion, electromagnetic compatibility, power quality, safety of nuclear power plants, condition monitoring and predictive maintenance for combined-cycle power plants and CHP installations, and biomass for electricity generation.

NUCLEAR R&D

Nuclear-related energy R&D programmes are within the competence of the federal government. Most national research is carried out by the National Nuclear Research Centre (CEN/SCK)⁴² located in Mol. Apart from research on the safety of light water reactors and nuclear waste management, many of the centre's activities do not involve nuclear energy directly but concern areas such as radiation protection, radioecology, radiobiology, radioisotope production, medical applications, nuclear fusion, natural radioactivity and safeguards. A significant proportion of the centre's expenditure is devoted to these activities. Government support to CEN/SCK is shown in Table 11.

Table 11
Contributions Paid to CEN/SCK by Government
(million BF)

	1999	2000	2001
Contributions	1,619.4	1,621.7	1,613.6
Of which for light water reactors	454.5	606.2	520.0

Source: Ministry of Economic Affairs, Energy Administration.

The CEN/SCK collaborates actively with Belgian universities and has a programme for young scientists from both Belgium and abroad.

The Tractebel Group does research to find solutions for specific problems that arise from operating nuclear power plants. The group comprises Tractebel Energy Engineering (a nuclear engineering company), Laborelec (a research laboratory set up by electricity utilities), Electrabel and Belgatom. The Association Vinçotte Nuclear (AVN, an approved inspection agency) carries out some research to support its own activities.

⁴². CEN/SCK – Centre d'Etude de l'Energie Nucléaire/Studiecentrum voor Kernenergie.

CRITIQUE

While the total non-nuclear R&D budget for energy has grown substantially during the second half of the 1990s, no federal policy framework for energy research seems to exist and responsibilities lie completely with the regions. There is no institutionalised mechanism to co-ordinate R&D policies and government-funded R&D activities among the regions. The regions do not have clear policies for promoting energy-related R&D, and R&D priorities for energy are not well defined. In Flanders, research and development policies seem to focus on market-oriented product development, while Wallonia emphasises academic and intellectual achievement. The Brussels-Capital region has no R&D budget for energy.

The regional governments should be careful in designing R&D budgets so that they are in line with energy policy objectives. In Flanders, for example, biomass and wind are expected to be the most important renewable energy sources in the future. However, 77% of the R&D budget for renewables is allocated to solar energy. Wind power is a more mature technology than technologies based on solar energy and therefore may not require much research, but energy generation from biomass is strongly related to local conditions (*e.g.* resources and logistics) and typically does need research to allow for efficient and economical utilisation.

The outcome of the completed and currently implemented programmes is not yet clear. Assessing their performance and closer co-operation among the regions would lead to a more efficient use of resources. It seems that such co-operation takes place on a small scale and is based on informal contacts among individual researchers. The participation of the regions in the Implementing Agreements of the IEA and European research programmes also calls for efficient co-ordination among them, and effective communication to share the results.

RECOMMENDATIONS

The Government of Belgium should:

- Clarify the objectives of R&D so that they are consistent with federal and regional energy policies, and ensure that R&D programmes are adequately planned and implemented to meet these objectives.
 - Develop tools to assess the performance of R&D activities in this regard.
-

ANNEX

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY							
	1973	1990	1998	1999	2005	2010	2020
TOTAL PRODUCTION	6.5	12.8	12.8	13.8	12.5	12.9	..
Coal ¹	6.4	1.2	0.2	0.2	-	-	..
Oil	-	-	-	-	-	-	..
Gas	0.0	0.0	-	-	-	-	..
Comb. Renewables & Wastes ²	0.0	0.4	0.6	0.8	0.2	0.6	..
Nuclear	0.0	11.1	12.0	12.8	12.3	12.3	..
Hydro	0.0	0.0	0.0	0.0	0.0	0.0	..
Geothermal	-	0.0	0.0	0.0	..	..	..
Solar/Wind/Other ³	-	0.0	0.0	0.0	0.0	0.0	..
TOTAL NET IMPORTS⁴	39.8	35.5	46.3	44.1	41.9	44.4	..
Coal ¹	0.8	1.1	1.0	1.0	0.9	0.9	..
Exports	5.3	10.3	9.7	8.3	8.6	8.6	..
Imports	4.6	9.2	8.6	7.4	7.7	7.7	..
Net Imports	15.1	19.2	21.4	22.5	16.0	16.4	..
Oil	46.4	41.7	51.9	50.1	41.8	42.9	..
Exports	3.1	4.1	5.4	4.4	4.0	4.0	..
Imports	28.2	18.4	25.1	23.2	21.8	22.5	..
Net Imports	-	-	-	-	-	-	..
Gas	7.1	8.2	12.4	13.5	12.4	14.2	..
Exports	7.1	8.2	12.4	13.5	12.4	14.2	..
Imports	0.2	0.7	0.6	0.7	..	..	..
Electricity	0.1	0.4	0.7	0.8	..	..	..
Exports	-0.1	-0.3	0.1	0.1	..	..	..
Imports							
Net Imports							
TOTAL STOCK CHANGES	-0.0	-0.1	-0.8	0.8	-	-	..
TOTAL SUPPLY (TPES)	46.3	48.4	58.3	58.6	54.4	57.3	..
Coal ¹	11.2	10.2	8.6	7.5	7.7	7.7	..
Oil	28.0	18.7	24.6	24.2	21.8	22.5	..
Gas	7.1	8.2	12.5	13.3	12.4	14.2	..
Comb. Renewables & Wastes ²	0.0	0.4	0.6	0.8	0.2	0.6	..
Nuclear	0.0	11.1	12.0	12.8	12.3	12.3	..
Hydro	0.0	0.0	0.0	0.0	0.0	0.0	..
Geothermal	-	0.0	0.0	0.0	..	..	..
Solar/Wind/Other ³	-	0.0	0.0	0.0	0.0	0.0	..
Electricity Trade ⁵	-0.1	-0.3	0.1	0.1	-	-	..
Shares (%)							
Coal	24.1	21.1	14.7	12.8	14.2	13.4	..
Oil	60.5	38.7	42.1	41.2	40.1	39.3	..
Gas	15.4	16.9	21.4	22.7	22.8	24.7	..
Comb. Renewables & Wastes	-	0.9	1.0	1.3	0.3	1.0	..
Nuclear	-	23.0	20.6	21.8	22.6	21.4	..
Hydro	-	-	0.1	-	0.1	0.1	..
Geothermal	-	-	-	-	..	..	..
Solar/Wind/Other	-	-	-	-	-	-	..
Electricity Trade	-0.1	-0.7	0.2	0.1	-	-	..

0 is negligible. - is nil, .. is not available.

Please note: All forecast data are based on the 1996 submission.

DEMAND**FINAL CONSUMPTION BY SECTOR**

	1973	1990	1998	1999	2005	2010	2020
TFC	34.6	32.9	41.2	41.3	39.5	41.0	..
Coal ¹	5.7	3.4	2.6	2.5	3.7	3.7	..
Oil	21.0	17.3	22.4	22.0	20.1	20.8	..
Gas	4.6	6.8	9.3	9.7	8.8	9.0	..
Comb. Renewables & Wastes ²	-	0.2	0.2	0.3	..	..	..
Geothermal	-	-	-	-	-	-	..
Solar/Wind/Other	-	-	-	-	-	-	..
Electricity	2.9	5.0	6.4	6.4	6.0	6.4	..
Heat	0.3	0.2	0.3	0.4	0.9	1.1	..
Shares (%)							
Coal	16.5	10.2	6.2	6.1	9.4	9.0	..
Oil	60.7	52.6	54.4	53.2	50.8	50.7	..
Gas	13.3	20.7	22.7	23.5	22.3	22.0	..
Comb. Renewables & Wastes	-	0.6	0.4	0.7	..	..	..
Geothermal	-	-	-	-	-	-	..
Solar/Wind/Other	-	-	-	-	-	-	..
Electricity	8.5	15.1	15.4	15.5	15.1	15.7	..
Heat	0.9	0.7	0.8	0.9	2.3	2.6	..
TOTAL INDUSTRY⁶	16.8	13.4	16.6	17.2	15.7	16.1	..
Coal ¹	3.5	2.9	2.3	2.3	3.4	3.4	..
Oil	7.9	4.3	6.3	6.3	4.1	4.1	..
Gas	3.2	3.3	4.4	4.9	3.9	3.9	..
Comb. Renewables & Wastes ²	-	0.0	0.0	0.1	..	..	..
Geothermal	-	-	-	-	-	-	..
Solar/Wind/Other	-	-	-	-	-	-	..
Electricity	1.9	2.6	3.2	3.2	3.4	3.7	..
Heat	0.3	0.2	0.3	0.3	0.8	0.9	..
Shares (%)							
Coal	21.1	21.7	14.1	13.6	21.8	21.3	..
Oil	46.8	32.4	37.9	36.4	26.4	25.6	..
Gas	18.7	24.7	26.8	28.8	25.1	24.5	..
Comb. Renewables & Wastes	-	0.1	0.1	0.4	..	..	..
Geothermal	-	-	-	-	-	-	..
Solar/Wind/Other	-	-	-	-	-	-	..
Electricity	11.5	19.7	19.4	18.8	21.8	23.0	..
Heat	1.9	1.4	1.7	2.0	4.8	5.5	..
TRANSPORT⁷	5.0	7.9	9.8	9.8	9.4	9.7	..
TOTAL OTHER SECTORS⁸	12.7	11.7	14.8	14.3	14.4	15.2	..
Coal ¹	2.2	0.5	0.2	0.2	0.3	0.3	..
Oil	8.1	5.2	6.4	6.0	6.6	7.2	..
Gas	1.5	3.5	4.9	4.8	4.9	5.1	..
Comb. Renewables & Wastes ²	-	0.2	0.2	0.2	..	..	..
Geothermal	-	-	-	-	-	-	..
Solar/Wind/Other	-	-	-	-	-	-	..
Electricity	0.9	2.3	3.0	3.1	2.4	2.6	..
Heat	-	0.0	0.0	0.1	0.2	0.2	..
Shares (%)							
Coal	17.0	4.1	1.5	1.3	2.1	1.6	..
Oil	64.2	44.6	43.5	42.0	46.1	47.0	..
Gas	11.4	30.1	33.1	33.4	34.0	33.2	..
Comb. Renewables & Wastes	-	1.6	1.2	1.4	..	..	..
Geothermal	-	-	-	-	-	-	..
Solar/Wind/Other	-	-	-	-	-	-	..
Electricity	7.4	19.3	20.5	21.4	16.7	16.9	..
Heat	-	0.3	0.3	0.4	1.2	1.2	..

DEMAND							
ENERGY TRANSFORMATION AND LOSSES							
	1973	1990	1998	1999	2005	2010	2020
ELECTRICITY GENERATION⁹							
INPUT (Mtoe)	10.0	17.5	19.6	20.1	20.0	22.0	..
OUTPUT (Mtoe)	3.5	6.0	7.1	7.2	6.7	7.3	..
(TWh gross)	40.6	70.2	82.1	83.4	78.3	84.9	..
Output Shares (%)							
Coal	21.7	28.3	20.6	15.0	11.5	8.7	..
Oil	53.7	1.9	3.1	1.2	2.3	2.3	..
Gas	23.7	7.7	18.3	23.1	24.7	29.6	..
Comb. Renewables & Wastes	0.3	0.9	1.3	1.4	1.0	3.5	..
Nuclear	0.2	60.8	56.2	58.8	60.1	55.5	..
Hydro	0.4	0.4	0.5	0.4	0.4	0.4	..
Geothermal	-	-	-	-	-	-	..
Solar/Wind/Other	-	0.0	0.0	0.0	0.0	0.0	..
TOTAL LOSSES	11.8	16.0	16.6	16.8	14.9	16.3	..
of which:							
Electricity and Heat Generation ¹⁰	6.2	11.3	12.2	12.5	12.3	13.6	..
Other Transformation	4.2	2.1	1.7	1.5	1.3	1.3	..
Own Use and Losses ¹¹	1.4	2.7	2.7	2.7	1.3	1.5	..
Statistical Differences	-0.1	-0.5	0.6	0.6	-	-	..
INDICATORS							
	1973	1990	1998	1999	2005	2010	2020
GDP (billion 1995 US\$)	174.25	256.19	295.71	303.80	348.21	390.13	..
Population (millions)	9.73	9.97	10.20	10.22	10.00	10.00	..
TPES/GDP ¹²	0.27	0.19	0.20	0.19	0.16	0.15	..
Energy Production/TPES	0.14	0.26	0.22	0.23	0.23	0.23	..
Per Capita TPES ¹³	4.76	4.86	5.72	5.74	5.44	5.73	..
Oil Supply/GDP ¹²	0.16	0.07	0.08	0.08	0.06	0.06	..
TFC/GDP ¹²	0.20	0.13	0.14	0.14	0.11	0.10	..
Per Capita TFC ¹³	3.55	3.30	4.04	4.04	3.95	4.10	..
Energy-related CO ₂ Emissions (Mt CO ₂) ¹⁴	136.9	106.2	122.5	118.7	108.8	114.8	..
CO ₂ Emissions from Bunkers (Mt CO ₂)	11.3	16.0	22.0	18.5	17.1	17.1	..
GROWTH RATES (% per year)							
	73-79	79-90	90-98	98-99	99-05	05-10	10-20
TPES	0.7	0.0	2.4	0.5	-1.3	1.0	..
Coal	-1.0	-0.3	-2.2	-12.7	0.5	-	..
Oil	-1.5	-2.8	3.4	-1.6	-1.7	0.6	..
Gas	4.5	-1.2	5.4	6.9	-1.2	2.7	..
Comb. Renewables & Wastes	41.7	17.8	2.9	37.5	-23.8	31.5	..
Nuclear	130.2	12.8	1.0	6.2	-0.7	-	..
Hydro	4.9	1.3	4.6	-12.1	0.6	-	..
Geothermal	-	-	-	-	-	-	..
Solar/Wind/Other	-	-	-	-	-10.9	-	..
TFC	0.3	-0.6	2.8	0.2	-0.7	0.7	..
Electricity Consumption	4.2	2.6	3.1	0.7	-1.2	1.5	..
Energy Production	2.4	5.0	0.0	7.5	-1.7	0.7	..
Net Oil Imports	-0.8	-3.4	4.0	-7.7	-1.0	0.6	..
GDP	2.4	2.3	1.8	2.7	2.3	2.3	..
Growth in the TPES/GDP Ratio	-1.6	-2.2	0.5	-2.2	-3.5	-1.2	..
Growth in the TFC/GDP Ratio	-2.0	-2.8	1.0	-2.5	-3.0	-1.5	..

Please note: Rounding may cause totals to differ from the sum of the elements.

Footnotes to Energy Balances and Key Statistical Data

1. Includes lignite and peat, except for Finland, Ireland and Sweden. In these three cases, peat is shown separately.
2. Comprises solid biomass and animal products, gas/liquids from biomass, industrial waste and municipal waste. Data are often based on partial surveys and may not be comparable between countries.
3. Other includes tide, wave and ambient heat used in heat pumps.
4. Total net imports include combustible renewables and waste.
5. Total supply of electricity represents net trade. A negative number indicates that exports are greater than imports.
6. Includes non-energy use.
7. Includes less than 1% non-oil fuels.
8. Includes residential, commercial, public service and agricultural sectors.
9. Inputs to electricity generation include inputs to electricity, CHP and heat plants. Output refers only to electricity generation.
10. Losses arising in the production of electricity and heat at public utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of 33% for nuclear, 10% for geothermal and 100% for hydro.
11. Data on “losses” for forecast years often include large statistical differences covering differences between expected supply and demand and mostly do not reflect real expectations on transformation gains and losses.
12. Toe per thousand US dollars at 1990 prices and exchange rates.
13. Toe per person.
14. “Energy-related CO₂ emissions” specifically means CO₂ from the combustion of the fossil fuel components of TPES (*i.e.* coal and coal products, peat, crude oil and derived products and natural gas), while CO₂ emissions from the remaining components of TPES (*i.e.* electricity from hydro, other renewables and nuclear) are zero. Emissions from the combustion of biomass-derived fuels are not included, in accordance with the IPCC greenhouse gas inventory methodology. TPES, by definition, excludes international marine bunkers. INC-IX decided in February 1994 that emissions from international marine and aviation bunkers should not be included in national totals but should be reported separately, as far as possible. CO₂ emissions from bunkers are those quantities of fuels delivered for international *marine* bunkers and the emissions arising from their use. Data for deliveries of fuel to international *aviation* bunkers are not generally available to the IEA and, as a result, these emissions have not been deducted from the national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 1999 and applying this factor to forecast energy supply. Future coal emissions are based on product-specific supply projections and are calculated using the IPCC/OECD emission factors and methodology.

ANNEX

INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

The Member countries* of the International Energy Agency (IEA) seek to create the conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and the well-being of their people and of the environment. In formulating energy policies, the establishment of free and open markets is a fundamental point of departure, though energy security and environmental protection need to be given particular emphasis by governments. IEA countries recognise the significance of increasing global interdependence in energy. They therefore seek to promote the effective operation of international energy markets and encourage dialogue with all participants.

In order to secure their objectives they therefore aim to create a policy framework consistent with the following goals:

1 Diversity, efficiency and flexibility within the energy sector are basic conditions for longer-term energy security: the fuels used within and across sectors and the sources of those fuels should be as diverse as practicable. Non-fossil fuels, particularly nuclear and hydro power, make a substantial contribution to the energy supply diversity of IEA countries as a group.

2 Energy systems should have the ability to respond promptly and flexibly to energy emergencies. In some cases this requires collective mechanisms and action: IEA countries co-operate through the Agency in responding jointly to oil supply emergencies.

3 The environmentally sustainable provision and use of energy is central to the achievement of these shared goals. Decision-makers should seek to minimise the adverse environmental impacts of energy activities, just as environmental decisions should take account of the energy consequences. Government interventions should where practicable have regard to the Polluter Pays Principle.

4 More environmentally acceptable energy sources need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil sources is also a priority. A number of

* Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

IEA Members wish to retain and improve the nuclear option for the future, at the highest available safety standards, because nuclear energy does not emit carbon dioxide. Renewable sources will also have an increasingly important contribution to make.

5 Improved energy efficiency can promote both environmental protection and energy security in a cost-effective manner. There are significant opportunities for greater energy efficiency at all stages of the energy cycle from production to consumption. Strong efforts by governments and all energy users are needed to realise these opportunities.

6 Continued research, development and market deployment of new and improved energy technologies make a critical contribution to achieving the objectives outlined above. Energy technology policies should complement broader energy policies. International co-operation in the development and dissemination of energy technologies, including industry participation and co-operation with non-member countries, should be encouraged.

7 Undistorted energy prices enable markets to work efficiently. Energy prices should not be held artificially below the costs of supply to promote social or industrial goals. To the extent necessary and practicable, the environmental costs of energy production and use should be reflected in prices.

8 Free and open trade and a secure framework for investment contribute to efficient energy markets and energy security. Distortions to energy trade and investment should be avoided.

9 Co-operation among all energy market participants helps to improve information and understanding, and encourage the development of efficient, environmentally acceptable and flexible energy systems and markets worldwide. These are needed to help promote the investment, trade and confidence necessary to achieve global energy security and environmental objectives.

(The Shared Goals were adopted by IEA Ministers at their 4 June 1993 meeting in Paris.)

ANNEX

GLOSSARY AND LIST OF ABBREVIATIONS

In this report, abbreviations are substituted for a number of terms used within the International Energy Agency. While these terms generally have been written out on first mention and abbreviated subsequently, this glossary provides a quick and central reference for many of the abbreviations used.

BBRI	Belgian Building Research Institute.
bcm	billion cubic metres.
BF	Belgian francs.
BFE	Federation of the Electricity Companies in Belgium.
CCEG	Control Committee for Electricity and Gas.
CEN/SCK	National Nuclear Research Centre.
CGEE	Management Committee of Electricity Companies.
CHP	combined production of heat and power; sometimes, when referring to industrial CHP, the term “co-generation” is used.
CPTE	Company for the Co-ordination of the Production and Transport of Electricity.
CRE	Commission for the Regulation of Electricity.
CREG	Commission for Electricity and Gas Regulation.
EU	The European Union.
FRDO/CFDD	Federal Council on Sustainable Development.
GDP	gross domestic product.
GHG	greenhouse gases (see footnote 10).
GJ	gigajoule, or $1 \text{ joule} \times 10^9$.
GW	gigawatt, or $1 \text{ watt} \times 10^9$.
GWh	gigawatt-hour = $1 \text{ gigawatt} \times 1 \text{ hour}$.
HWR	heavy water reactor.
IBGE/BIM	Brussels Institute for the Management of the Environment.

ICDO/CIDD	Inter-departmental Commission for Sustainable Development.
IEA	International Energy Agency.
IWT	Institute for the Promotion of Innovation by Science and Technology in Flanders.
kJ	kilojoule, or $1 \text{ joule} \times 10^3$.
kV	kilovolt, or $1 \text{ volt} \times 10^3$.
kVA	kilovolt-ampere = $1 \text{ kilovolt} \times 1 \text{ ampere}$.
kWh	kilowatt-hour = $1 \text{ kilowatt} \times \text{one hour}$.
LNG	liquefied natural gas.
LPG	liquefied petroleum gas.
LWR	light water reactor.
Mt	million tonnes.
Mtoe	million tonnes of oil equivalent; see toe.
MW	megawatt, or $1 \text{ watt} \times 10^6$.
MW _e	megawatt of electrical capacity.
MWh	megawatt-hour = $1 \text{ megawatt} \times \text{one hour}$.
MW _t	megawatt of thermal capacity.
NOB	National Oil Board.
OECD	Organisation for Economic Co-operation and Development.
OPEC	Organisation of the Petroleum Exporting Countries.
PJ	petajoule, or $1 \text{ joule} \times 10^{15}$.
PPP	purchasing power parity.
PWR	pressurised water reactor.
R&D	research and development, especially in energy technology; may include the demonstration and dissemination phases as well.
S	sulphur.
SPE	Société Coopérative de Production d'Electricité.

TFC	total final consumption of energy.
TJ	terajoule, or $1 \text{ joule} \times 10^{12}$.
Toe	tonnes of oil equivalent, defined as 107 kcal.
TPA	third party access.
TPES	total primary energy supply.
TSO	Transmission System Operator.
TW	terawatt, or $1 \text{ watt} \times 10^{12}$.
TWh	terawatt-hour = $1 \text{ terawatt} \times 1 \text{ hour}$.
UNFCCC	United Nations Framework Convention on Climate Change.
VIREG	Flemish Institute for Rational Use of Energy.
VITO	Flemish Institute for Technological Research.
VLIET	Flemish Programme for the Promotion of Energy Technology.

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PRINTED IN FRANCE BY STEDI

(61 01 18 1P) ISBN 92-64-18734-0 - 2001