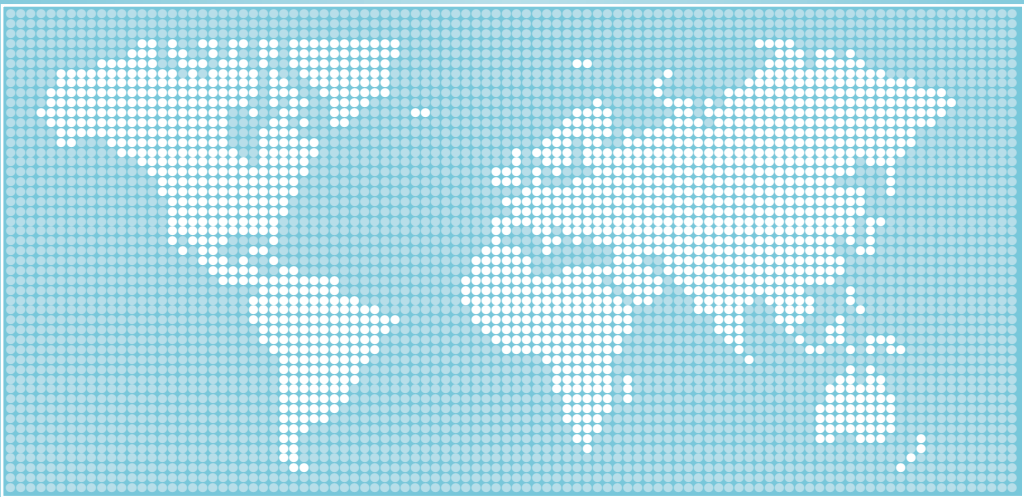


COUNTRY  
REVIEWS

# Environmental Performance Reviews Luxembourg

ENVIRONMENT



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# Environmental Performance Reviews

## Luxembourg



ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

## **ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT**

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**LUXEMBOURG**

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## FOREWORD

The principal aim of the OECD's environmental performance reviews is to help *Member countries improve their individual and collective performances in environmental management*. The primary goals of this programme are:

- to help *individual governments* assess progress by establishing baseline conditions, trends, policy commitments, institutional arrangements and routine capabilities for carrying out national evaluations;
- to promote environmental improvement and a continuous policy *dialogue among Member countries*, through a peer review process and by the transfer of information on policies, approaches and experiences of reviewed countries; and
- to stimulate *greater accountability* from Member countries' governments towards public opinion within developed countries and beyond.

Programme efforts are directed at *promoting sustainable development*, with emphasis on developments in domestic and international environmental policy, as well as on the integration of economic and environmental decision making.

Environmental performance is assessed with regard to the degree of achievement of *domestic objectives and international commitments*. Such objectives and commitments may be broad aims, specific qualitative goals, precise quantitative targets or a commitment to a set of measures to be taken. Assessment of environmental performance is also placed within the context of historical environmental records, the present state of the environment, the physical endowment of the country in natural resources, its economic conditions and demographic trends.

These systematic, independent and periodic reviews are organised and conducted in a way similar to the OECD's economic reviews. The report is peer-reviewed by the Working Party on Environmental Performance, composed of officials from Member countries who have responsibility for national environmental policy development and implementation and a broad competence recognised at national and international levels. The conclusions and recommendations of the report are approved by the Working Party.

Joke Waller-Hunter  
Director  
Environment Directorate

## GENERAL INTRODUCTION

This review of Luxembourg's environmental performance *examines results to date* in the light of domestic objectives and international commitments. Two countries assisted with this review: Belgium and Canada.

The report is organised in three parts according to the strategic goals identified by OECD Environment Ministers:

- Part I is entitled “Pollution Control and Nature Conservation” and focuses on air and waste management, and biodiversity and nature conservation;
- Part II is entitled “Sustainable Development and Integration of Policies” and focuses on institutional aspects and on how policies concerning economics and energy are integrated with environmental policies;
- Part III is entitled “Co-operation with the International Community” and focuses on international environmental topics concerning Luxembourg.

The OECD extends its most sincere thanks to all those who helped in the course of this review, and especially to the examining countries (Belgium and Canada) and their experts. The OECD is particularly indebted to the Government of Luxembourg for its co-operation in expediting the provision of information and the organisation of the experts' mission to Luxembourg, and in facilitating contacts with many individuals both inside and outside administrative and governmental structures of the country.

The OECD Working Party on Environmental Performance conducted the review at its meeting on 3-5 July 2000 and approved its conclusions and recommendations. This report is published under the authority of the Secretary-General of the OECD.

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## ABBREVIATIONS AND SIGNS

### Abbreviations

AAMA	American Automobile Manufacturers Association
BAT	Best available technology
BATNEEC	Best available technology not entailing excessive cost
CES	Economic and Social Council
CFC	Chlorofluorocarbon
CIPMS	International Commission for the Protection of the Moselle and the Sarre
CITES	Convention on International Trade in Endangered Species
CRTE	Environmental Technology Resource Centre
DAC	OECD Development Assistance Committee
EIA	Environmental impact assessment
EMAS	EU Eco-Management Audit Scheme
EMEP	Programme for Monitoring and Evaluation of the long-range transmission of air pollutants in Europe
FCCC	Framework Convention on Climate Change
FEDIL	Federation of Luxembourg Industries
GDP	Gross domestic product
GEF	Global Environment Facility
GNP	Gross national product
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IRF	International Road Federation
IUCN	World Conservation Union (International Union for Conservation of Nature)
LNVL	National League for the Protection of Nature and Birds
LPG	Liquefied petroleum gas
Mtoe	Million tonnes of oil equivalent
NGO	Non-governmental organisation
NMVOCS	Non-methane volatile organic compounds
ODA	Official development assistance
OSPAR	Paris Convention for the Protection of the Marine Environment of the North-East Atlantic
PAHs	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
PM <sub>10</sub>	Particulate matter 10 microns or less in diameter
PNDD	National Plan for Sustainable Development
SAC	Special area of conservation under the EU habitats directive
SDK	SuperDrecksKëcht, problem waste collection programme
SFK	SuperFreonsKëcht, refrigerator collection programme
STATEC	National Statistics Office

SPA	Special protection area under the EU birds directive
toe	Tonne of oil equivalent
VAT	Value added tax
VOCs	Volatile organic compounds

### Signs

The following signs are used in Figures and Tables:

- . . : not available
- : nil or negligible
- . : decimal point

### Country Aggregates

OECD Europe: All European Member countries of the OECD, i.e. countries of the European Union plus the Czech Republic, Hungary, Iceland, Norway, Poland, Switzerland and Turkey.

OECD: The countries of OECD Europe plus Australia, Canada, Japan, Korea, Mexico, New Zealand and the United States.

Country aggregates may include Secretariat estimates.

The sign \* indicates that only western Germany is included.

The sign \*\* indicates that not all countries are included.

### Currency

Monetary unit: Luxembourg franc (LUF).

On average in 1998, LUF 36.298 = USD 1; on average in 1999, LUF 37 577 = USD 1.

### Cut-off Date

This report is based on information and data available up to February 2000.



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## CONCLUSIONS AND RECOMMENDATIONS\*

During the 1990s, *Luxembourg's economy experienced strong growth* (averaging 7% a year), and the resident population rose 1.1% a year. Pressures on the environment from production generally decreased over this period, while pressure from consumption (traffic pollution, waste generation, suburban expansion) increased with rises in population and personal income. Luxembourg is highly interdependent economically and environmentally with neighbouring countries and Europe as a whole, with exports and imports reaching 95% of GDP, 94% of electricity imported, much industrial waste exported, transboundary air and water pollution, and large numbers of foreign vehicles present. One-third of the workforce lives outside Luxembourg.

Luxembourg has set *ambitious environmental objectives*. During the 1990s, EU directives had a decisive influence on the country's environmental policy. In combination with industrial contraction and restructuring, environmental policy has led to significant progress on conventional pollutants. Diffuse and consumption-linked pollution, deterioration of the natural environment and waste generation are not yet under control. The coming challenges are: i) to implement more cost-effective environmental policies; ii) to integrate environmental concerns more fully into economic decision making; and iii) to continue and to expand international co-operation.

This OECD report establishes a baseline for assessing future environmental progress and examines Luxembourg's environmental performance, i.e. the extent to which its *domestic objectives and international commitments* are being met, based on environmental effectiveness and economic efficiency criteria. A number of recommendations are put forward that could contribute to strengthening the country's environmental performance.

### 1. Implementation of Environmental Policies

#### ***Strengthening the cost-effectiveness of environmental policies***

Environmental policy in Luxembourg rests chiefly on *environmental laws and regulations*. These set strict standards and are comprehensive. They have been strongly influenced by EU directives on the environment and regulatory approaches in neighbouring countries (e.g. best available technology).

---

\* Conclusions and Recommendations reviewed and approved by the Working Party on Environmental Performance at its meeting in July 2000.

Environmental agencies set emission standards for industrial establishments on a *case by case* basis. Enforcement should be strengthened and private-sector initiatives to enhance environmental management (e.g. under the EMAS programme) should be further encouraged. Environmental *data and indicators* need to be better developed and more extensively used in designing, implementing and assessing policy.

*Public expenditure* on pollution control and nature conservation represents around 0.75% of GDP. This includes current expenditure and investment by national and local authorities. The Environmental Protection Fund and the Water Management Fund support in particular local authority investments in environmental infrastructure at varying rates, covering up to 100% of capital costs. Information on private-sector expenditure is not collected.

Luxembourg has endorsed the *polluter pays* and *user pays principles*. In practice, however, polluters usually do not meet the costs they generate, nor do users of environmental services bear their costs. Little use is made of *economic instruments* to internalise negative externalities. Local authorities set charges for waste disposal and waste water treatment, which are generally low since communes as a rule meet only 10% of infrastructure investment costs. Taxes on motor vehicle fuel are set so as to maximise tax revenue, and over half of all motor fuel is sold to non-residents. This “gasoline tourism” has adverse environmental effects. A government intention to introduce environmental taxes, first broached in 1994, has not yet been acted on.

It is *recommended* to:

- better respond to the environmental challenges arising from continued growth in *consumption, mobility and land use*;
- translate medium- and long-term *strategic plans* into priorities for environmental management and financing;
- apply the *polluter pays and user pays principles* more fully (e.g. in the management of waste, waste water and energy);
- increase the *use of economic instruments* for waste and water management at the local level;
- strengthen the enforcement of environmental laws and regulations;
- develop *voluntary initiatives* in the industrial sector (environmental management, audits, etc.);
- improve *environmental information* (data, indicators).

## Air

Luxembourg has met or will shortly *meet all its international commitments to reduce emissions of atmospheric pollutants*. Emissions of most conventional pollutants have been decoupled from economic growth, chiefly as a result of the shift to a largely service economy and technological changes in industry. Since 1990, emissions of SO<sub>x</sub>, NO<sub>x</sub> and CO have fallen by approximately 75%, 25%, and 70%; CO<sub>2</sub> emissions have fallen by approximately 20%. The many regulatory measures that have been applied include improving fuel quality for industrial and household use, ending sales of leaded gasoline, limiting industrial and transport emissions and mandating technical inspection of motor vehicles. Air quality is good in Luxembourg and ambient air standards are generally met, except for ozone.

Since 1994 exceedances of ambient thresholds for *tropospheric ozone*, in both urban and rural areas, indicate the need to better control regional emissions of NO<sub>x</sub> and NMVOCs, in particular from vehicles. In 1999 Luxembourg set particularly ambitious targets to reduce emissions of SO<sub>x</sub>, NO<sub>x</sub> and VOCs under the Gothenburg Protocol. It will achieve these objectives only if concerns about air quality are more fully integrated into decisions concerning transport, energy, economic policy and taxation. To that end, economic instruments could be used to influence energy consumers' behaviour, and economic analysis could be used to improve selection of policy measures. In particular it would be appropriate to examine the environmental effectiveness and economic efficiency of fiscal instruments such as an environmental surtax on motor vehicle fuels.

It is *recommended to*:

- define and implement the measures needed to meet commitments on *emissions to air* (CO<sub>2</sub>, NO<sub>x</sub> and NMVOCs), including economic instruments;
- continue to develop and promote *public transport* at regional level, and to internalise the external costs of road transport (e.g. with an environmental surtax on *motor vehicle fuels*);
- resolutely apply *energy-saving programmes*, particularly for transport and the residential/commercial sector, with priority on the most cost-effective measures;
- strengthen *co-operation* between national and communal authorities in enforcing regulations on atmospheric emissions;
- develop and implement a regional plan for the prevention and control of *tropospheric ozone* (aiming at NO<sub>x</sub>, VOCs and ozone), in co-operation with neighbouring countries.

## Waste

Luxembourg has a comprehensive *set of laws and regulations* for waste management based on prevention and recovery. A *national waste plan* is being prepared. Numerous *information* and *awareness* measures are directed at households and the commercial sector. Separate collection, covering all recoverable components, takes place throughout the country. *Disposal infrastructure* has been modernised and brought into line with standards. Non-compliant facilities, such as landfills for inert waste, hospital incinerators and a national landfill for non-household waste, have been closed. Work has begun on establishing a register of polluted sites and on cleaning up former landfills and other contaminated sites. *Technological change* in the steel industry (conversion from blast to electric arc furnaces) has helped to reduce quantities of industrial waste, and to transform this industry into one specialising in the recovery of scrap from well beyond the country's borders. Several other industrial sectors (glass, aluminium, construction) also use high proportions of *recovered materials*.

To meet the quantified targets in the National Plan for Sustainable Development cost-effectively, enforcement of some regulations should be stepped up and economic instruments used more fully. *Volumes of municipal waste* are increasing under the dual impetus of population growth and rising per capita generation of waste. The *polluter pays principle* is applied only partially. Over half of Luxembourg's *industrial, commercial and service waste* is exported. Accordingly, firms should systematically establish waste prevention and management plans, and efforts to find reliable medium- and long-term disposal capacity should be made, including through bilateral or multilateral co-operation with neighbouring regions. Substantial efforts are needed to manage *hospital waste* more effectively.

It is *recommended* to:

- finalise and implement the *National Waste Management Plan*;
- emphasize efforts to *reduce volumes of municipal waste* (e.g. through implementing of harmonised taxation by all local authorities, application of the polluter pays principle, awareness campaigns on waste prevention, efforts to change consumption patterns);
- assure more efficient utilisation of municipal waste *treatment capacity*;
- pursue the *prevention* of industrial, commercial and service waste generation (via waste prevention and management plans, improved dialogue with public authorities, advisory services to promote producer-responsibility, economic instruments, voluntary agreements), and the reuse/recovery of such waste;

- assure on a long term basis the *disposal* of Luxembourg's final industrial waste through making increased use of national disposal capacities and through concluding agreements with neighbouring countries;
- manage *hospital waste* effectively, respecting the proximity principle;
- speed up the establishment of a register of *polluted sites* and the clean-up of contaminated sites.

### **Nature**

In response to pressures on the natural environment from development (agriculture, urbanisation, transport infrastructure, tourism), Luxembourg has introduced laws and regulations to protect nature and has built up a *satisfactory, well organised body of information* of species, including inventories of fauna and flora, and red lists. Significant public expenditure, on the order of 0.12% of GDP, is allocated to nature conservation, including backing for the activities of several NGOs. The National Plan for Sustainable Development contains a strategic vision and a *set of objectives* concerning biodiversity, forests, agriculture, soil and watercourses. Luxembourg has ratified all international conventions on nature conservation. In the "*green belt*" (i.e. all land not covered by physical development plans), building is allowed only for farming or public purposes. A ban on forest clearance has played a major role in protecting woodland habitats. *Forest policy* has reverted to a *more sustainable approach*, involving acknowledgement of the economic, environmental and social functions of woodlands, natural regeneration of deciduous areas and a shift from conifer plantations to deciduous or mixed planting. *Purchases of woodland* by the public authorities have expanded the area of forest in public ownership by 37% over the past ten years.

However, nearly 20 years after passage of the 1982 Conservation of Nature and Natural Resources Act, despite ambitious statements of intent, just 1% of the national territory is classified as conservation areas (24 reserves have been established, out of a projected 140) and 6.2% as special protection areas (15 SPAs, under the EU birds directive). The Upper Sure natural park was completed in 1999 but two other projects, including the Our park proposed in the 1964 Clervaux Treaty with Germany, have yet to be implemented in practice. The *management of these areas* is inadequate, with a lack of multi-year management plans and qualified staff. The conservation areas, at present highly fragmented, are to be extended (under the habitats directive) and included in a *national ecological network* as part of the EU's Natura 2000 system. The modernisation of agriculture has greatly contributed to the *depletion of biodiversity* in Luxembourg. The *agri-environmental programme* (providing assistance for shifts to extensive stockbreeding and arable farming, support for organic farming, introduction of structures for landscape protection, etc.) is not sufficiently utilised and ought to be

strengthened. A policy to conserve the agricultural environment, integrating the restoration of natural habitats in farm management, would be desirable. Sustainable management of private forest (54% of the total) is difficult because much of the land is in small plots.

It is *recommended* to:

- use *information on species and their habitats* more effectively to define priorities for nature conservation and build public awareness of these priorities;
- increase the extent of protected areas by activating the Luxembourg component of the *Natura 2000* network, and by realising the Germany-Luxembourg and France-Germany-Luxembourg natural parks, in co-operation with these neighbouring countries;
- strengthen protection of conservation areas by establishing and applying multi-year *management plans* for existing SPAs and for special conservation areas;
- boost the *resources* for nature conservation and promote *partnerships* among central and local government and social partners;
- control water pollution and continue rehabilitation of *aquatic ecosystems*;
- continue efforts towards *sustainable forestry*;
- significantly step up *agri-environmental* efforts as well as measures to promote *sustainable physical development* (partnerships, intercommunal syndicates, integration of nature conservation concerns in agriculture policy, progress towards sustainable farming and tourism practices).

## 2. Towards Sustainable Development

### ***Integrating environmental issues in economic decision making***

Despite rapid growth of GDP and the population, several pressures on the environment have diminished significantly in Luxembourg. This *decoupling is chiefly the outcome of a shift to a largely service economy*, with rapid expansion in the tertiary sector replacing the former dominance of steelmaking. But the striking economic performance, and the greater household affluence that it brings, are generating challenges for the protection of the environment and nature. The construction sector is expanding swiftly, the car ownership rate is Europe's highest and environmental policies have to cope with the consequences of changing consumption patterns entailing greater volumes of waste, more traffic, spreading suburbs and the related demand for environmental infrastructure.

With few exceptions, environmental concerns are not yet fully integrated into *sectoral policies*. In agriculture policy, EU initiatives to promote more environment-friendly farming should be followed up more diligently. In energy, transport and fiscal

policy, environmental concerns seem to carry little weight. Overall, Luxembourg primarily emphasises economic and social development, protection of agriculture, development of road transport and growth in household consumption.

The ambitious *National Plan for Sustainable Development* covers the economic, environmental and social dimensions of sustainability. It lists current realities and operations and sets them against scenarios for the future; it identifies priorities for action; it covers all major economic sectors and all relevant environmental management issues. Drawn up by the Ministry of the Environment, with the backing of an interministerial working group, it was approved by the government in 1999 for consultation. Parliamentary debate as well as broad consultation of the population are to take place on this document during 2000. This process should lead to clarification of objectives and deadlines, and encourage local Agenda 21 initiatives. It should also be co-ordinated more closely with the process of physical development planning.

*Environmental impact assessments* (EIAs) could be strengthened in terms of both projects and policies. Mechanisms for public consultations and dispute mediation should be expanded.

It is *recommended* to:

- further specify the *National Plan for Sustainable Development* with quantified objectives and deadlines, following *broad consultation* with government agencies and social partners;
- institutionalise a high-level *body for interministerial co-ordination* on sustainable development;
- translate the National Plan for Sustainable Development into *practical measures* for fuller integration of environmental concerns in sectoral policies, particularly agriculture and transport policy;
- consider the introduction of *environmental taxes and charges*, possibly in the context of broader fiscal reform;
- strengthen *EIAs* in terms of both coverage and policy;
- *develop partnership approaches* for local environmental management (e.g. local Agenda 21 initiatives).

### ***Energy and the environment***

During the 1990s, *final energy consumption* in industry fell by 30% thanks to the contraction of steelmaking, enhanced energy efficiency (estimated at 13%) and structural and technological change. A key factor is that, largely because of the replacement of blast furnaces by electric arc processes, energy consumption in the steel industry has fallen substantially in recent years. Since 1990, the use of solid fuels has fallen by 60%, while the use of natural gas has risen by 50%.



Natural gas is increasingly used by industry and households, and the trend will continue when a new gas turbine/steam co-generation plant is commissioned in 2001. Use of renewable energy sources is progressing, despite their limited potential. The *Energy Efficiency Act* (1993) seeks to promote energy saving in all sectors and to reduce dependence on conventional energy forms by encouraging the use of renewables. A national strategy to reduce greenhouse gases was developed in May 2000. *Voluntary agreements* have been used effectively to encourage greater energy efficiency in a number of industrial sectors.

In the 1990s Luxembourg's *energy intensity* fell by 33%, but it is still 9% above the average for OECD Europe. In the late 1990s, *CO<sub>2</sub> emissions* per unit of GDP were 20% above the OECD Europe average, even though 94% of the electricity consumed in Luxembourg is imported. The level of excess emissions would not be substantially different if emissions from vehicle fuels sold in Luxembourg but consumed abroad were deducted, and emissions arising abroad from the generation of electricity consumed in Luxembourg were added. *Energy consumption by transport*, largely accounted for by road vehicles, has risen 54% since 1990. *Taxes on vehicle fuel*, lower than in neighbouring countries, attract substantial purchases by non-residents (50-70% of fuel sales). Similarly, energy consumption in the *residential/commercial sector* has risen 40% since 1990. *Subsidies* have been the main tools used to encourage better energy efficiency and use of alternative energy sources, but with little take-up by industry. The incentive effects of the few economic instruments employed in recent years have been small. To achieve the targets in the National Plan for Sustainable Development, Luxembourg will have to consider additional measures, particularly to reduce energy intensity. Allocation of subsidies for renewables should be associated with stringent *economic analysis*.

It is *recommended* to:

- specify the energy-related objectives and measures in the *National Plan for Sustainable Development*, involving all parties concerned;
- strengthen incentives for *energy efficiency*, particularly in the transport and residential/commercial sectors;
- seek to progressively increase the *price of motor vehicle fuels* so as to encourage savings in motor fuel consumption, reduce emissions and achieve fuller internalisation of external costs;
- make use of *economic analysis* to support the choice of subsidies for renewable energy development;
- establish an effective *follow-up and evaluation system* for energy efficiency incentives;
- conduct a more systematic assessment of the environmental impacts of the use of the main energy sources.

### 3. International Co-operation

Luxembourg has successfully helped *deepen bilateral and regional co-operation on environmental matters*. It has rapidly implemented most EU directives and ratified most major international environmental agreements. Luxembourg's environmental standards are frequently high, and *striking achievements* such as recovering CFCs from discarded refrigerators deserve mention. River water quality has improved and transboundary water pollution has diminished. With regard to atmospheric pollutants, international targets for SO<sub>x</sub> have been more than met. Targets for NO<sub>x</sub> and VOCs have been reached or will be soon. On CO<sub>2</sub> emissions, the very ambitious targets that Luxembourg has set itself for 2000 and 2005 will probably be met. To reach the target of reducing emissions by 2008-12 by 28% over 1990 levels, as laid out in an EU agreement, current measures will need to be stepped up. *Luxembourg is among the most generous providers of official development assistance*, and the level of aid has increased considerably in recent years.

While the achievements in international co-operation are wholly positive, there remain areas to which insufficient resources have been devoted or where political will has been somewhat lacking. *Several EU directives have not yet been fully implemented*. Strategies and plans of real effectiveness are lacking in many spheres, particularly for waste, chemicals, atmospheric pollutants and CO<sub>2</sub>. Investment in tertiary wastewater treatment plants has not been on schedule. Transboundary river pollution and the resulting soil pollution have not diminished as much as had been hoped. Substantial efforts will be necessary to meet the Gothenburg Protocol targets.

There is *little or no follow-up on legislative measures taken* with a view to promoting international co-operation. Application of the concept of sustainable development has made little headway at either interministerial or local level. Ratification of some conventions has been considerably delayed. In many cases these delays have been due not only to *insufficient resources* to meet international commitments, but also to the low priority ascribed to the environment.

It is *recommended* to:

- pursue and *step up regional co-operation* on the environment (e.g. on waste, tropospheric ozone, natural parks and protected zones);
- take all institutional and financial measures needed to *establish and fund the tertiary waste water treatment facilities required under the EU waste water directive*;
- adopt and implement *strategies and plans* to meet the international obligations stemming from the *Kyoto and Gothenburg protocols by 2010*, and strengthen the measures already in place.

# 1

## THE CONTEXT

### 1. The Physical Context

Located in the middle of Western Europe, Luxembourg is bordered by Belgium, France and Germany (Figure 1.1). The *country covers* 2 586 km<sup>2</sup>, running 82 kilometres north to south and 57 kilometres east to west at its widest.

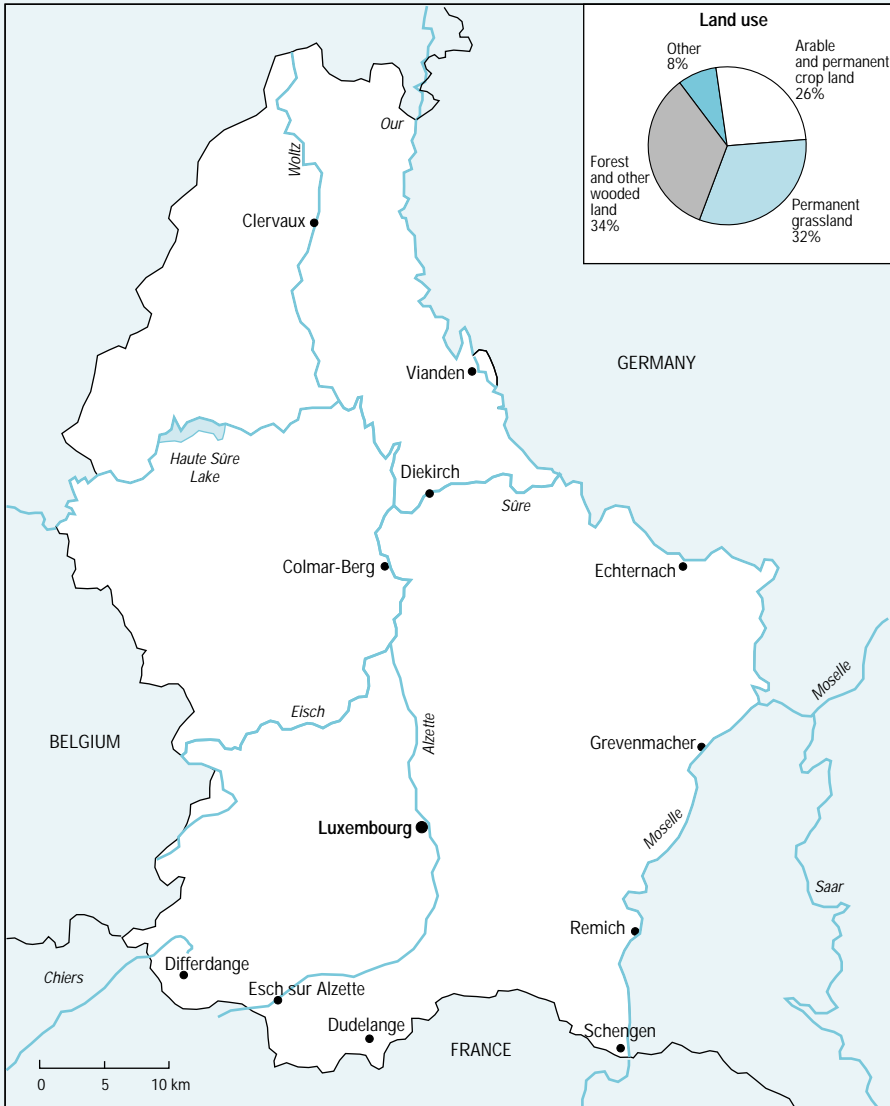
Geographically and geologically, there are *two natural regions*: Oesling in the north and Bon Pays in the south. Oesling, which makes up one-third of the country, consists of upland plateaux divided by narrow valleys. The plateaux are generally given over to arable farming, and the valley floors and slopes to woods or pastures. Bon Pays, at the north-east limit of the Paris Basin, consists mainly of grazing; there are vineyards on the Moselle valley slopes, and a substantial iron and steel industry has been established in the south since the late 19th century.

Most *rivers* in Luxembourg flow into the Moselle, itself a tributary of the Rhine. Rivers and streams form a fairly dense network in the narrow Oesling valleys, whose geomorphology remains relatively natural. The rivers in Bon Pays, in the farming valleys, have generally undergone the hydrological modifications associated with intensive agriculture (course straightening, for example, and flood control for water meadows).

As regards *land use*, Luxembourg has a high proportion of farmland and permanent grazing (58%) and woodland (34%). The balance (8%) consists of built-up sites (5%) and infrastructure (quarries, landfills, roads, railways).

*Luxembourg has few exploitable natural resources* apart from its woodlands. The water resources have been developed, with canalisation of the Moselle and dams on the Our (for the *Société électrique de l'Our*) and the Upper Sûre (for a drinking water reservoir).

Figure 1.1 Map of Luxembourg



## 2. The Human Context

Luxembourg's *resident population totals nearly 420 000*. With 167 inhabitants per square kilometre, the country is *very densely populated* compared with the average for OECD Europe (103/km<sup>2</sup>). There are substantial variations, such as lower densities in the north than in the south (Table 1.1). The *population is largely concentrated* in the capital city, Luxembourg (79 800 inhabitants), in its urban area (150 000 inhabitants) and in the industrial towns of the south (Table 1.1). There has been strong population growth on the fringes of all urban areas since 1995.

The *average annual rate of increase in the resident population* was 1.3% between 1986 and 1996, against an OECD average of 0.7% over the same period. Some 90% of the demographic increase is due to net immigration. Foreign nationals make up 34% of the population.

In the 1990s, *unemployment* remained low (under 4%) and the increase in employment was among the highest in the OECD. During 15 years of sustained growth, labour market tensions were avoided largely due to immigration (25% of jobs are held by resident foreigners) and to cross-border workers (who hold more than 30% of jobs).

Luxembourg has *three official languages*. Letzeburgesch, the national language, is spoken throughout the country, but little used in writing. The written languages are German and French, the latter being used for administrative purposes.

Table 1.1 **Main communes: population, land area and density, 1999<sup>a</sup>**

Commune	Canton	Population ('000)	Land area (km <sup>2</sup> )	Population density (inhab./km <sup>2</sup> )
Luxembourg	Luxembourg	79.8	52	1 530
Esch-sur-Alzette	Esch-sur-Alzette	24.9	14	1 780
Differdange	Esch-sur-Alzette	17.1	22	770
Dudelange	Esch-sur-Alzette	16.6	21	790
Pétange	Esch-sur-Alzette	13.5	12	1 125
Sanem	Esch-sur-Alzette	12.8	24	530
Hespérange	Luxembourg-Campagne	10.3	27	380

a) Calculated on the basis of the 1991 census.

Source: STATEC.

### 3. The Economic Context

Luxembourg's *economic performance has been remarkable*. Since the early 1980s the economy has enjoyed *strong growth*, with a 146% increase in GDP over 1980-99, an average of 4.8% per year (Figure 1.2). In 1999, GDP growth was 5.1% and GDP stood at USD 19 billion (LUF 709 billion) at current prices, USD 15.3 billion (LUF 605 billion) at 1991 prices and purchasing power parities. Per capita GDP (USD 35 500, LUF 1.3 million), counting both residents and cross-border workers, is among the highest in the OECD (Figure 1.2). Public finances have been in surplus for more than ten years, and public debt is equivalent to 7% of GDP.

#### ***The structure of the economy***

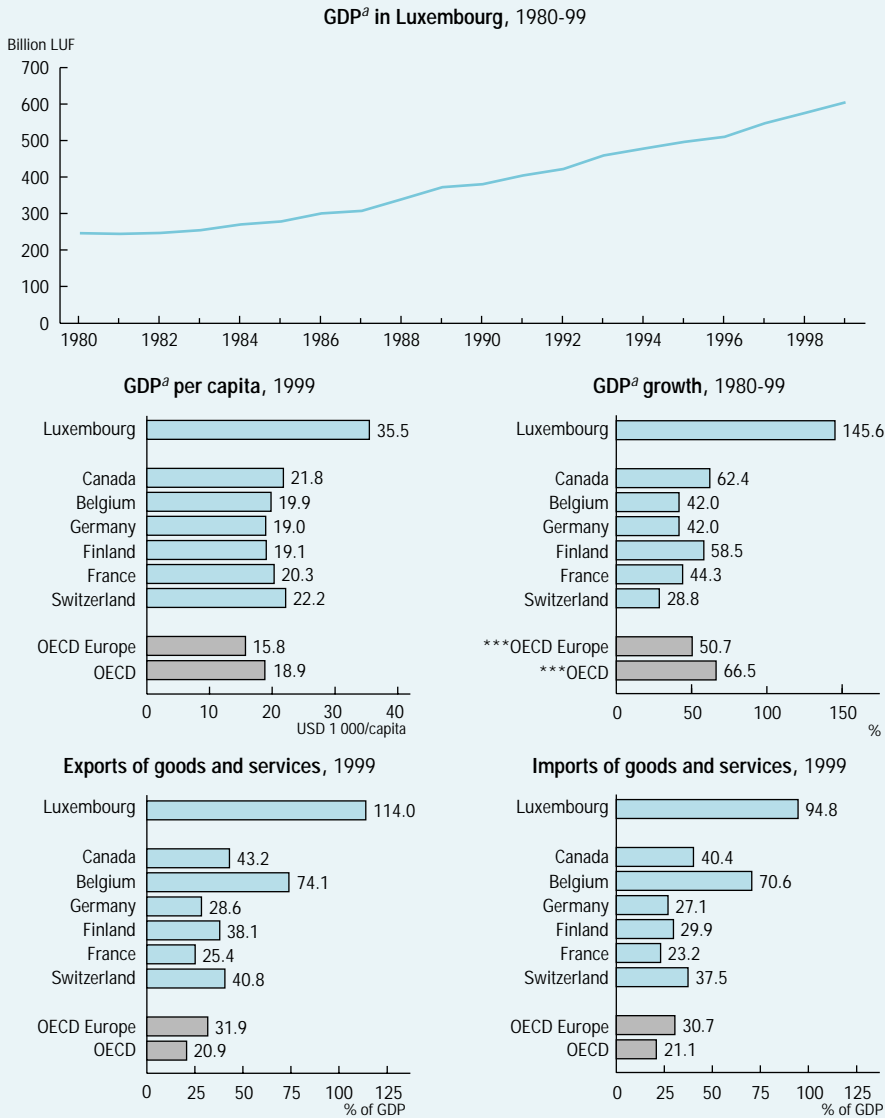
The *structure of Luxembourg's economy* shows strongly established services (banking and insurance, communications) generating 78% of GDP, industry (steel and chemicals) 21% and primary activity (including agriculture) 1%. Luxembourg is host to several European Union institutions. The economy has undergone considerable structural change in recent decades. With steelmaking in decline and government policy favouring industrial diversification, the chemicals, rubber and plastics industries have started to develop. Furthermore, growth continued even as a radical shift was made from an industrial economy based on steel to a service economy based on banking and finance.

Out of a total of 219 000 jobs, 71% are in services, 26.5% in industry and 2.5% in agriculture. Cross-border workers, totalling 67 000, account for over 30% of the country's jobs. The main centres of employment are the capital and its immediate area (banking, commerce, industry), the south (steel, other industry) and the Colmar-Berg region (chemicals, tyre production). After undergoing a crisis in the 1970s, the *steel industry* has undertaken major technological transformation, and its job numbers have fallen considerably. At the same time the strong *international banking sector* that developed in the capital has compensated for the decline in steel jobs. With over 200 banks represented, Luxembourg is the third largest financial centre in Europe, and the seventh in the world.

#### ***Integration in the international economy***

Luxembourg's external economic relations have long been marked by *integration in broader economic areas*. The Belgium-Luxembourg Economic Convention has been in effect since 1922. Luxembourg is a member of the Benelux customs and trade union, and has played its part in every stage of European integration.

Figure 1.2 Economic structure and trends



a) GDP at 1991 price levels and purchasing power parities.  
 Source: OECD.

*Foreign trade* has an important role, with exports of goods and services equivalent to 114% of GDP and imports 95% in 1999 (Figure 1.2). The European Union is Luxembourg's chief economic partner, both for imports (89% of the total) and for exports (84%). The country's three main trading partners are France, Germany and Belgium. The *main export goods* are metals (33%), machinery and electrical equipment (19%), and plastics, rubber and tyres (13%). The major factors in the worsening of the trade deficit since the mid-1970s have been *energy dependence*, the increase in imports of intermediate goods and the tripling of household consumption. The service sector (notably banking, air transport and telecommunications) contributes to a *positive trade balance* for goods and services.

Successive governments have had active policies to enhance Luxembourg's attractions *as a site for financial and industrial activity*. Tax advantages in relation to neighbouring countries, strict banking secrecy regulations and the transposition of EU directives into Luxembourg law, combined with a skilled multilingual labour force, play central roles in this effort.

#### **4. The Institutional Context**

##### ***Government***

Luxembourg is a *representative democracy and constitutional monarchy*. The Grand Duke selects the prime minister, who presents a list of government members. The Grand Duke formally appoints the ministers, who must be approved by a majority of the Chamber of Deputies. Ministers are collectively accountable to the Chamber for all measures decided by the government sitting in council. The number of ministries (19) is far greater than the number of ministerial posts; ministers frequently hold several portfolios.

*Executive powers* lie with the Grand Duke, but ministers and state secretaries, directing various branches of the public service, have an important role in exercising these powers. Article 36 of the Constitution allows the executive branch to issue the decrees needed to implement legislation. The Parliament and the judiciary counterbalance the executive branch through approval of the annual budget, judicial decisions on decrees, and administrative courts.

*Legislative powers* lie jointly with the Grand Duke and the *Chamber of Deputies*. Bills, introduced by the government or by the Chamber, become law only upon approval by both the Chamber and the Grand Duke. The 60 deputies forming the Chamber are *directly elected* for five years; voting, which is compulsory and by secret ballot, is characterised by universal suffrage among Luxembourg nationals over 18 years of age. In the Luxembourg parliamentary system, the *Council of State*, made up of 21 councillors, exerts the moderating influence of a second legislative chamber. Its members are appointed by the



Grand Duke, either directly or on the proposal of the Chamber of Deputies or the Council of State itself. The government must seek the Council of State's opinion on all legislation that it proposes to introduce, but is not bound by the Council's opinion. Similarly, the Chamber of Deputies may not vote on a bill until the Council of State has given its opinion.

The country is divided into *three administrative districts* (Luxembourg, Grevenmacher and Diekirch), 12 cantons and 118 communes. Luxembourg district, in the south-west, is made up of four cantons: Esch-sur-Alzette, Capellen, Mersch and Luxembourg (including Luxembourg-Campagne). The district of Grevenmacher, in the south-east, is divided into the cantons of Remich, Grevenmacher and Echternach. Diekirch district, in the north, comprises five cantons: Redange, Wiltz, Clervaux, Vianden and Diekirch. Powers to regulate land use lie with the communes, and are exercised through a general development plan, which every commune is required to have. For each administrative district, a commissioner acts as liaison between the communes and the interior minister, and administers funds for physical development projects.

### ***Environmental administrative organisation***

There has been a ministerial post with responsibility for the environment since 1971, but not until 1984 was there a separate *Ministry of the Environment* with general powers relating to every aspect of the natural and human environment (covering air, water, waste and nature). In 1989, the ministry acquired responsibilities for physical development to ensure fuller national co-ordination of the two areas. Following a government reshuffle in 1992, the environment and physical development were again assigned to two separate ministries. After national elections in 1999 and the formation of a new coalition government, an agency for water management is expected to be created, reporting to the interior minister. The Ministry of the Environment has a staff of 20. Its responsibilities cover:

- supervision of the Environment Administration;
- supervision of some activities of the Water and Forests Administration;
- interministerial co-ordination on environmental problems;
- co-ordination of statutory and regulatory provisions concerning the environment;
- management of environmental protection funds;
- abatement and control of noise and air pollution;
- reduction, recycling and disposal of urban and industrial waste.

The *Water and Forests Administration*, with a staff of 120, is responsible for enforcing nature conservation legislation and reports to the environment minister. Hunting, fishing and public forest management also come within its purview,

under the aegis of the Ministry of Agriculture, Viticulture and Rural Development. By means of grants from this ministry, the Water and Forests Administration also has an advisory role as regards private forests.

The *Environment Administration* has a staff of 50 and is responsible for protecting the environment to improve the quality of human life. Its role is both preventive and remedial. Its duties include preventing pollution, combating air pollution and noise, and managing waste. This administration consists of three services: i) air and noise (including a division on classified installations, which integrates environmental protection concerns in operating permits); ii) waste; and iii) water.

The powers of the *Ministry of the Interior* include the administration of inter-communal syndicates, general policy for physical planning and development, abandoned industrial sites, and natural parks. Since 1999 the ministry has also co-ordinated general water policy, including management and protection of water as a natural resource, cleaning up water and rivers, sewage sludge management, drinking water supplies and water pricing. *Other ministries* have environmental responsibilities as well, such as that of the Ministry of Agriculture concerning regulation of non-navigable waterways.

The *communal authorities* have very wide powers relating to environmental protection, covering land use and urban development plans, traffic planning, disposal of waste water and household waste, local roads and management of green spaces. Communes frequently delegate these responsibilities to inter-communal syndicates. Waste disposal, for instance, is assigned to such bodies.

## 5. The Legislative and Regulatory Context

Luxembourg has a substantial package of national *legislative and regulatory provisions* on environmental protection (Table 1.2), combined in the *Environment Code*.

The *Conservation of Nature and Natural Resources Act (1982)* is designed to safeguard the character, diversity and integrity of the natural environment. It defines the types of construction permitted in green areas, regulates the protection of flora and fauna, and provides for the establishment of protected areas. In the event of forest being cleared, for example, replacement plantation is required, at least equivalent in quantitative and qualitative terms to that removed.

The 1999 *Physical Development Act*, superseding a 1974 law, is intended to ensure that the inhabitants of Luxembourg enjoy optimal living conditions through harmonious and sustainable development of the country's regions, enhancing their respective resources and maintaining a structural and economic balance among them. Among other things the Act provides for rational land use, landscape protection, optimal use of natural resources, and investment in the removal and treatment of solid and liquid waste.

The *Clean Air Act (1976)* provides for implementing decrees to be issued by the Grand Duke to prevent and reduce air pollution. With the stated aim of regulating all emissions of gaseous, liquid or solid substances into the air, from whatever source, the Act has led to the approval of decrees concerning large combustion plants, industrial and crafts establishments and service stations, among other subjects.

Pursuant to the *Hazardous Installations Act (1999)*, all activities liable to present a danger or a threat to the safety, health or well-being of staff or the general public, or to the built and natural environment, have to be licensed. Permits issued by ministers (Classes 1 and 3) and burgomasters (Class 2) set operating conditions as judged necessary for the protection of humans and of the built and natural environment. Reference is made to the best available technology not entailing excessive cost.

The *Energy Efficiency Act (1993)* provides for the promotion of energy conservation, savings and efficiency in all sectors. The Act emphasises reducing dependence on conventional forms of energy and seeks to promote the use of

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Table 1.2 Principal laws relating to the environment

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1929	Watercourse Protection and Improvement Act
1937	Urban Development Act
1951	Woodland Protection Act
1965	Nature Protection Act
1974	Physical Development Act
1976	Clean Air Act
1976	Noise Abatement Act
1980	Surface Water Quality Act
1982	Conservation of Nature and Natural Resources Act
1990	Hazardous Installations Act
1992	Freedom of Access to Environmental Information Act
1992	Climate and Ozone Layer Protection Act
1993	Water Protection and Management Act
1993	Energy Efficiency Act
1993	Natural Parks Act
1994	Waste Prevention and Management Act
1994	Act on the Classification, Packaging and Labelling of Hazardous Preparations
1999	Classified Installations Act
1999	Physical Development Act

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Source: Ministry of the Environment.

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new or renewable energy sources, such as co-generation and independent production of primary and secondary energy.

The *Water Protection and Management Act (1993)* concerns the quantity and quality of water resources. It introduced permits for water withdrawals and discharges, regulates waste water treatment and provides for the establishment of protected areas around points where water is abstracted for human use. Implementing decrees set forth measures to be taken to prevent or reduce water pollution.

The *Waste Prevention and Management Act (1994)* establishes a strict hierarchy for waste management objectives and provides for the drawing up of a national waste management plan, divided as appropriate into sectoral plans. It also set up a licensing system for the establishment and operation of plants or sites for disposal or recycling operations. The polluter pays principle is explicitly acknowledged; the price of waste treatment includes all costs stemming from the establishment and management of the waste disposal and recycling infrastructure. Waste generators are liable for damage caused by that waste, independent of any negligence. The communes are responsible for managing household, bulky and similar waste within their area. The communes and the government share responsibility for special waste.

The *Freedom of Access to Environmental Information Act (1992)* obliges the public authorities to make environmental information available on request, without any reasons having to be given.

*Part I*

**POLLUTION CONTROL  
AND NATURE CONSERVATION**

# 2

## AIR MANAGEMENT

### 1. Air Pollution: Current Situation and Trends

#### *Atmospheric emissions*

*SO<sub>x</sub> emissions* totalled 3 600 tonnes in 1998, down 76% from 1990 (Table 2.1). Combustion in industry accounted for 42% of total emissions, non-industrial combustion for 31% and mobile sources for 17%. Luxembourg's *SO<sub>x</sub>* emissions per capita and per unit of GDP are low, respectively around 28% and 12% of the OECD Europe average (Figure 2.1).

*Emissions of NO<sub>x</sub>* totalled 17 000 tonnes in 1998, a 27% decline from 1990 (Table 2.1). They come from mobile sources (49%), industrial combustion (37%) and non-industrial combustion (8%). *NO<sub>x</sub>* emissions per capita are among the highest for OECD Europe, 40% above the average.

*Emissions of non-methane volatile organic compounds (NMVOCs)* amounted to 13 000 tonnes in 1998, 30% less than in 1990 (Table 2.1). Transport represents 57% of these emissions, with solvent use accounting for 28% and distribution of fossil fuel for 5% each.

*CO<sub>2</sub> emissions* from energy use totalled 8.6 million tonnes in 1997, 21% down on the 1990 level (Table 2.1). The main sources were transport (52%), industry (26%) and non-industrial combustion (19%). *CO<sub>2</sub>* emissions per capita in 1997 were 2.6 times the OECD Europe average (and, indeed, the highest level of any OECD country), and per unit of GDP they were 20% above the average (Figure 2.1). *Methane emissions* totalled 25 000 tonnes in 1996, generated largely by agriculture (72%) and waste processing and disposal (15%).

#### *Air quality*

The 1999 annual mean for atmospheric *SO<sub>2</sub> concentrations* in the capital was 10 µg/m<sup>3</sup>, well below the limit value (Table 2.2); in rural areas the levels are

lower still. Since 1990, SO<sub>2</sub> concentrations have fallen by 10-30% at all air quality monitoring stations, and the limit values are generally respected.

The *annual mean NO<sub>2</sub> concentration* in 1999 in the capital was 51 µg/m<sup>3</sup>, slightly above the annual limit value (Table 2.2). In rural areas the limits are generally respected, averaging 10 µg/m<sup>3</sup>. Overall, NO<sub>2</sub> concentrations have fallen by 5-20% in all communes since 1990, but NO<sub>2</sub> levels are demonstrating a very clear trend to stabilise around the EU guidance values, exceeding them in some years.

Measurements of *black smoke concentrations* show little change in recent years. They are well below the limit values almost everywhere, except along some very busy roads and in the vicinity of steelmaking plants. *PM<sub>10</sub> concentrations* measured in the cities of Luxembourg and Esch-sur-Alzette have remained at 26-28 µg/m<sup>3</sup> since the early 1990s. The limit value for *lead* in suspended particles has not been exceeded; in 1997 the annual means were 0.03-0.08 µg/m<sup>3</sup>.

Table 2.1 Air pollutant emissions, by source, 1990-98<sup>a</sup>

		SO <sub>x</sub> <sup>b</sup>	%	NO <sub>x</sub> <sup>b</sup>	%	NMVOc <sup>b</sup>	%	CO <sup>b</sup>	%	CO <sub>2</sub> <sup>c</sup>	%
Power plants	1990	0.1	(0.7)	0.3	(1.3)	0	(0)	0.1	(0.1)	1.5	(4.6)
	1998	0	(0)	0.1	(0.6)	0	(0)	0	(0)	0.4	(4.6)
Industrial combustion	1990	12.6	(85.7)	10.8	(46.4)	0.4	(2.1)	97.9	(55.8)	5.0	(45.9)
	1998	1.5	(41.7)	6.2	(36.7)	0.1	(0.8)	4.0	(7.9)	2.2	(25.6)
Non-industrial combustion	1990	1.2	(8.1)	1.0	(4.3)	0.6	(3.2)	9.9	(5.6)	1.3	(11.9)
	1998	1.1	(30.5)	1.3	(7.7)	0.5	(3.8)	7.1	(13.9)	1.6	(18.6)
Industrial processes	1990	0.2	(1.4)	0.2	(0.8)	1.2	(6.4)	17.4	(9.9)	..	..
	1998	0.3	(8.3)	0.8	(4.7)	0.6	(4.6)	2.5	(4.9)	..	..
Mobile sources	1990	0.5	(3.4)	10.7	(45.9)	11.2	(60.0)	50.2	(28.6)	3.1	(28.4)
	1998	0.6	(16.7)	8.3	(49.1)	7.5	(57.2)	37.3	(73.3)	4.4	(51.2)
Miscellaneous	1990	0.1	(0.7)	0.3	(1.3)	5.3	(28.3)	0	(0)	0	(0)
	1998	0.1	(2.8)	0.2	(1.2)	4.4	(33.6)	0	(0)	0	(0)
<b>Total</b>	<b>1990</b>	<b>14.7</b>		<b>23.3</b>		<b>18.7</b>		<b>175.5</b>		<b>10.9</b>	
	<b>1998</b>	<b>3.6</b>		<b>16.9</b>		<b>13.1</b>		<b>50.9</b>		<b>8.6</b>	
Change			-76%		-27%		-30%		-71%		-21%

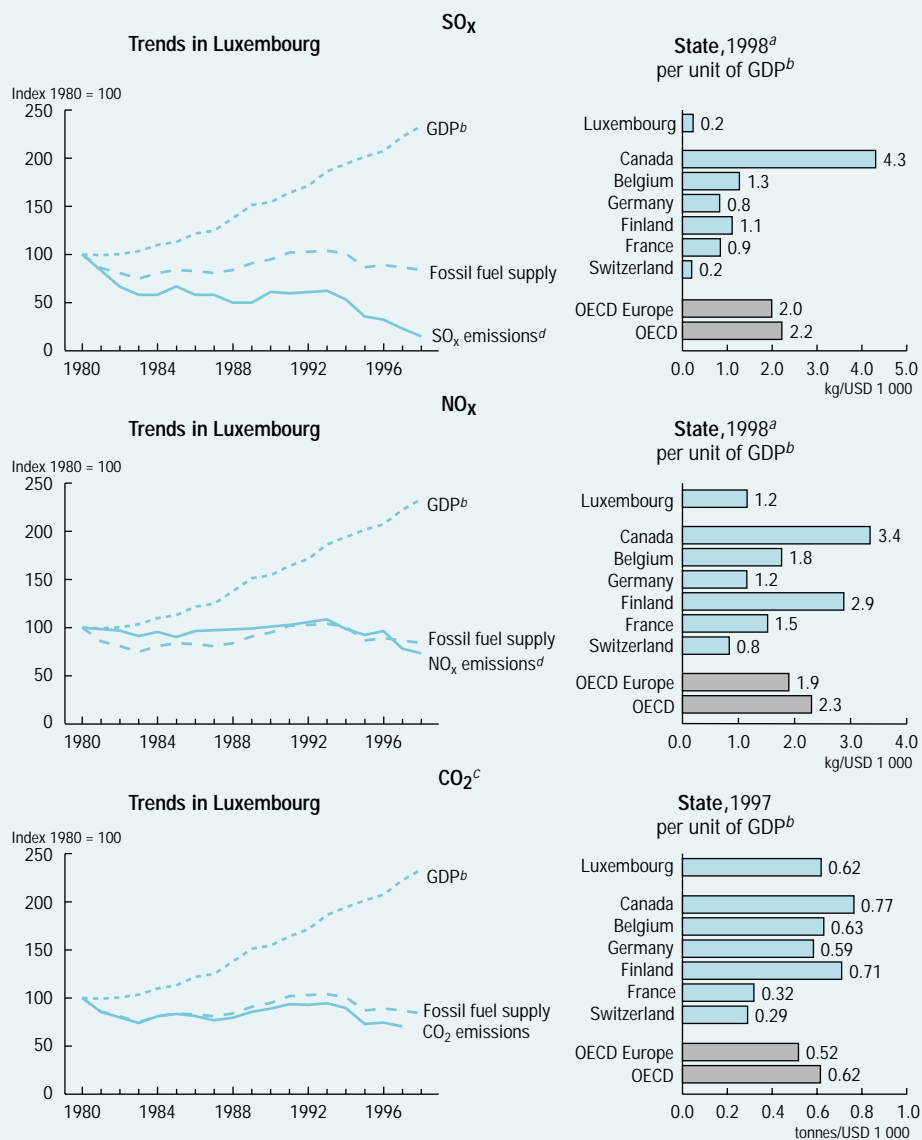
a) Percentages of total emissions are shown in brackets.

b) SO<sub>x</sub>, NO<sub>x</sub>, NMVOC and CO in thousands of tonnes; SO<sub>x</sub> = SO<sub>2</sub> equivalent; NO<sub>x</sub> = NO<sub>2</sub> equivalent.

c) CO<sub>2</sub> emissions in millions of tonnes from energy utilisation; the 1998 line shows data for 1997.

Source: Ministry of Environment; IEA-OECD.

Figure 2.1 Air pollutant emissions



a) Or latest available year.  
 b) GDP at 1991 prices and purchasing power parities.  
 c) Emissions from energy use only; excludes international marine bunkers.  
 d) SO<sub>x</sub>: 1991-92 Secretariat estimates; NO<sub>x</sub>: 1981-82, 84, 86-89 et 91-92 Secretariat estimates.  
 Source: OECD; IEA-OECD.



Some 60 to 70 times each summer since 1994, the maximum concentrations of *tropospheric ozone* in both urban and rural areas have exceeded the threshold value of  $110 \mu\text{g}/\text{m}^3$  (threshold for health protection, monitored over eight hours), but the public notification threshold ( $180 \mu\text{g}/\text{m}^3$ ) has not been passed. In 1999, the threshold value for protection of plants (24-hour mean;  $65 \mu\text{g}/\text{m}^3$ ) was exceeded in 136 of the 153 days during the summer, and the threshold for health protection (eight-hour mean;  $110 \mu\text{g}/\text{m}^3$ ) was passed on 62 days. An upward trend can be discerned in the number of days on which threshold values were exceeded in the 1990s.

The concentration of *benzene*, measured at one station in the capital, was  $7\text{-}9 \mu\text{g}/\text{m}^3$  for 1999, above the limit value of  $5 \mu\text{g}/\text{m}^3$  being discussed by the EU. Since 1995, *bioaccumulation of heavy metals and organic pollutants, particularly PAHs and PCBs*, has been regularly monitored around major industrial sites, using biological indicators (moss, cabbages and leeks sampled in the areas concerned). In 1998 the network consisted of 11 observation posts, including two in rural areas. The highest levels of *heavy metals (lead and zinc)* occur around steelmaking sites; the health levels for washed fresh vegetables are not

Table 2.2 Air quality limit values

Substance	Parameter	Limit value	International rules
SO <sub>2</sub>	Annual mean of daily values	$120 \mu\text{g}/\text{m}^3$ (PM emission < $40 \mu\text{g}/\text{m}^3$ ) $80 \mu\text{g}/\text{m}^3$ (PM emission > $40 \mu\text{g}/\text{m}^3$ )	EU Directive 80/779
	Winter mean of daily values	$180 \mu\text{g}/\text{m}^3$ (PM emission < $60 \mu\text{g}/\text{m}^3$ ) $130 \mu\text{g}/\text{m}^3$ (PM emission > $60 \mu\text{g}/\text{m}^3$ )	
Black smoke	Annual mean of daily values	$80 \mu\text{g}/\text{m}^3$	EU Directive 80/779
	Winter mean of daily values	$130 \mu\text{g}/\text{m}^3$	
NO <sub>2</sub>	Annual mean of daily values	$50 \mu\text{g}/\text{m}^3$	EU Directive 85/203
	98% of all daily means measured over a year	$200 \mu\text{g}/\text{m}^3$	
Ozone	1-hour mean	$180 \mu\text{g}/\text{m}^3$ notification level $360 \mu\text{g}/\text{m}^3$ warning level	EU Directive 92/72
	8-hour mean	$110 \mu\text{g}/\text{m}^3$ health protection level	
Lead	Annual mean	$2 \mu\text{g}/\text{m}^3$	EU Directive 82/884
CO	1-hour maximum	$30 \mu\text{g}/\text{m}^3$	WHO guide value
	8-hour maximum	$10 \mu\text{g}/\text{m}^3$	

Source: Ministry of the Environment; OECD.

exceeded. Very substantial variations in the quantities of *dioxins*, *furans* and *PAHs* accumulated by bio-indicators have been observed around several steel-making sites, from low levels to significantly high ones. The highest PCB levels are also observed in the steelmaking basin; the guidance value (250 ng/g) in vegetables is not exceeded.

## 2. Responses

The *Ministry of the Environment* is responsible for policy on air pollution and the greenhouse effect. The air and noise section of the Environment Administration is responsible for air testing and monitoring, and for air and climate protection. Enforcement of the Classified Installations Act (1999), which sets emission limits for operating permits, is a core activity of this section.

### **Objectives**

#### *General objectives*

The *general objectives of air protection policy* in Luxembourg, defined in the National Plan for Sustainable Development (PNDD) of 1999, are to comply with air quality standards (in particular tropospheric ozone levels), and to limit pollution through preventive measures that are both technically and economically feasible.

#### *Quantified objectives*

For emissions of *conventional pollutants*, Luxembourg has adopted quantitative targets in the framework of international commitments (Table 7.2). In addition, the national plan for sustainable development sets a target of reducing sulphur, NO<sub>x</sub> and VOC emissions by 70% from 1990 to 2010.

With regard to climate change, Luxembourg's commitment under the Kyoto Protocol is to take measures to reduce *greenhouse gas emissions by 28%* by 2008-12 in relation to 1990 levels (Table 7.2). Under the Göteborg Protocol, Luxembourg has undertaken to stabilise ammonia emissions at 1990 levels by 2010.

Numerous regulations reflect the *limit values for ambient concentrations* defined in EU directives for SO<sub>2</sub>, NO<sub>2</sub>, black smoke, ozone and lead (Table 2.2), aiming to assure acceptable air quality for the protection of human health, fauna and flora.

### **Air pollution prevention and control**

#### *Regulatory measures*

*Emission limits for classified installations* are set in operating permits (Chapter 5), calling for the best available technology. As the Classified

Installations Act sets emission limits case by case via operating permits for the largest installations, substantial discrepancies sometimes occur in the levels applied to these firms. Operators have to inspect combustion facilities regularly and classified installations are required to produce annual emission reports.

All *road vehicles* registered in Luxembourg undergo regular *technical inspection* for engine performance in terms of emissions and noise, and for mechanical aspects. In 1998, 316 500 inspections were carried out, with a failure rate of 16% on first examination. Emission standards are equivalent to the EU ones.

*Fuel quality* is also regulated on the lines of EU directives. Sale of leaded gasoline ceased in 1999. The maximum level for sulphur is 0.05% by weight in diesel and 0.2% by weight in heating fuel.

Under an EU directive, a *programme to clean up service stations* began in 1996. By 1999, 225 of the country's 250 filling stations had been cleaned up, with polluted soil being treated, storage tanks modernised and NMVOC collection systems installed.

#### *Economic instruments*

*Fines* can be imposed where industrial facilities exceed air pollution limits. In addition to fines of between LUF 10 000 and 800 000, penalties include imprisonment for between eight days and six months. Motor vehicles exceeding exhaust gas limits may also be fined.

The *annual road tax* for private cars, motorcycles and goods vehicles is calculated on the basis of engine capacity. For private cars, rates are between LUF 151 and 170 per 100 cc. The tax does not depend on vehicle emissions or energy performance, and makes no distinction between gasoline and diesel engines. The cost of commuting is tax deductible, no matter what transport mode is used.

The *fuel tax* is LUF 10 per litre for diesel and LUF 15 per litre for gasoline. All energy products are subject to *value added tax (VAT)* at 15% except fuel for public passenger transport, which benefits from a reduced rate. VAT on unleaded gasoline is 12%. Luxembourg's tax rates for motor vehicle fuel are among the lowest in OECD Europe (Table 2.3), a fact reflected in low pump prices. As a result, 50-70% of fuel sales are to cross-border "*gasoline tourists*", generating extra vehicle movements and pollutant emissions in Luxembourg. Electricity, domestic heating fuel and natural gas prices are also lower (by 15-35%) than the OECD Europe average (Table 6.3).

*Firms* investing in anti-pollution equipment and energy-saving technology are entitled, under a range of laws and regulations, to subsidies of up to 25% of the capital cost. A 1994 ministerial order offers the same entitlement to firms

generating energy from renewable sources: for the first 5 000 kW of installed capacity, the following subsidies are available: wind generation, LUF 3 000 per kW; co-generation, LUF 6 000 per kW; solar power, up to 25% of production cost. As much as 50% of the costs of energy audits may also subsidised, up to a ceiling of LUF 150 000. *Accelerated depreciation* is a further means of encouraging firms to invest in more energy-efficient technology (Chapter 6).

Between 1990 and 1992, nearly 6 000 *households* that replaced their heating units and improved combustion efficiency by 5% or more received *subsidies* of between LUF 10 000 and LUF 20 000. To promote use of less polluting motor vehicles, the government offered between LUF 10 000 and 20 000 for purchases of cars equipped with catalytic converters between 1990 and 1992; over 22 000 grants were made under this programme.

#### *Pollution prevention and control expenditure*

*Capital and operating expenditure* by the government and local authorities to control air pollution totalled LUF 18 million in 1997, or 0.4% of annual government

Table 2.3 Road transport fuel prices, 1999

	Diesel <sup>a</sup>		Unleaded gasoline <sup>b</sup>	
	Price (USD)	Tax (%)	Price <sup>c</sup> (USD)	Tax (%)
Luxembourg	0.50	54.2	0.63	64.1
Austria	0.57	54.9	0.83	67.7
Germany	0.59	61.9	0.79	73.8
Belgium	0.56	55.9	0.95	73.7
Finland	0.59	55.2	0.92	74.6
France	0.61	67.3	0.93	79.1
Italy	0.68	63.7	1.09	73.2
Netherlands	0.63	58.8	1.02	73.3
Switzerland	0.68	75.5	0.58	69.0
OECD Europe	0.64	..	0.96	..
OECD	..	..	0.54	..

a) Current prices and exchange rates.

b) Current prices and purchasing power parities.

c) 1998 data.

Source: IEA-OECD.

environmental spending (Table 5.2). Between 1990 and 1998 the *Environmental Protection Fund* budgeted LUF 132 million for air quality improvement and noise abatement.

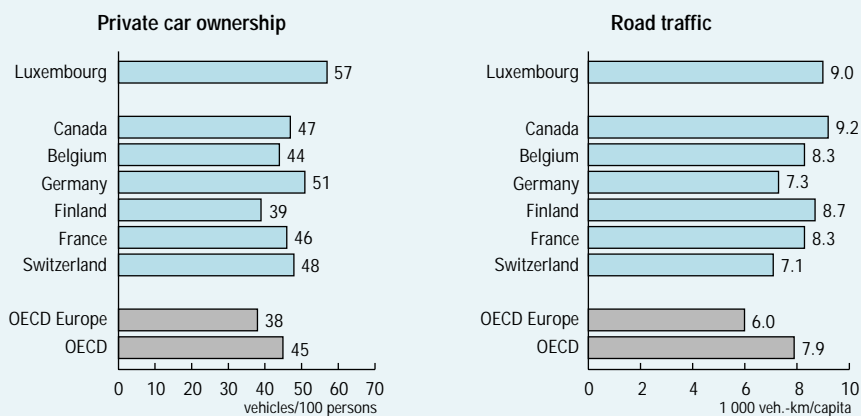
Comprehensive information on *private sector expenditure* to control air pollution is not available, but the Luxembourg Chamber of Commerce reports that industry has invested substantially since 1990. Steel and chemicals (LUF 900 million) and electronics and glass products (LUF 100 million) represented the bulk of this spending. Expenditure to clean up service stations has totalled LUF 3.2 billion since 1996, and as a result pump prices have risen by LUF 0.37 per litre for gasoline and LUF 0.20 per litre for diesel. Expenditure by households chiefly relates to controlling pollution from heating equipment and motor vehicles, including the cost of catalytic converters.

### ***Air quality management and the transport sector***

The main *modes of passenger transport* in Luxembourg are cars (80% of trips), buses (15%) and trains (2%). The car ownership rate (57 vehicles per 100 inhabitants) is among the highest in the OECD (Figure 2.2), and the number of private cars has risen 27% since 1990 (Table 5.1). The use of motor vehicles (in vehicle-kilometres per capita), which has been rising since the early 1990s, is also very high in the OECD context (Figure 2.2). Luxembourg has a *total motor vehicle fleet* of 287 000 vehicles. Private cars and taxis, with an average age of 5.8 years, represent 86% of the fleet, and light utility vehicles, on average 6.1 years old, account for 7%. Heavy goods vehicles, coaches and buses, with an average age of 7.7 years, also account for 7%. *Public transport* in Luxembourg is provided by some 500 diesel buses, which carry around 18 million passengers a year. The Ministry of Transport supports public transport with fare subsidies (fares cover only 15% of operating costs), provision of park-and-ride infrastructure, and high frequency of train and bus services.

*Total final energy consumption by transport* totalled 1.6 metric tonne of oil equivalent (Mtoe) in 1998, up 54% since 1990, most of it used by road vehicles. In 1998, the transport sector accounted for 77% of final oil consumption (Table 6.2). Road transport is responsible for 42% of total CO<sub>2</sub> emissions from fuel sold in Luxembourg. Energy consumption in the transport sector is accentuated by the low prices for oil products. With very low rates of taxation compared with adjoining countries, pump price differentials draw in non-residents such as cross-border workers, residents of neighbouring countries and truck drivers on trans-European journeys (Table 2.3); the resulting intensity of road traffic increases atmospheric emissions. At the same time, government revenue from fuel taxes is relatively high. The Ministry of the Environment estimates that 50-70% of motor fuel sold in Luxembourg is used abroad (Table 2.4); the corresponding tax revenue represents some 10% of the government budget.

Figure 2.2 Trends in the transport sector  
State, 1998



Source: AAMA; IRF; OECD.

Table 2.4 Sales of road transport fuel, <sup>a</sup> 1997

	Total fuel sales (tonnes)	Purchases by non-residents (tonnes)	Purchases by non-residents (%)
Gasoline	542 030	315 695	58
Diesel	656 300	501 020	76
LPG	1 190	965	81
<b>Total</b>	<b>1 199 520</b>	<b>817 680</b>	<b>68</b>

a) Not including aviation fuel.

Source: Ministry of the Environment.

### ***Air quality management and the energy sector***

Luxembourg's *energy intensity* is among the highest in OECD Europe, reflecting the significance of steelmaking and the substantial proportion of motor fuel sold to non-residents (Table 2.4). Energy consumption by households is high, in part to relatively high per capita GDP and relatively low fuel prices (Table 2.4). Energy intensity is 4% above the average for OECD Europe, though it has declined 39% since 1990 (Table 5.1). The decrease is largely attributable to lower industrial consumption. Energy intensity in the residential/commercial sector has also fallen, but is still higher than the average for OECD Europe. *Final energy consumption* totalled 3.3 Mtoe in 1998, 10% more than in 1990; 49% can be assigned to the transport sector, 27% to industry and 23% to the residential/commercial sector (Figure 6.2).

The *Energy Efficiency Act* (1993) is designed to promote energy saving in all sectors and to reduce dependence on conventional sources by promoting new and renewable forms of energy. Regulations adopted under this framework act provide subsidies for capital spending on energy-saving equipment and facilities in the industrial and residential/commercial sectors, but take-up has been very low (Chapter 6).

## **3. Environmental Performance**

### ***Performance on emissions***

Since 1990 emissions of the chief air pollutants have fallen: by 76% for  $SO_x$ , 27% for  $NO_x$  and 71% for CO.  $CO_2$  emissions are down 21% (Table 2.1). At the same time, energy consumption by transport has risen by 54%. Luxembourg has met all its international commitments to reduce emissions into the air (Table 7.2): for  *$SO_x$  emissions*, it exceeded the target of a 30% reduction by 1993 over 1980 (Helsinki Protocol) and has nearly reached the target of a 58% reduction by 2000 (Oslo Protocol). For  *$NO_x$  emissions*, it achieved the target of stabilising emissions at 1987 levels by 1994 (Sofia Protocol). For *NM VOC emissions*, it achieved the 30% reduction between 1990 and 1999 (Geneva Protocol).

These results reflect the *restructuring of the economy*, the country's *special energy situation* (e.g. virtually all electricity is imported) and its pollution prevention and control policies. Structural transformation in industry, together with growing use of natural gas and changes in technology, go some way to account for the results, for instance in steelmaking with the shift from blast furnaces to electric arc furnaces. Regulations on fixed sources (integrated pollution control under the Classified Installations Act, fuel quality standards) and mobile sources (emission standards necessitating catalytic converters since 1993, complete withdrawal of leaded fuel since 1999) have also played a significant role in reducing

emissions. But the share of NO<sub>x</sub>, SO<sub>x</sub> and CO<sub>2</sub> emissions generated by the transport sector has risen (Table 2.1); this is partly because industrial emissions are lower, but it also reflects rising vehicle numbers and the amount of emissions from vehicles used by cross-border workers and “gasoline tourists”.

In 1995, Luxembourg began a monitoring programme near major industrial sites for *bioaccumulation of organic pollutants and heavy metals* conveyed and deposited by air. No critical concentration has been observed, but substantial variations in the quantities of dioxins and furans (sometimes very high) have been detected at certain periods. As the monitoring programme continues, such pollution will be evaluated more effectively.

### ***Air quality performance***

*Air quality in Luxembourg is good* by and large, although the thresholds for *tropospheric ozone* are exceeded more and more frequently. Air quality has improved in respect of most pollutants since the early 1990s, reflecting the significant reductions in emissions of SO<sub>x</sub>, NO<sub>x</sub>, NMVOC and CO. For NO<sub>x</sub>, however, the annual average concentration in the capital has exceeded the World Health Organization’s annual guidance value since 1997, reflecting the predominant and growing contribution from motor vehicles. In addition, *concentrations of tropospheric ozone* often exceed limit values in the capital and at rural metering stations.

### ***Integrating environmental concerns in sectoral policy***

#### *Transport sector*

During the 1990s a substantial number of *regulatory measures* were introduced in the transport sector to improve its environmental performance: higher fuel quality, emission limits for vehicles, clean-up of service stations and compulsory vehicle inspection. To date the approach to integrating environmental objectives in the transport sector has been essentially a regulatory one. In terms of reducing emissions per vehicle, the approach has yielded considerable results.

There is still significant scope to use *economic instruments*. It would particularly be appropriate to examine the economic and environmental effectiveness of fiscal instruments such as an environmental surtax on fuels. There is also a need to harmonise *fiscal and economic incentives* with air quality management objectives. For instance, the fact that the cost of commuting to work can be deducted from taxable income, whatever the transport mode used, undermines efforts to promote public transport. Because of the significance of cross-border movements, Luxembourg, in conjunction with its neighbours, should seek ways to develop and promote public transport.



### *Energy sector*

Luxembourg's *energy intensity* is among the highest in OECD Europe, and *per capita CO<sub>2</sub> emissions* are well above the average for OECD Europe, even though 94% of electricity consumed in Luxembourg is imported. The finding would be essentially the same if emissions from fuels sold in Luxembourg but consumed abroad were deducted, and emissions arising abroad from electricity generation were added (Table 7.3). The *Energy Efficiency Act* (1993) is designed to promote energy saving in all sectors and to reduce dependence on conventional forms of energy by promoting the use of new and renewable sources. Decrees implementing the Act have introduced subsidies for capital spending on energy-saving equipment in the industrial and residential/commercial sectors. Take-up is very low, however. Subsidies for the development and production of renewables have been applied, but their cost-effectiveness is questionable (Chapter 6).

# 3

## WASTE MANAGEMENT

### 1. Current Situation and Trends

#### ***Classification***

Waste is classified in Luxembourg into five major *categories*: i) household, bulky and similar waste, ii) industrial, commercial and service waste, iii) inert waste, iv) hospital and similar waste, and v) sewage sludge. Other types cover more than one category, such as hazardous and problem waste and final waste. Disposal and treatment/recovery operations are defined to conform with EU legislation. It should be noted that the priority is on reuse of materials and that incineration with energy recovery is not considered as equivalent to treatment with material recovery when the principal aim is waste disposal.

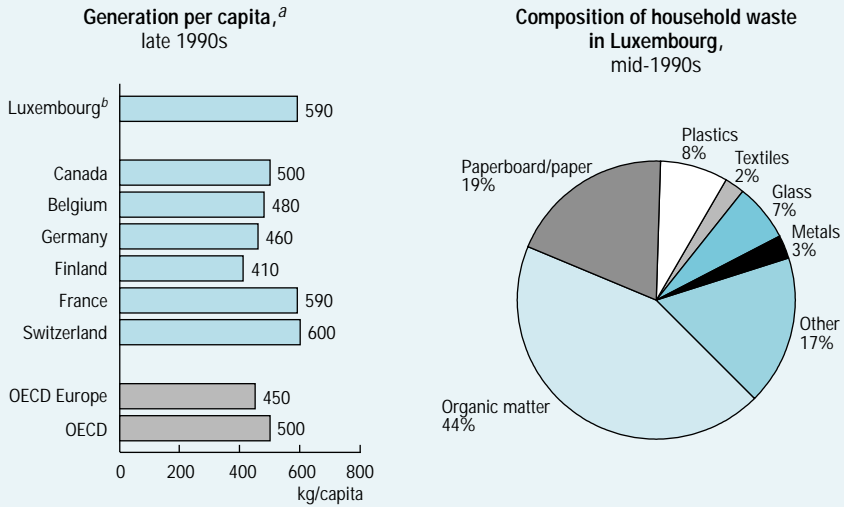
#### ***Waste generation***

In 1997 the volume of *municipal waste* totalled 249 000 tonnes. This waste, collected by or for communes, includes household, bulky and similar waste generated by business, trade and service firms. The total is made up of 182 000 tonnes of mixed household waste (unsorted and due for disposal) and 67 000 tonnes of waste collected separately for recycling. In addition, 32 000 tonnes of household-type building waste is collected separately. After rising for a long time, the volume of mixed household waste has declined since 1994, and the volume covered by separate collection is increasing. One-third of mixed household waste is land-filled, and the rest is incinerated with energy recovery (Figure 3.1).

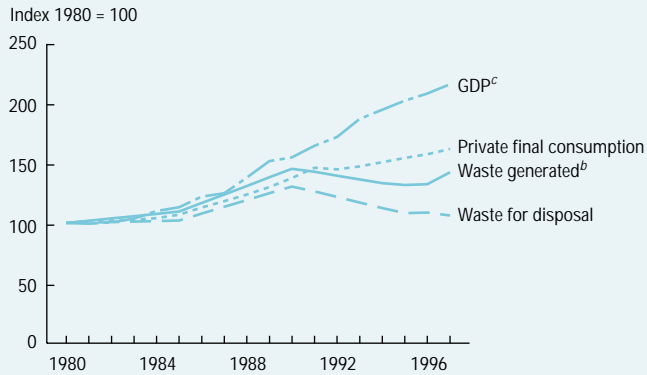
The total volume of *recoverable waste collected separately* (both municipal and other waste) was 242 000 tonnes in 1997. The bulk of this waste is exported for recycling.

*Industrial, commercial and service waste* was estimated, on the basis of internal and cross-border transfers, at 568 000 tonnes in 1997. That includes 142 000 tonnes of hazardous waste, mainly exported to other EU countries,

Figure 3.1 Municipal waste generation



## Trends in Luxembourg



a) When interpreting national figures, it should be borne in mind that the definition of municipal waste and the survey methods may vary from country to country. According to the definition used by the OECD, municipal waste is waste collected by or for municipalities and includes household, bulky and commercial waste and similar waste handled at the same facilities.

b) Secretariat estimate.

c) GDP at 1991 price levels.

Source: OECD; Environment Administration.

usually Germany, France, Belgium, Spain and the Netherlands. In addition there are 25 000 tonnes of *sewage sludge*, mostly recycled in agriculture, and 4 million tonnes of *inert waste*, essentially construction waste (Table 3.1).

Table 3.1 **Production, movements and treatment of non-household waste, 1997**

('000 tonnes)

	National production	Movements			Treatment <sup>b</sup>	
		Domestic transfers	Exports	Imports	Recovery	Disposal
Hazardous waste	142.2	3.3	138.9	39.7	137.0	44.9
Other waste <sup>a</sup>	426.1	267.9	158.1	0.4	230.1	196.4
<b>Total</b>	<b>568.3</b>	<b>271.2</b>	<b>297.1</b>	<b>40.1</b>	<b>367.1</b>	<b>241.2</b>

a) Industrial, commercial and service waste not classified as hazardous. Inert waste not included.

b) Domestic waste plus imports.

Source: Environment Administration.

## 2. Responses

### *Objectives*

The Waste Prevention and Management Act (1994) provides for full-cost pricing at every stage of waste management and sets the following goals, in order of priority:

- preventing and reducing waste production and pollution from waste;
- recovery through reuse, recycling or any other environmentally appropriate method;
- disposal of final waste in environmentally and economically appropriate ways.

Luxembourg's National *Plan for Sustainable Development* (1999) sets out the following *quantified targets* for 1999-2010:

- for *household, bulky and similar waste*: a 50% reduction in the volume of waste per capita; recovery of 80% of organic waste and 50% of other recyclable waste; separate collection of 75% of problem waste;
- for *inert waste*: 25% recovery;

- for *non-household and similar waste*: a 15% reduction in volume, and 75% recovery.

The Environment Administration is preparing a *national waste management plan* in conjunction with other government services, local authorities and council unions, trade groups and NGOs. The five-year plan includes a set of sectoral plans covering each major category of waste.

### ***Institutional and regulatory framework***

The *Waste Prevention and Management Act* (1994) and the EU directive on monitoring and control of waste transfers into and out of the European Union (1993) form the basis for waste management in Luxembourg. They are supplemented by other laws and various *grand-ducal decrees*: the law ratifying and implementing the *Basel Convention on the control of transboundary movements of hazardous wastes and their disposal* (1993), the decree of 31 October 1998 implementing EU Directive 94/62 on *packaging and packaging waste*, and decrees on hazardous waste, spent oil, PCBs, incineration of household and hazardous waste, and sewage sludge.

The *management of household, bulky and similar waste* is a responsibility of the *communes*. All communes belong to one of three large *intercommunal syndicates* that handle disposal of such waste. Other syndicates with narrower responsibilities have been established to manage more specific services or sites. Ten syndicates are now wholly or partly dedicated to waste management. Private firms operate on behalf of the communes and intercommunal syndicates. Representatives of the syndicates, the Ministry of the Environment, the Environment Administration and the Ministry of the Interior sit on a co-ordinating board for household waste management.

The *Ministry of the Environment and the Environment Administration* are responsible for issuance of permits, supervision of waste prevention and management plans, movements of waste, data collection and dissemination, cross-border co-operation, supervision of government and EU policy, and co-ordination among the various levels of government. The *Ministry of the Interior*, which supervises local authorities, oversees waste management expenditure, local authority regulations and the formation of intercommunal syndicates. Some decisions concerning inert waste in landfills are the responsibility of the *Water and Forests Administration*.

### ***Municipal waste: minimisation and recovery***

The strategy for managing *municipal waste* aims at the *highest possible degree of recovery*. It is based on separate collection, both mobile and at 17 waste delivery sites open to the public, and on a programme of public information. Arrangements for sorting recyclable materials cover the whole country.

Separate collection applies to paper, glass, bulky items and organic waste, as well as virtually all recoverable items and problem waste. To encourage waste reduction, some container points accept discarded items that can be reused (Table 3.2).

Following a 1994-97 pilot project, 12 communes now operate a *harmonised charging system* based on full-cost pricing. The system involves dustbin identification via microchips, mobile collection of three types of waste charged at different rates (final waste, organic waste and paper), and removal of bulky waste on request, for a fee (or such waste can be taken by individuals to container points for no charge). In the communes involved, the volume of waste for disposal has been cut by 50%.

### Organic waste

A substantial proportion of the organic element in household waste and waste from highway and park maintenance is dealt with by *composting* at three centres with total annual capacity of 31 000 tonnes, serving 57% of the population. Quality is analysed on a regular basis before the compost is sold (within Luxembourg only). To achieve 80% recovery by 2010, two additional facilities are planned, and individual composting is being encouraged.

Table 3.2 Separate collection of waste for recovery, 1997

('000 tonnes)

	Household waste	Other waste <sup>a</sup>	Total
Metal and scrap	4.8	110.7 <sup>b</sup>	115.5 <sup>b</sup>
Paper and cardboard	19.3	34.60	53.9
Organic waste	22.2	4.0	26.2
Glass	10.0	5.8	15.8
Plastics	3.9	6.8	10.7
Wood	3.0	9.5	12.6
Old clothes and textiles	1.8	0.0	1.8
Tyres and rubber	0.4	2.3	2.8
Electronic scrap	0.3	0.3	0.6
Other components (e.g. plastics and containers)	1.7	0.0	1.7
<b>Total</b>	<b>67.4</b>	<b>174.0</b>	<b>241.6</b>
	(160 kg/capita)	(413 kg/capita)	(574 kg/capita)

a) Mainly commercial waste, but including some industrial waste.

b) May include imports.

Source: Environment Administration.

### *Problem waste*

In 1999 around 1 400 tonnes of *household problem waste* was collected, out of a total estimated at 2 120 tonnes. The most important elements were *paint* (33%), *batteries* (25%) and *used oil and grease* (17%). Most of this waste was exported, mainly to Belgium.

*Separate collection* of problem waste has taken place since 1985 under the SuperDrecksKëscht (SDK) programme, which has ISO 14001 certification and is managed by the Environment Administration in conjunction with the communes. It consists of collection using mobile containers, collection at fixed points and collection of large quantities from households. This effort is supplemented by special operations run by non-profit groups aimed at specific waste flows, such as toner cartridges, asbestos cement, syringes and gas canisters. The cost of SDK averaged LUF 155/kg in 1999, for a total of LUF 160 million, funded by the government.

Since 1991 old refrigerators have been collected separately under the Super-FreonsKëscht (SFK) programme. After processing, the insulating foam is sold as an oil absorbent. In 1999, 13 123 refrigerators were collected and processed in this programme.

### *Packaging waste*

The grand-ducal decree of 31 October 1998 makes it compulsory for *firms that package goods, or sell packaged goods*, to take the packaging back. It sets quantified targets to be achieved by 30 June 2001: 55% recovery, as a minimum, and 45% recycling with at least 15% for each type of packaging.

A substantial portion of household packaging waste is collected separately or via container points, by or for the communes. Deposit-refund arrangements apply for some glass packaging. In 1995 the private sector set up a non-profit body, *Valorlux*, to meet the obligations of the firms involved. By early 2000 it had 457 member firms, mainly in the foodstuffs industry. *Valorlux* contributes financially to collection systems for glass and paper, and, with the communes, runs collection systems for plastics, metal and drink cartons. As it has not yet received government approval, *Valorlux* operates under bilateral contracts with communes or intercommunal syndicates. Under this system, 7 000 tonnes was collected in 1997, including 500 tonnes of plastics, metal and drink cartons which, after hand sorting in Germany, were 70% recycled and 30% incinerated.

### ***Municipal waste: treatment and disposal***

Unrecyclable municipal waste is either incinerated with energy recovery (68%), or landfilled (32%), depending on where it originates; one of the three *intercommunal syndicates* operates an incineration facility, and the other two have controlled landfills.

The *incineration plant*, with capacity of 140 000 tonnes a year, is equipped with an energy recovery system that produces 34 GWh a year (10% of the electricity generated in Luxembourg, and 1% of the country's consumption). It first operated with only rudimentary control of emissions to air; *scrubbing systems* that meet stricter environmental standards were later installed. Clean-up operations have been conducted or are under way to ensure that the two *controlled landfills* comply with regulations. The cost for disposal to landfill is around LUF 5 000 per tonne; incineration costs LUF 3 900 for household waste and can go as high as LUF 7 200 for certain kinds of commercial waste.

The incinerator is one of the main sources of *industrial waste* in Luxembourg. It produces 40 000 tonnes of slag a year, of which the bulk (78% in 1999) is reused, together with 14 700 tonnes of hazardous waste exported to Germany, where it is put in underground facilities.

### ***Non-household waste: recovery and disposal***

With regard to non-household waste (industrial, commercial and service waste, hospital waste and inert waste), Luxembourg's policy is to apply the *proximity* principle and a degree of *self-sufficiency*, while at the same time seeking *synergies* with adjoining regions through *transboundary co-operation*. In the early 1990s Luxembourg took part in the EU Saar-Lor-Lux Master Plan to co-ordinate *disposal of non-household industrial waste across the "Grande Région"* (Wallonia, Saar, Lorraine and Rhineland-Palatinate, with a total population of 11 million). As the outcome of this project was inconclusive, Luxembourg's waste is exported to more distant points. Recent discussions with Germany's Rhineland-Palatinate, under which Luxembourg waste volumes would be taken into account when that Land plans further capacity, have led to an informal agreement but, so far, no concrete follow-up.

Under the Waste Prevention and Management Act, factories and businesses have to appoint a waste officer and draw up a *waste prevention and management plan*. Classified installations must include the plan in any licensing application; other firms must supply it at Environment Administration request. In 1999, 66% of applications for permits were accompanied by waste plans, half of which were complete.

### ***Industrial waste: disposal***

Apart from the landfills belonging to ARBED, the national steelmaking concern, there are no longer any landfills for industrial waste in Luxembourg. A site formerly used for non-household waste, which was closed in 1994, is now being cleaned up. Proposals for a new landfill site were dropped in 1998 following opposition by local people and NGOs and an administrative court order voiding



the planning permission. A physical-chemical treatment plant has been running since 1998. Its capacity (60 000 tonnes/year) is far in excess of national requirements, and it deals largely with imported materials. The lack of other adequate disposal capacity compels firms to export their waste or to invest in waste prevention and on-site recovery.

#### *Industrial waste: recovery and minimisation*

Several industrial branches use waste in their manufacturing operations: glass-making (37 000 tonnes of cullet a year), aluminium (recasting: 80 000 tonnes a year) and construction (old tyres as alternative fuel: 18 000 tonnes a year; alumina sludge and used catalytic converters: 36 300 tonnes a year). Most of *these recycled materials are imported*, as the domestic market alone is not sufficient to meet demand.

The fall in steel output and in particular the *change in technology from blast furnaces to electric arc furnaces* has brought down the volume of waste to be handled and significantly increased the use of scrap iron (2.6 million tonnes in 1998), which can account for up to 100% of raw material in arc furnace processes. The Luxembourg steel industry accordingly plays a prominent role in the reuse of scrap iron in the *Grande Région* and well beyond it.

Recovery is given impetus by a *recycling market*, co-ordinated with similar markets elsewhere in the Grande Région, and run by the government and the trade body FEDIL. An Environmental Technology Resource Centre (CRTE) was set up in 1997 to advise firms on environmental technology.

#### *Commercial waste*

As part of the SDK programme, *small enterprises* belonging to the Luxembourg Trades Chamber can obtain information and practical advice on minimising and managing all their non-household waste, and mobile collection is available upon request. The programme is voluntary, and coexists with other collection and treatment programmes. The Environment Administration awards quality labels, subject to annual inspections, to firms that manage their waste in line with the SDK concept. Of the 630 enterprises taking part in the programme as of January 2000, 296 held quality labels. While firms bear the cost of collecting and processing problem waste, the government handles information and advisory services, at a cost of LUF 40-50 million a year.

#### *Hospital and similar waste*

Flows of hospital waste, and the related costs, are *not clearly identified* and hard to itemise. Hospital incinerators were closed in 1997, and this waste is now disposed of along with household waste or is exported, chiefly to Belgium and the

Netherlands, for incineration. Some hospitals participate in the SDK programme for their problem waste. Most hospital-type waste from sources other than hospitals goes into the flow of household waste and is not specially monitored.

### *Inert waste*

Luxembourg has a restrictive policy on landfills. It is establishing a country-wide network of *recycling and disposal centres* for inert waste, and encourages reuse or recovery in construction and demolition projects. In 1999, its ten inert waste sites took in over 4 million tonnes of waste. The average charge per tonne is around LUF 120. Five additional sites are being set up or planned. The goal is 25% reuse/recovery by 2010.

A large number of *uncontrolled communal and private landfills*, which posed threats to amenity and landscape, have been closed, but unauthorised dumping of inert waste continues. Former dumps are rehabilitated under the supervision of the Environment and the Water and Forests Administrations. The operators bear the rehabilitation costs; for communes the government provides subsidies of 20%.

### **Expenditure and funding**

*Public expenditure* for waste management totalled about LUF 1.8 billion in 1997, equivalent to about 0.3% of GDP (Table 3.3).

Table 3.3 **Public expenditure on waste management,<sup>a</sup> 1997**  
(LUF million)

	Operating expenditure		Capital expenditure		Total		Proportion of environmental expenditure <sup>b</sup>
Communes <sup>c</sup>	1 074	81%	124	28%	1 198	68%	45%
Central government <sup>d</sup>	245	19%	314	72%	558	32%	26%
<b>Total</b>	<b>1 318</b>	<b>100%</b>	<b>438</b>	<b>100%</b>	<b>1 756<sup>e</sup></b>	<b>100%</b>	<b>37%</b>

a) OECD Secretariat estimates.

b) Pollution abatement and control plus nature protection (excludes water supply and distribution expenses).

c) Excludes government transfers spent by communes.

d) Includes government transfers spent by communes.

e) Equals 0.3% of GDP.

Source: OECD.

One source of *funding for municipal waste management* is a *local council tax*, which, under the polluter pays principle, is supposed to correspond to actual waste generation and vary in terms of operating and capital costs. The basis for calculating the tax differs significantly by commune, the amounts charged varying by a factor of one to nine. Some communes also charge when people bring in waste requiring special treatment, such as old refrigerators or problem waste not covered by the SDK programme.

Municipal waste management expenditure also relies on considerable government funding to communes. In addition the government directly assumes part or all of the cost of special programmes such as SDK. At the end of 1997, these two areas involved a total of LUF 552 million, or over half the expenditure of the national Environmental Protection Fund.

No figures are available on the cost of dealing with *industrial waste* and other non-household waste, which is borne entirely by the firms involved.

### ***Transboundary movements of waste***

Luxembourg ratified the *Basel Convention* in 1993 and, as an EU member, applies the directive on supervision and control of waste entering and leaving the European Union, which includes the provisions of the OECD Council Decision on control of transboundary movements of wastes destined for recovery operations. Regular highway checks are made to identify any unauthorised movements of waste.

Nearly all the *hazardous waste* generated in Luxembourg is *exported*. It consists chiefly of contaminated soil, asbestos cement, used oil, chemicals, paint, acid, batteries, incineration residue and waste containing heavy metals. Quantities vary considerably from year to year. In 1999 exports totalled 260 000 tonnes, of which 83% was destined for recovery operations; *imports* amounted to some 50 000 tonnes, again largely for recovery. In recent years, the quantities of waste *transiting* Luxembourg, mainly by road, have been increasing (Table 3.1).

A *tax* is levied via the forms required for *movements of hazardous waste*: LUF 500 per notification form and LUF 100 per waysheet. This generated around LUF 3.8 million in 1999.

### ***Remediation of contaminated sites***

The Waste Prevention and Management Act (1994) specifies that communes, in co-operation with the Environment Administration and the Water and Forests Administration, must draw up a register of former landfills and contaminated sites within five years of the Act's entry into force. These sites are to be cleaned up and rehabilitated under a multi-year plan. The costs are borne

by the site owner; the public authorities pay if the owner is unknown or insolvent. Preparations for drawing up the register started in 1998, overseen by the Environment Administration. The criteria for listing and evaluating potentially contaminated sites are under discussion, in connection with a proposed grand-ducal decree on contaminated soil and subsoil.

The chief work under way involves cleaning up and rehabilitating the old industrial waste landfill site, which was operated between 1974 and 1994, and reconverting steelmaking areas through a consortium of the government, ARBED and local authorities. Other projects, in progress or completed, involve rehabilitation of sites occupied by service stations or scrap-metal dealers; a former bitumen factory site was cleaned up in 1995-96.

### 3. Environmental Performance

Luxembourg's policy on waste management is fulfilled through a comprehensive *framework of laws and regulations* that initially focused on disposal but now emphasise recovery, reduction and a *waste management hierarchy*. A *national waste plan* is being formulated.

#### ***Minimisation and reuse/recovery of municipal waste***

The *volume of municipal waste rose sharply* in the 1980s, reflecting a growing population and, more particularly, high and rising income, which affects consumption levels and trends. The volume generated per capita (590 kg) is among the highest in OECD countries.

Over the last ten years, however, through measures promoting separate collection and recovery, waste generation and private final consumption have been decoupled and the *volume of municipal waste for disposal* has stabilised. Since 1994 this trend has been particularly marked for household waste, partly because of a successful public-awareness drive. With annual averages of 160 kg per capita for household waste *separately collected*, and 574 kg for total waste, Luxembourg's performance in this area ranks *among the best*. Volumes have increased steadily, in particular for problem waste (e.g. paint, batteries, used oil). The minimum recycling target of 15% for glass and cardboard *packaging* was achieved ahead of schedule. Extending the Valorlux collection system across the entire country should help in achieving targets for other waste types, but this move is being held up because no certified agency has yet been selected.

*Volumes for disposal are still higher* than in the 1980s, however, and the volume of household-type waste generated by commerce and services is rising steadily. The proportion of organic materials and plastics remains high, pointing to an *unexploited potential for reduction*.

With regard to its top priority, *waste prevention*, Luxembourg will have to make strong additional efforts, employing economic instruments and heightening public awareness to change behaviour and consumption patterns by households, services and shops.

Improvements will also be needed in the *co-ordination* of collection, disposal and recycling operations. Overlaps persist, especially in the south, where some communes belong to several intercommunal syndicates with similar responsibilities but continue to operate their own programmes. On top of this are operations run by the government (SDK) and the private sector (Valorlux). The resulting confusion in municipal waste management makes it hard to exploit synergies.

### ***Management of non-household and similar waste***

The volume of non-household waste, particularly *industrial waste*, is down, reflecting the reduced role of steelmaking as well as technological changes and increased recovery within firms.

The steel, glass, aluminium and construction industries use *large amounts* of recovered material. Technological change in steelmaking has cut the volume of waste generated and led to a switch from iron ore to scrap iron as the raw material, allowing reuse on a scale that goes beyond the country's borders.

As regards *disposal*, the rejection of a landfill project in 1998 left Luxembourg very short of capacity for industrial waste on the amber and red lists. As the principles of proximity and self-sufficiency can apply only over a fairly large area, Luxembourg should seek bilateral or multilateral co-operation with adjoining regions while maintaining its own specialised treatment capacity. The start-up of a physical-chemical treatment facility in 1998 was a step in this direction, but remains insufficient.

Statutory requirements concerning the preparation of *waste prevention and management plans* are only partly observed, and those concerning *hospital and similar waste* are very inadequately enforced. Advisory functions need to be stepped up to encourage producers to act more responsibly and to achieve more integrated management of contamination on industrial sites. The advisory activities carried out by the SDK2 programme and the CRTE resource centre can serve as examples, and could be expanded in conjunction with the Chamber of Commerce and FEDIL.

### ***Economic aspects***

The *polluter pays principle* is applied only partially. For *household waste*, government *aid* to communes has greatly assisted in the modernisation of disposal infrastructure and the enhancement of recovery infrastructure. Waste

management is *funded* via a disposal tax that rarely reflects full costs, varies substantially by commune and is not an effective incentive for households. Extending the harmonised and differentiated taxation model to all communes opens up new prospects, but steps will have to be taken to keep people from throwing chargeable waste into separate-collection containers for which no charge is made.

The polluter pays principle is applied more effectively to *industrial waste*, as treatment operations are usually run by private concerns whose pricing fully reflects the costs.

The role of *economic instruments* in achieving the objectives of reduction at source and recovery remains small, however. The only economic instruments and taxes are deposit-refund systems for glass packaging, local taxes for household waste and the taxes involved in filing the forms required for movements of hazardous waste.

### ***International waste movements***

Luxembourg ratified the *Basel Convention* in 1993 and applies EU legislation on this subject. Before 1993, movements of hazardous waste were controlled and subject to notification. Given the size of the country, international movements of waste may be expected to continue. In addition, the increase in amounts of waste in transit through Luxembourg raises questions about safety and inspection frequency.

### ***Contaminated sites***

The Waste Prevention and Management Act attached particular importance to cleaning up old landfills and other contaminated sites. Cleaning and rehabilitation of a number of *contaminated sites* is under way, but the establishment of a national register has been held up. The main point to be settled concerns the funding of clean-up and rehabilitation where the party responsible is unknown or insolvent. The financial guarantees required by the Classified Installations Act (1999) will provide an effective instrument for the future. As the Environmental Protection Fund will not be able to assume the whole burden, other forms of funding need to be considered, such as a special fund whose revenue would come either from the government budget or from an earmarked tax on hazardous waste.

# 4

## BIODIVERSITY AND NATURE CONSERVATION

### 1. The State of and Pressures on Nature

#### *Current situation and trends*

##### *Biodiversity*

Luxembourg, a relatively small country on the edge of Europe's continental biogeographical region, offers a fairly wide range of species and habitats for its size.

Of the 64 *mammal* species, over half (33) are threatened. The otter has disappeared from the rivers. Populations of the badger, on the other hand, which was decimated by gassing during rabies control, have been restored; similarly, the wildcat is still present in the Ardennes and in disused opencast mines in the south (Figure 4.1).

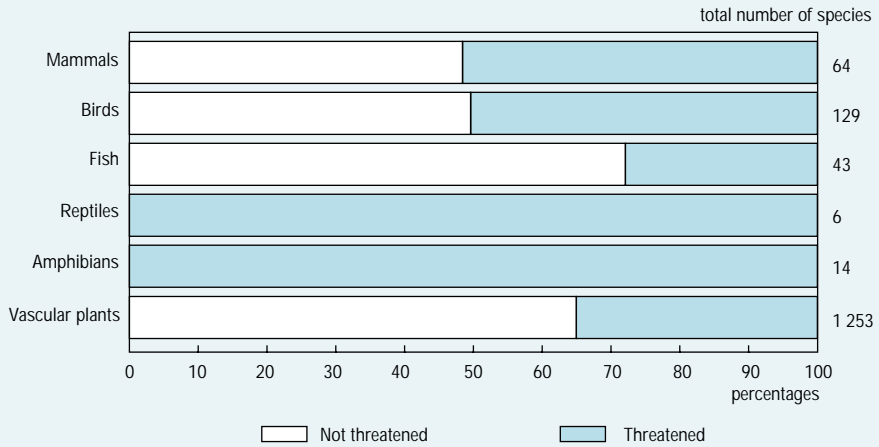
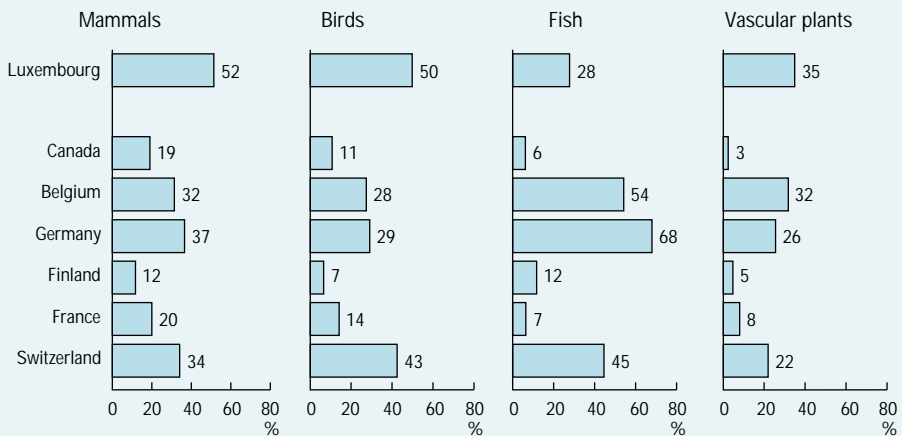
Of the 129 *nesting bird* species (the country has 287 bird species in all), 50% are threatened. Several bird species disappeared in the 1960s: the marsh-harrier, the peregrine falcon, the black grouse, the hoopoe, the crested lark, the tawny pipit and the sedge warbler. One species made a reappearance: the black stork, which is again nesting in the Belgian and Luxembourg Ardennes (Figure 4.1).

Of the 43 *fish* species, 12 are threatened by destruction of spawning grounds, river engineering, silting-up of natural beds or obstacles to migration. Over the past century, 12 species have disappeared, including the salmon, which used to run up the Rhine and Moselle to spawn in Luxembourg's northern rivers (Figure 4.1). A colony of pearl mussels still exists in the Our, however.

All species of *reptiles* (six) and amphibians (14) are threatened with extinction because of destruction of their habitats (ponds, wetlands and streams), motor traffic, habitat fragmentation by the road network and eutrophication of water caused by agricultural inputs (Figure 4.1).

Figure 4.1 Fauna and flora

State in Luxembourg, late 1990s

Threatened species<sup>a</sup>

a) Categories "endangered" and "vulnerable" of the IUCN classification in % of known species; also includes species that may already be extinct but have been observed in the last 50 years.

Source: OECD; Water and Forest Administration.



Of the 1 253 *vascular plant* species recorded in Luxembourg, 35% are threatened or extinct. Of the 278 plant species on the EU list, only two exist in Luxembourg: a fern (*Trichomanes speciosum*) and a moss (*Dichranum viride*).

Few species are classified as game by law. In general, indigenous *larger game* (including stags, roe deer and wild boar, which depend heavily on forest habitats) is on the increase. *Small game* has considerably diminished: the hare population has dropped by two-thirds, remaining mostly in forest habitats; and partridge shooting was halted in 1983 owing to an alarming decline in the species. But the mallard population is recovering, and the sometimes migratory wood pigeon has maintained a stable population. The fox population, which had suffered considerably from rabies and the measures taken to eradicate it, has been restored following oral vaccination campaigns.

### *Land habitats*

Of the 200 or so habitat types identified by the relevant EU directive, 31 exist in Luxembourg, mostly beech forests and some alluvial and ravine forests. Grassland formations include mesophile hay meadows and semi-natural calcareous grassland.

*Forests cover 34% of Luxembourg's territory* (88 600 hectares). The Ardennes region is the most heavily wooded. In addition to beech and oak forests, other woodland types are of great interest for their rarity and their flora and fauna: ravine forests of maple, alluvial or riparian belts, swampy alder stands and peaty birch forests. Luxembourg's woodlands have been made accessible by the public road network; they are open to the public, and the ancient stands are broken up by crop lands and grazing land. The extremely fragmented *private forests*, found mostly in the Ardennes, represent 54% of the country's woodland.

### *Water habitats*

Apart from the Chiers, which flows towards France and forms part of the Meuse basin, all the rivers are part of the Moselle sub-basin, which empties into the Rhine. The density of rivers and streams is highest in the narrow valleys of the Ardennes, where they have retained a fairly natural geomorphology. Running over impermeable shale beds, they have irregular flow rates that depend on rainfall. The rivers and streams in Bon Pays (Gutland), to the south, flowing through mostly agricultural valleys, have generally undergone the hydrological changes consequent upon intensive farming: bed straightening and channelling, removal of riparian galleries, flood control for water meadows, etc.

### ***Pressures on the countryside***

Human activities such as agriculture, urbanisation, transport and tourism are increasingly exerting pressure on the countryside in general and on many natural or semi-natural ecosystems in particular.

#### *Agriculture*

After experiencing a food shortage in World War I, Luxembourg embarked on an extremely active *farm support* policy to ensure that the country was self-sufficient. This policy was continued in the Common Market, with the entire country being classified as a less-favoured farming area. *Intensification* of farming under the Common Agricultural Policy, on often quite poor soil, has had the usual pernicious consequences for flora, fauna and habitats. In the 20th century the number of farms fell from 15 000 to 2 500 and the decline is continuing, while the average area farmed has increased from 3.5 hectares to 50 hectares. Agriculture is oriented towards beef and dairy farming and the cultivation of animal fodder, permanent and temporary grassland, and silage maize.

*Land consolidation* has played a large part in eliminating the structures that pattern the farming environment: hedges, areas of scrub, scattered trees, ponds, etc. *Vineyard consolidation* on the banks of the Moselle has affected over half of Luxembourg's vineyards, destroying the stone-wall terraces that provided shelter for certain types of fauna. *Drainage* of wet grasslands in the south-west has led to the disappearance of many wetland biotopes. Overuse of *fertiliser* has amounted annually, per hectare, to 88 kg of nitrogen, 63.5 kg of phosphorus and 62.5 kg of potassium, depleting natural flora and polluting streams and rivers, groundwater reservoirs, and springs.

#### *Road infrastructure and river traffic*

Over the past 50 years, the *road system* has expanded considerably. The network of secondary, local and agricultural roads has been adapted to accommodate higher-speed motor traffic, with sealed road surfaces providing easy access to the countryside. Not only does traffic lead to a higher rate of wildlife mortality, but disturbance of wild animals in their habitats may also threaten breeding.

A *motorway* construction programme begun in 1960 has contributed to the destruction of natural habitats and has isolated wildlife by fragmenting territories. A stretch of the north motorway is being built through the country's largest wooded area, the Grünewald, despite opposition from environmental NGOs and papers of protest lodged with the European Commission and the Bern Convention Secretariat.

The *Moselle* was canalised in the 1960s, changing a broad river with a relatively natural flow into an excavated navigable channel (recently deepened again) with consolidated banks punctuated by locks and weirs.

### *Pressures on forests*

Luxembourg has no natural forest; its woodland has been *strongly shaped by human activity*. The beech forests of Bon Pays were overexploited to produce charcoal as fuel for the iron industry. Those of the Ardennes were converted into oak coppices so the bark could be used for leather tanning. Later these coppices were converted into conifer plantations, particularly of Norway spruce and more recently of Douglas fir. World War II badly damaged much of the forest, and gunfire reduced timber quality. Forestry policy was directed towards optimum output of high-quality timber.

In 1984 the Water and Forests Administration set up a system to monitor *forest health*. In the following years, annual inventories revealed a rapid increase in the percentage of damaged trees: 3.5% in 1984, 20.4% in 1992 and 37.5% in 1996; however, the situation appears to have stabilised since. Deterioration in forest health arises from complex factors involving not only air pollution but also climatic variations, diseases due to cyclical insect infestation, depletion of forest soil, and deficiencies of magnesium and calcium. The situation has been further worsened by poor selection of tree species and inappropriate forest management.

Luxembourg forests also suffered *exceptional storms*, in 1984 and 1990, which left some 1.7 million cubic metres of dead wood, representing five times the annual felled volume and 5% of total woodland area.

## **2. Responses**

The *Water and Forests Administration* has been in charge of nature conservation since 1965. It is also responsible for management of forests in public ownership (belonging to central government, local authorities and public institutions) as well as for hunting, fishing and supervision and assistance for private forests. Its *forests division*, including the forestry and forest planning department and the hunting and fishing department, is under the Ministry of Agriculture. Its *nature division* is under the Ministry of the Environment. The relevant *advisory bodies* are the Council for Nature Conservation and, to a lesser extent, the Hunting Council and the Fishing Council. Some communes also have environmental advisory committees.

The *1965 Nature Protection Act*, the country's first such measure, focused on protecting landscapes and the rural environment. It reflected an emerging awareness of uncontrolled building development on city outskirts and the urbanisation of the countryside as a result of second homes, industrial estates, farm buildings

and expansion of the road network. The Act was *amended* three times: in 1978 to demarcate development areas and define a “green belt” of agricultural, forest and other land without buildings; in 1982 to provide for local and urban development plans to be submitted to the Ministry of the Environment for approval and to introduce the concept of nature conservation areas; and in 1992 to regulate sporting and recreational activities in forests and on rivers (Table 4.1).

### Objectives

The Nature Conservation Act as amended in 1982 cites as *overall objectives*:

- conserving the character, diversity and integrity of the natural environment;
- protecting and restoring natural areas and landscapes;

Table 4.1 Legal instruments affecting the natural environment

5 May	1905	Act on Clearing of Wooded Areas
29 July	1965	Nature Protection Act
11 August	1982	Conservation of Nature and Natural Resources Act
8 April	1986	Grand-ducal decree on protection of certain species of wild fauna
19 August	1989	Grand-ducal decree on protection of certain species of wild flora
19 May	1885	<i>Hunting Act</i> , subsequently amended, with regulations covering species of wild fauna classified as game, hunting and shooting permits and examinations, weapons, methods, open seasons, shooting plans and marking of larger game
24 August	1956	Supplementary Act covering <i>hunting</i> areas and the rental of hunting grounds, game stocks, restocking, game reserves and compensation for damage caused by larger game
20 December	1980	Act concerning the <i>quality of water</i> requiring protection or improvement so as to support fish
8 October	1920	Act concerning development of <i>government-run woodland</i>
30 January	1951	Act on <i>woodland conservation</i> ; prohibition of overfelling in <i>private forests</i>
10 October	1995	Grand-ducal decree on <i>grants for forest measures</i>
20 March	1974	<i>Physical Development Act</i>
11 July	1986	Government decision concerning revision of general guidelines for the <i>physical development</i> master plan – Chapter E; Environment
29 June	1965	Act approving the treaty between the Grand Duchy of Luxembourg and the Rhineland-Palatinate concerning the creation of a <i>common natural park</i>
30 August	1993	<i>Natural Parks Act</i>
27 October	1997	Grand-ducal decree instituting an aid programme to encourage <i>agricultural production</i> methods compatible with the requirements of environmental protection and the maintenance of the countryside

Source: Ministry of the Environment.

- protecting flora, fauna and their biotopes;
- maintaining and improving biological balances;
- protecting natural resources from damage of all kinds;
- improving the structures of the natural environment.

*More specific objectives* appear in the *government's "general declaration of intent" (1981)*. Proposals for natural parks, recreational protected areas, inter-urban protected green belts, landscapes to be protected, special-interest forest areas, nature reserves, and natural sites and monuments are listed and specified geographically. These proposals cover 48.1% of the country's territory.

More recently, the 1999 *National Plan for Sustainable Development (PNDD)* laid down the following main *quantified targets and deadlines* for nature and biodiversity:

- creating a national *biodiversity* network covering 15% of the country by 2005;
- creating a national network of naturally developing *forests* representing 5% of woodland by 2010;
- converting 10% of *farmland* to environment-friendly farming and conservation by 2005;
- stabilising annual *land* consumption by 2005 and then reducing it by 50% by 2010;
- restoring the ecological functions of all *rivers* and their alluvial areas by 2010.

The *EU birds and habitats directives* have been instrumental in laying down specific protection targets tying in with the above objectives.

### **Information**

The Luxembourg Natural History Museum, the nature division of the Water and Forests Administration, and NGOs such as Hëllef fir d'Natur, LNVL and Mouvement Écologique have made many studies and inventories of indigenous species. The Natural History Museum is continuing *species inventories* of Luxembourg flora and fauna and their habitats: small mammals, mustelids (badger and polecat), bats and their breeding sites, amphibians (the salamander), reptiles (sand lizard and wall lizard) and birds (lapwing, great grey shrike, red-backed shrike and hazel grouse).

Ad hoc work is under way to draw up and revise the *red lists for Luxembourg*, including lichens, bryophytes, lepidoptera, grasshoppers, dragonflies, fish, amphibians and reptiles, nesting birds and bats. Luxembourg does not yet have comprehensive red lists for threatened habitats, plant associations and mammals.

Computerised biophysical land-use *mapping* at 1/20 000 covers natural elements such as habitats and green structures. Communal biotope mapping also involves an analytical document and proposals for managing the countryside in the communes. Phytosociological mapping of forest vegetation is in progress.

### **Protected areas**

#### *Nature conservation areas (present and future)*

The 1982 Act initiated procedures to list 140 *nature reserves* that were identified in the 1981 general declaration of intent and were specified and supplemented in the 1991 inventory of sites of ecological interest. The nature reserves represent a total of 22 800 hectares (9% of the country). They include forest reserves, wetlands, dry grasslands and various habitat reserves. Their size varies considerably, from 4 hectares to 1 300 hectares.

Now, nearly 20 years later, 24 of these sites have been listed as conservation areas, totalling 2 582 hectares or 1% of the country (Table 4.2). *Hunting* is banned over 3.8% of their area, subject to restrictions in 54.2% and virtually unrestricted in 42%. The listing procedure is continuing for several other sites.

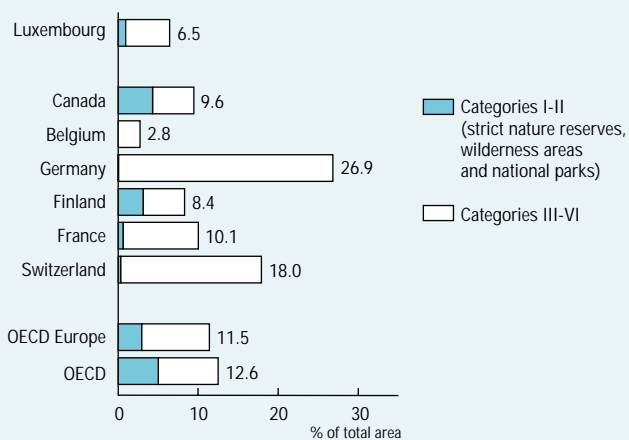
#### *SPAs (birds directive) and proposed SACs (habitats directive)*

In accordance with EU directives, Luxembourg designated additional sites after the European Commission found that not enough had been named. Now, 15 *special protection areas (SPAs) under the birds directive* have been designated, totalling 16 500 hectares (6.2% of the country). In all, some 6.5% of the country was thus designated in the second half of the 1990s (Figure 4.2). As for the habitats directive, Luxembourg has sent the European Commission a *national list of proposed sites* for inclusion in the system of special areas for conservation (SACs) constituting the *Natura 2000 network*. The list proposes 38 sites covering 35 200 hectares (13.6% of the country). Nature conservation areas, SPAs and SACs overlap to some extent.

#### *Natural parks*

The 1993 Act put the Ministry for Physical Development in charge of supervising natural parks, which are designed to encourage socio-economic growth and develop the natural and cultural heritage. The *first such park* was set up in 1999: the Upper Sûre natural park, covering the Upper Sûre basin with its artificial lake, Luxembourg's principal drinking-water reservoir at 19 900 hectares (7.6% of the country). A procedure is under way to create the Our natural park, which, together with the South Eifel natural park in Germany, will form the Germany-Luxembourg park proposed in the 1964 Treaty of Clervaux.

Figure 4.2 Major protected areas,<sup>a</sup> late 1990s



a) IUCN management categories I to VI; national classifications may differ.  
 Source: IUCN; Ministry of the Environment; OECD.

Table 4.2 Principal protected areas,<sup>a</sup> 1998

Category	Number	Area (ha)	Country (%)
Conservation areas	24	2 582	1.0
Natura 2000			
of which:			
SPAs (birds directive)	15	16 500	6.2
SACs <sup>b</sup> (habitats directive)	38	35 215	13.6
Natural park <sup>c</sup>	1	19 900	7.6
Ramsar site <sup>d</sup>	1	313	0.1

a) Since many areas are designated more than once, it is not possible to put a figure on the total area protected.

b) Proposed for designation.

c) Upper Sure Natural Park.

d) Haff Remech wetland.

Source: Ministry of the Environment.

### *Woodland, farmland and the green belt*

Under the 1982 Act, *forest clearance* is prohibited and *afforestation of farmland* is subject to ministerial permission. The Act also defined the *green belt* as the first line of protection: it covers all land not included in development plans, which are approved by the Ministry of the Environment and concern the building of dwellings, commercial and industrial establishments and the like. Only public or agricultural development (such as roads or farm buildings) can be authorised in the green belt. Any plan to extend a development area or build in a rural green belt must be submitted for an opinion from the Water and Forests Administration's nature and forests divisions: the 2 000 cases handled every year include power lines, additions to communal development plans, stream dredging, construction of farm buildings and environmental impact assessments for motorways.

### *Green plans*

The Ministry of the Environment encourages each commune to draw up a "green plan" for managing landscapes and natural resources within its area. This plan, which currently lacks a statutory basis, complements the communal development plan, which covers built-up areas.

### ***Protected species and their biotopes***

The Water and Forests Administration's nature and forests divisions and their regional services are involved in *protecting species* through habitat management. A long-term programme aims to *rehabilitate watercourses* canalised or channelled for navigation or improvement of grasslands.

Specific programmes include monitoring the wildcat population, restoring a relict population of pearl mussels in the Our in the Ardennes, seeking potential habitats for the hazel grouse, conducting a census of the grey partridge population, protecting two species of bat and assessing the populations of several plant species threatened with extinction.

### ***Public expenditure on nature conservation***

Public expenditure on nature conservation in 1997 is estimated at LUF 374 million, representing 0.06% of GDP (Table 4.3). Of the total, 93% was *direct expenditure by central government* and 7% by communes. The Ministry of the Environment has an Environmental Protection Fund, the share of which earmarked for capital spending on nature conservation has fallen considerably: it includes acquisition of forests and rare or threatened natural habitats, and implementation of large-scale restoration or conservation programmes such as river rehabilitation and the creation or restoration of wetlands, ponds and lakes.



### Non-governmental organisations

NGOs are actively involved in species protection through specific programmes (e.g. inventory of long-standing orchards and management of local fruit-tree stocks) and management of biotopes they own, as well as through implementation of green plans and mapping of communal biotopes.

The oldest association is the LNVL, the *Ligue luxembourgeoise pour la protection de la nature et des oiseaux* (national league for the protection of nature and birds), with 15 000 members. It uses local branches to manage natural habitats, while continuing its traditional activities of inventoring and monitoring avifauna. *Mouvement Écologique* is active in all fields of the environment. *Hëllef fir d'Natur* concentrates on acquiring parcels of land and managing them as private nature reserves; the Ministry of the Environment supports this with grants covering 50% of the site price. *Other associations* indirectly involved in environmental management include the Luxembourg Hunting Federation, the St. Hubert Club, the Luxembourg Anglers' Federation and the Luxembourg Naturalists' Society, which is actively engaged in research and has close links with the Natural History Museum.

### 3. Environmental Performance

Within a few decades, Luxembourg's countryside has been *seriously modified by development pressures* (agriculture, urbanisation, transport infrastructure

Table 4.3 Public expenditure on nature conservation,<sup>a</sup> 1997

	Operating		Capital		Total	
	LUF million	% of env. exp.	LUF million	% of env. exp.	LUF million	% of env. exp.
Communes <sup>b</sup>	21	(1)	3	(0)	25	(1)
Central government <sup>c</sup>	257	(12)	93	(4)	350	(17)
<b>Total</b>	<b>278</b>	<b>(6)</b>	<b>97</b>	<b>(2)</b>	<b>374<sup>d</sup></b>	<b>(8)</b>

a) OECD Secretariat estimates. The figures in brackets show spending on nature conservation as a percentage of total environmental expenditure.

b) Excludes transfers from central government to communes.

c) Includes transfers to communes.

d) 0.06% of GDP.

Source: OECD.

and tourism), often related to communal projects. These pressures have affected both land and water habitats: gradual erosion of the natural environment, fragmentation of woodlands, straightening and pollution of rivers, disappearance of landscape structures, and fringe development in the countryside as a result of scattered building.

In response, the 1982 Act marked the start of an ambitious policy to protect flora, fauna and habitats. More recently, the PNDD, although lacking a statutory basis, has provided a *set of targets* for biodiversity, forests, agriculture, land and watercourses. It should help underpin a *strategic, partnership-based approach* to biodiversity and nature conservation involving the main players and sectors of the national economy. The Ministry of the Environment gives financial support to a *number of NGOs* working on nature conservation.

### ***Improving conservation of protected areas***

#### *Designating protected areas*

The first nature reserves were designated in 1987; today, nearly 20 years after the 1982 Nature Conservation Act, *24 national reserves (1% of the country)* have been listed, together with *15 SPAs under the EU birds directive (6.2% of the country)*. The area formally designated thus amounted recently to only about 6.5% of the country. The share may soon rise to 13.6%, however, with the formal designation of 38 proposed SACs under the habitats directive, though the various sites overlap considerably.

The first natural park, that of the Upper Sûre in the Ardennes on the Belgian border, was established recently (1999). The planned creation of the Our natural park would finally give a statutory basis to the Luxembourg part of the Germano-Luxembourg Natural Park, allowing for its administration and management more than 35 years after the Treaty of Clervaux (1964). The third prospective natural park, Trois Frontières, concerns an ecologically and culturally sensitive area of the Moselle valley at the meeting point of the French, German and Luxembourg borders.

#### *Managing protected areas*

The *management of these protected areas* is still in its infancy, for want of multi-year management plans and adequate technical staff (in the nature and forests divisions' regional services, for example). Hunting is prohibited over only 3.8% of the total area of the 24 reserves and is permitted unconditionally over 42% of the area. It will be necessary to draw up a programme of management plans for protected areas. Nature conservation must also be given the resources necessary for management in areas already designated and in future SACs.

Management should take a partnership approach towards the Natural History Museum proposals, management measures taken by national and local government departments, and NGO projects. It should answer the objectives of the PNDD with regard to biodiversity and nature conservation and meet the recommendations and obligations of EU regulations and international conventions. The protected areas, which are at present widely dispersed, should form part of a *coherent national ecological network*.

### ***Improving species management***

#### *Scientific information*

Considerable efforts are being made to complete or improve flora and fauna *inventories* and *red lists*. Special attention is being paid to species listed in international agreements. Computerised inventories are being compiled for the entire country. They are often drawn up in partnership with scientific bodies or institutes from neighbouring countries.

On the whole, despite some lacunae, Luxembourg has *adequate and well-organised information* concerning species. It would nevertheless appear necessary to make better use of this information in order to *establish priorities* for conservation policies and to *add to information* and public awareness concerning species to be protected.

#### *Hunting and fishing*

Special funds for hunting and fishing are allocated in part to *game and fish restocking*. Restocking with partridges and pheasants from central Europe has been abandoned and game restocking today is confined to native-bred leverets. The *hunting fund* is being channelled towards creating biotopes suitable for small game. Under a similar approach, the *fishing fund*, which is still used for sizeable releases of fish (trout, trench, pike, grayling, carp, pike perch) into public waters, could also play a role in restoring aquatic habitats.

### ***Conservation outside protected areas: the green belt***

In *green belt* areas (areas not covered by development plans), planning permission must be obtained for public or agricultural building. The nature division thus participates directly in conserving habitats outside protected areas and is involved in all plans likely to modify the part of the rural environment that is not covered by urban development plans.

A statutory framework for land use guarantees *no clearance of forests* and *no afforestation of farmland*. Measures have been taken to *rehabilitate* watercourses (development of reed beds, floodable grasslands) and some wetlands (the

Ramsar site of Haff Remech, for example). The establishment of partnerships involving national and local authorities and NGOs to develop and manage such sites is highly desirable.

### ***Sustainable agriculture and conserving nature and biodiversity***

The modernisation of agriculture seems to have played a large part in the *depletion of biodiversity* in Luxembourg. Consolidation, destruction of landscape structures (scattered trees, spinneys, hedges, field borders, orchards, hay meadows), rechanneling of streams, drainage, removal of terraced vineyards, networks of asphalted farm roads and excessive use of fertilisers and pesticides have all led to depletion of natural habitats and created stress that many wild animals can no longer cope with.

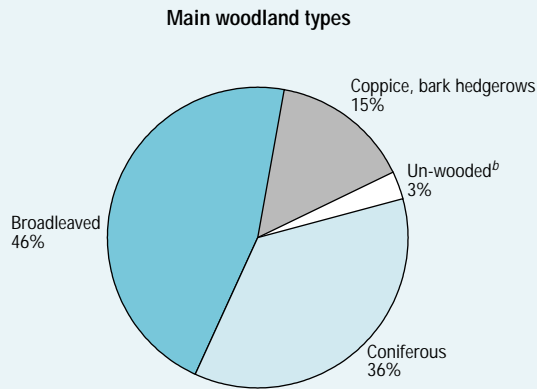
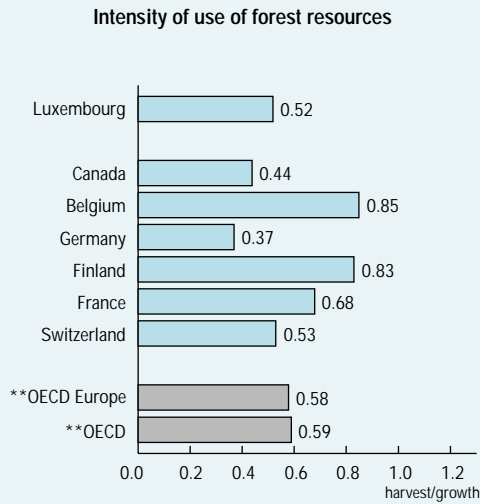
Since 1997 the Ministry of Agriculture has been implementing an *agri-environmental programme* under Regulation (EEC) 2078/92. The programme provides aid for extensification of livestock and arable farming, as well as support for organic farming, the introduction of landscape structures, etc. Although most of the measures are aimed at extensification, some are for preserving hedges, stream banks and orchards with hay meadows. The programme has attracted few participants so far. Fewer than 1% of farms are classified as organic. The Ministry of Agriculture should give the relevant department adequate resources to pursue an active policy of conserving the farming environment and devoting more attention to the restoration of natural habitats in farm management.

An ambitious draft regulation from the Ministry of the Environment provides for the introduction of a range of *aid programmes for protection of biological diversity*, aimed in particular at rural areas and forests. It is estimated that this aid will amount to LUF 110-135 million annually.

### ***Sustainable forestry and conserving nature and biodiversity***

In the 1980s, the Ministry of the Environment altered its forestry policy to take account of not only the timber-producing function but also the ecological and social functions of forests, including such factors as protection of soil and drinking-water reserves, conservation of specific flora and fauna, landscape and recreational value, and historical and cultural importance. A return to *more sustainable forestry*, with natural regeneration of deciduous woodland and abandonment of coniferous plantations in favour of deciduous or mixed plantations, has been accentuated by the restoration of the trees destroyed in the 1984 and 1990 storms, which amounted to the equivalent of 5% of the country's woodland (Figure 4.3). The health of Luxembourg's forests seems to have stabilised since 1996 following a period of decline. The government is actively working to make the forests more accessible to the general public, establish reception and information facilities and educate young people about the forest environment. A

Figure 4.3 Forest resources,<sup>a</sup> late 1990s



a) Harvest divided by productive capacity (measured as annual growth).

b) Forest roads, nurseries, stocking areas, etc.

Source: OECD; STATEC.

ministerial circular of June 1999 sets out guidelines for more natural methods of silviculture. The guidelines are obligatory for public forests, recommended for private ones.

Woodlands in public ownership are run by the Water and Forests Administration, which sells the felled timber, amounting to some 180 000 cubic metres a year. Overall, the *intensity of forest resource use* is average (Figure 4.3). Luxembourg supports efforts to adopt European eco-labelling for forestry products and *eco-certification* for sustainable forestry practices.

The Water and Forests Administration has pursued a policy of *woodland acquisition* in order to assure conservation and sustainable management; in the course of a century, the state forest area has increased tenfold. Recently, the administration took over natural habitats and forests that the iron and steel industry had abandoned in the south. In ten years the area of state forest has increased by 37%. Sustainable management of private woodland, which is fragmented and accounts for 54% of Luxembourg's forested area, remains difficult despite the fairly high level of biodiversity. The ban on clearance helps to assure an *increase in woodland*.

### ***International agreements***

Luxembourg was *prompt to ratify most international conventions* relating to nature conservation: the Bern Convention, the Bonn Convention, the Benelux Convention on nature conservation and landscape protection, the London Agreement on the conservation of bats in Europe, the Rio Convention on biological diversity and the Washington Convention (CITES). National initiatives concerning the countryside often spring from international obligations.

The 1971 *Ramsar Convention* on wetlands of international importance especially as waterfowl habitat was not ratified until 1998. A wetland of international importance has been designated at Haff Remech along the border between Germany and Luxembourg. Its management and rehabilitation are progressing well. Preparations are under way for designating the Upper Sûre valley, shared with Belgium's Wallonia region, as the second Ramsar wetland site.

*Part II*

**SUSTAINABLE DEVELOPMENT  
AND INTEGRATION OF POLICIES**

# 5

## ECONOMIC AND ENVIRONMENTAL POLICY

### 1. Towards Sustainable Development

#### *Economic and environmental trends*

Compared with other OECD countries, Luxembourg has *high per capita GDP*, high export and import ratios, and low unemployment (Annex II). More than one-third of the workforce that generates Luxembourg's GDP lives in France, Belgium or Germany, crossing the border daily.

Over the past two decades the country has experienced *rapid demographic and economic growth* (Table 5.1), faster than in any other EU country (except Ireland, for GDP). This growth has been accompanied by *structural change* (Chapter 1). The share of mining and manufacturing in GDP has fallen to less than 15%, while the service sector's share has virtually doubled. Employment in steelmaking has declined to 10% of industrial jobs.

In the 1990s, while the population increased by about 12%, the *vehicle stock* grew by over 27%. At 570 private cars per 1 000 inhabitants, the car ownership rate is among the highest in Europe. Outside urban areas, road traffic has increased at over 10% a year. Public transport accounts for 20% of all workday trips.

Major improvements have been made with regard to *conventional pollutants*, thanks largely to industrial production changes and to environmental policies. During the 1990s, emissions of SO<sub>x</sub> fell by 76%, NO<sub>x</sub> by 27% and VOC by 30%, while CO<sub>2</sub> emissions from energy use declined by about 21%. However, pressures resulting from *changes in consumption patterns* have increased, reflecting rises in population and income. In *geographical* terms, development has focused on the south, particularly the immediate surroundings of the capital. Housing, jobs, shopping and recreational facilities are increasingly dispersed, reflecting households' desire for a better living environment combined with rising urban property prices. The environment in general is consequently under further pressure: increasing road



traffic (bringing pollution, congestion, noise), deteriorating landscape and higher demand for environmental infrastructure such as drinking water supply, sewage systems and waste management.

### ***Integration of environmental concerns***

#### *Horizontal co-ordination*

Luxembourg's economic policy focuses on sectors and branches of strategic importance for the economy. Efforts to diversify are under way. Horizontal co-ordination on environmental matters is carried out by *interministerial committees* and through informal contacts among officials.

For example, the 1993 Water Protection and Management Act established an interministerial committee on water policy and a technical committee involving the ministries and agencies dealing with the environment, physical planning, the interior, construction and agriculture. Since 1999, the Ministry of the Interior has

Table 5.1 Economic trends and environmental pressure

	1980-98	1990-98
Economic trends		
GDP <sup>a</sup>	133.6	51.1
Population	16.8	11.0
Per capita GDP <sup>a</sup>	100.0	36.2
Total employment	50.0	26.3
Industrial output <sup>b</sup>	60.5	11.9
Primary energy	-8.9	-7.1
Energy intensity (in GDP terms)	-61.0	-38.5
Total final energy consumption	16.4	10.1
Stock of private cars	83.0	27.4
Environmental pressure		
CO <sub>2</sub> emissions <sup>c</sup>	-34.1	-25.8
SO <sub>x</sub> emissions	-85.0	-75.5
NO <sub>x</sub> emissions	-26.5	-27.5
Total municipal waste <sup>d</sup>	36.0	-1.0

a) At 1991 prices and purchasing power parities.

b) Includes mining, manufacturing, and gas, electricity and water.

c) Due to energy use; not including barge refuelling.

d) To 1997.

Source: OECD.

held responsibility for water. Physical planning, local development, transport infrastructure construction, energy, agriculture, forestry and rural development are other key policy areas requiring integration of environmental concerns. Horizontal co-ordination focuses mostly on specific projects.

### *National Plan for Sustainable Development*

In 1997, five years after the UN Conference on Environment and Development, the Luxembourg Government presented a preliminary draft for a *National Plan for Sustainable Development* (PNDD) to the UN General Assembly in New York. The plan itself was approved in 1999 by the government sitting in council. It is now under review by the Chamber of Deputies. Broad public consultation began in 2000, with a brochure describing the PNDD sent to all households.

The plan is based on *three priorities*: i) increasing environmental efficiency, ii) integrating environmental and social costs by applying the polluter pays principle, and iii) involving all parts of society. The plan defines a set of national objectives and international commitments (on development aid, for example). It has no statutory basis, but provides non-binding general policy guidelines.

As regards national development, the plan rests upon *three pillars*: economic performance, protection of both the built and the natural environment, and socio-economic equity and social protection. For each of these sections, the report describes the current situation, as well as actions and instruments being used, reviews scenarios for future development, then identifies priorities for action. The economic section is subdivided into main economic sectors (industry, agriculture, energy and transport) and the environmental section into main issues (nature, forests, soil, water, air and climate, and waste).

In addition, two guarantees are held to be essential for the environment section: a statutory one and a financial one. As regards the *statutory guarantee*, the plan envisages amending the Constitution to integrate environmental concerns more fully into sectoral policies. The *financial guarantee* involves more coherent and readily available funding for environmental quality; this would entail abolishing *grants and subsidies with environmentally harmful effects* and reviewing environment-related capital spending, in particular to bring about a *shift towards preventive measures*. It would also entail a reform of the Environmental Protection Fund and the use of environmental taxes and charges earmarked for environmental measures. Finally, the plan proposes accompanying measures, describes further steps to be taken and outlines a set of *indicators* to monitor progress towards sustainable development.

The Ministry of the Environment, with the support of an *interministerial working group*, drafted the plan. The working group is also to help in implementing the plan, monitoring progress and promoting joint operations. A proposal has

been made to form a national committee for sustainable development, playing an advisory role, with representatives from all government levels, the private sector and trade unions, NGOs, etc.

#### *Master plan for physical development*

Luxembourg has also begun preparing a new master plan for physical development. While the sustainable development plan is structured primarily on sectoral lines, the master plan takes a spatial approach, seeking in particular to link activities at various geographic levels, from European to local. The previous master plan (1978) addressed some 30 separate issues; the new one, by contrast, deals with development challenges under three headings:

- urban and rural development;
- transport and telecommunications;
- the environment and natural resources.

#### ***Economic impact of environmental policy***

##### *Expenditure on environmental protection*

*Public expenditure on environmental protection*, based on communal budgets, environmental protection fund outlays and the national accounts, can be estimated at LUF 4.8 billion for 1997, or 0.8% of GDP (Table 5.2). This total includes expenditure on nature protection by national and local environmental services, but not spending on public water supply. *Public expenditure on pollution control* totalled about LUF 3.7 billion, or 0.6% of GDP. Compared to that in other countries, this public spending is relatively low as a proportion of GDP. No information is available regarding *private expenditure* (by businesses and households) on the environment.

Recurrent or operating expenditure accounts for two-thirds of this total, and capital expenditure for one-third. The bulk of public spending on pollution control goes for water protection (40%) and waste management (37%); half of these expenditures are funded by the government, either directly or via grants to communes. The *government's role* is particularly significant in nature conservation and in waste management infrastructure.

Around half of government spending on pollution control and nature conservation is capital expenditure made via the *Environmental Protection Fund* managed by the Ministry of the Environment; this funding largely takes the form of grants to communes. In 1999, such spending totalled LUF 1.58 billion. Since the fund was set up in 1985, 52% of its disbursements have been allocated for water and 32% for waste. The share for nature conservation has fallen considerably.

## Employment

According to recent research, the number of jobs directly or indirectly linked to environmental protection is between 1 500 and 2 000, or 1% of total employment.

## 2. Instruments for Policy Implementation

### Regulatory instruments

Luxembourg has a comprehensive panoply of *environmental legislation*, strongly influenced by EU directives. All the laws and regulations concerning the environment have been combined in a single document.

The *Hazardous Installations Act* of 1990 required licensing of any activity that could present a danger or a threat to the safety, health or well-being of staff or the general public, or to the built or natural environment. The licences set forth the installation and operating conditions judged necessary for the protection of humans and of the built and natural environment. Reference is made to the best available technology not entailing excessive cost (BATNEEC). Licensing powers are shared between the Ministry of Labour (health and safety in the workplace,

Table 5.2 Public expenditure on environmental protection,<sup>a</sup> 1997

	Total expenditure			Capital expenditure			Recurrent expenditure		
	LUF million	Govt. <sup>b</sup> %	Communes <sup>c</sup> %	LUF million	Govt. <sup>b</sup> %	Communes <sup>c</sup> %	LUF million	Govt. <sup>b</sup> %	Communes <sup>c</sup> %
Water <sup>d</sup>	1 900	27	73	1 004	48	52	895	4	96
Waste	1 756	32	68	438	72	28	1 318	19	81
Air	18	99	1	5	95	5	14	100	0
Subtotal	3 674	30	70	1 447	55	45	2 228	13	87
Nature	374	93	7	97	97	3	278	92	8
Other <sup>e</sup>	731	92	8	171	96	4	560	90	10
<b>Total</b>	<b>4 780</b>	<b>44</b>	<b>56</b>	<b>1 714</b>	<b>62</b>	<b>38</b>	<b>3 065</b>	<b>35</b>	<b>65</b>

a) Secretariat estimates.

b) Includes central government transfers to communes.

c) Excludes central government transfers to communes.

d) Waste water collection (e.g. sewage systems) and treatment (e.g. treatment plants), plus groundwater and soil protection. Excludes water supply and distribution.

e) Noise protection, information and training, and other items.

Source: OECD Secretariat estimates.

industrial hazards, ergonomics) and the Ministry of the Environment (protection of air, water, soil, fauna and flora, noise control and waste management). The *Classified Installations Act* (1999) amended the earlier legislation while keeping the same guiding principles. It introduced:

- administrative simplifications, including reclassification of installations and shorter periods for examining applications and making licensing decisions;
- arrangements for monitoring enforcement, including a committee made up of representatives from the ministries and agencies concerned, as well as from businesses and environmental NGOs;
- a Technology Resource Centre for the Environment (CRTE);
- provisions relating to environmental impact assessments and major accidents;
- the right of recognised environmental associations to join legal proceedings.

There are four categories of classified installations. Classes 1 and 2 require a public licensing procedure. The government receives around 1 350 *licensing applications* a year under the Act.

*Inspection, monitoring and enforcement* of environmental regulations frequently involve several government services. Apart from the police and gendarmerie, customs and Environment Administration officials, as well as those of the Water and Forests Administration, have powers to inspect and report non-compliance with environmental legislation.

### ***Economic instruments***

Luxembourg makes little use of economic instruments to achieve its environmental objectives. *Taxation* is used to raise revenue and to influence relative prices in such a way as to produce economic benefits.

#### *Transport taxes*

The level of *fuel taxes* induces foreign customers to buy motor fuel in Luxembourg rather than in their home countries. More than half the country's fuel tax receipts, which in total represent some 10% of the national budget, are paid by foreign customers (Table 2.4). Although there is some tax differentiation in favour of less polluting types of fuel, the dominant rationale in setting tax rates is raising revenue rather than providing incentives to reduce environmental damage.

To recover the cost of environmental protection measures taken at filling stations, a charge called the "*environnement margin*" was introduced in 1995: LUF 0.37 per litre of gasoline and LUF 0.20 per litre of diesel. Luxembourg has also used VAT as a way to differentiate fuel taxes. The normal rate on energy

products is 15% (the VAT on unleaded gasoline is 12% because of a former differentiation with leaded gasoline, which was phased out in 1999). There is a special low rate for public transport fuel. VAT differentiation primarily affects households; the competitive position of firms is not affected, since they can deduct VAT payments from their tax-assessable turnover.

### *Environmental taxes and charges*

In 1994 the government stated that “to ensure *due application of the polluter pays principle*, the production and consumption of environmentally harmful items will be penalised. To this end, the government is considering introducing environmental taxes on a range of products: a tax on packaging, especially that of beverages; a charge on the discharge of industrial and domestic waste water; an energy/CO<sub>2</sub> tax on fuels; and a tax on problem waste. To protect firms from weakened competitiveness caused by the wage escalator mechanism, and to assure the regulatory effect of these taxes, the price effect will be partly or wholly neutralised with regard to the said mechanism”.

These proposals were subsequently reviewed by the *Economic and Social Council* (CES), a special advisory body. While the Council endorsed the polluter pays principle and the use of economic instruments to internalise externalities, it objected strongly to any unilateral attempt to introduce taxes and charges. The main objections concerned potential competitive disadvantages stemming from the taxation itself and from an automatic adjustment of wages in response to increased inflation. Trade unions further raised social concerns and argued for an exemption of at least 35 cubic metres for waste water charges.

In 1998 the *Parliament* urged the government to introduce environmental taxation. In 1999 the government proposed a feasibility study on the introduction of an “*Ecobonus*” programme. Put forward by Mouvement Écologique, an environmental NGO, the programme envisaged introducing a revenue-neutral energy tax. Households would receive allowances, at a flat rate per household member, producing a net gain for households with below-average energy consumption and a modest cost increase for households with energy-intensive lifestyles. The main burden of the tax would fall on foreign customers, who would not receive the allowance.

Water and waste charges vary considerably from commune to commune. For example, *prices for public water supply* range from LUF 12 to LUF 58 per cubic metre for metered prices, depending on base rates. Industry in some cases pays much less for water than do households. *Charges* range from LUF 1 to LUF 18 per cubic metre or from LUF 30 to LUF 2 000 per household. Industry often receives preferential treatment (Chapter 3). For *waste*, the base, structure and level of taxation all differ from one commune to another: in 1994 totals ranged

from LUF 1 500 to LUF 13 650 for a 120-litre container, and from LUF 3 000 to LUF 27 120 for a 240-litre container. Communes belonging to the same intercommunal syndicate handling waste collection often charge different rates for identical service. A pilot project was launched in 1994 to help harmonise the calculation of municipal waste charges across the country (Chapter 3).

### *Financial assistance*

Luxembourg has several financial aid programmes for clean-up operations, pollution prevention and energy saving. As part of its general programmes *supporting economic diversification*, it has also introduced specific aid for investment in environmental protection and energy saving, focusing on: preventing, reducing or eliminating discharges to air, water and soil, as well as emissions of odors, noise, vibration and radiation; preventing, reducing, recycling or eliminating waste; and promoting energy efficiency and use of renewable energy sources. Grants for up to 25% of capital expenditure are made to firms that surpass current environmental requirements. Five to ten projects a year have qualified; the total capital cost runs LUF 800-2 000 million.

Similarly, businesses in the *trades, commerce, hotels, catering and transport* sectors can receive grants towards capital spending on environmental protection or energy efficiency. The grants cover 7.5-15% of the capital cost. The costs involved in obtaining ISO 14001 certification are regarded as capital spending.

The *National Lending and Investment Society* makes long- and medium-term loans, particularly to finance environment-friendly plant and equipment. Loans cover 25-50% (in exceptional cases, 75%) of costs for large businesses, and 60-75% for small and medium-sized firms.

The Ministry of Economy's Energy Division subsidises facilities tapping *new and renewable energy sources* or using new energy-saving technologies. The maximum rates vary. For *wind generation* projects with rated capacity of over 50 kW, grants of LUF 3 000 per kilowatt are available for the first five proposals accepted, with a ceiling of LUF 6 million per project. For *solar power*, nearly 70% of applications are for the installation of solar panels, with a maximum subsidy of 25% of the capital cost and a ceiling of LUF 1.5 million. The Ministry of Economy also subsidises energy audits at firms in existence before August 1996.

### **Other instruments**

#### *Consultation*

*Representatives of industry and trade unions* are regularly consulted during the preparatory work on legislation and grand-ducal decrees. Similarly, the *CES* issues an annual opinion on government policy. It has for instance given its views on matters of environmental policy such as the proposal to introduce environmental

taxes (1995) and the preliminary draft of the sustainable development plan. In addition, the chambers of trades, commerce, agriculture and labour are consulted during preparatory work on legislation and grand-ducal decrees.

*Environmental NGOs* are formally consulted on projects of environmental relevance. They are also involved in environmental education, awareness and capacity building, in buying and managing protected sites and in generating data relating to nature conservation. NGOs recognised under Article 43 of the Conservation of Nature and Natural Resources Act (1982) have the official right to appeal against decisions. An umbrella organisation, NATURA, covers 32 associations. The main ones are *Ligue pour la Protection de la Nature et des Oiseaux* (15 000 members), *Mouvement Écologique* (3 500 members) and *Greenpeace Luxembourg*. Two foundations involving experts and consultants perform environmental work, often for government agencies. A system of public co-financing for some environmental NGO activities was established in 2000.

#### *EIAs and access to information*

European legislation on *environmental impact assessment* (EIA) was separately transposed for private projects, land consolidation programmes and major public infrastructure projects. Concerns have been expressed about the quality of EIAs. The assessment of a northern highway project, the Autoroute du Nord, cutting through the protected Grünewald area, was challenged as having inadequately evaluated alternative options. NGOs have encountered difficulties in gaining access to information on the likely impact of some other projects on environment and nature.

#### *Voluntary commitments*

In recent years firms' perceptions of the environment have started to change. The earliest initiatives came from major international chemical and oil producers as they became aware of their impact on the environment. Such companies decided *voluntarily* to introduce controls to gradually reduce their impact. Other sectors followed, with energy efficiency improvements, reuse or recycling of raw materials and reductions in harmful emissions, and they managed at the same time to maintain or enhance their competitiveness.

In March 1996 the government and the *Fédération des Industriels Luxembourgeois* (FEDIL) signed a voluntary agreement under which 35 of the group's member firms aimed to reduce their energy consumption per unit of production by 10% between 1990 and 2000. A FEDIL survey suggests that industry improved its energy efficiency by 13% between 1990 and 1997. Another agreement, with the body representing Luxembourg's *hospitals*, pledges to raise efficiency by 20% over 1991-2001. A further agreement seeks a 20% improvement in energy efficiency in the *financial sector*.



### *Education, research and development*

Luxembourg has taken steps to raise environmental awareness through *education and information*. The measures have focused on waste prevention, reuse and recycling.

The CRTE, established by the Ministries for Economic Affairs and the Environment, aims to help disseminate the best available technology, chiefly to *small and medium-sized firms*, and to remove technical and financial obstacles to the use of environment-friendly technology.

## **3. Environmental Performance**

### ***Economic trends, planning and integration***

Pollution in Luxembourg has diminished significantly, despite rapid growth in population and GDP. This decoupling may be attributed not only to environmental policy but also to the shift to a largely service economy: once characterised by a dominant steel industry, the economy has seen dynamic expansion of consumer and other services. Population growth and affluence are nevertheless generating new challenges for environmental protection and nature conservation, related to *changing consumption patterns*. Waste management, the spread of suburbs, increasing mobility and the resulting infrastructure requirements have become ever more important issues. Luxembourg's construction sector has grown rapidly, and its car ownership rate is among the highest in Europe.

The new *National Plan for Sustainable Development* may be considered a response to these challenges. It addresses the economic, environmental and social dimensions of sustainable development. Setting current realities and practices against forward-looking scenarios, the plan identifies priorities for action covering all major sectors of the economy and all environmental issues. This ambitious plan puts a strong emphasis on environmental objectives. Although it was drafted with the support of an interministerial working group, a broader consultation process will be needed to *mobilise support and achieve a consensus* to implement the plan. This process will probably lead to some adjustments and clarify the objectives and deadlines. It should also encourage information exchange concerning local Agenda 21 initiatives.

The government has stated that sustainable development should become the cornerstone of all government policies. For this to happen, *horizontal co-ordination will need to be institutionalised* at senior policy level. The further development and implementation of the sustainable development plan should also be closely co-ordinated with physical planning and development.

Overall, more can be done to integrate environmental concerns in *sectoral policies* and in the actions of the general public. The greening of subsidies to *agriculture*, following the reform of the EU Common Agricultural Policy, has been slow: agri-environmental measures were introduced only in 1996, and links between direct payments and respect for environmental concerns have not been strong enough. In *energy* and *transport* policy, the integration of environmental concerns should continue. For instance, voluntary agreements aimed at energy savings in industry, banks and hospitals were usefully concluded in 1996, but the ten-year reduction targets were not very ambitious, and were achieved within a few months.

Steps should also be taken to promote horizontal integration among the different areas of environmental policy, since significant responsibilities such as biodiversity and water management do not lie with the Ministry of the Environment alone. Environmental *data and indicators* can become important tools for this purpose. Although headway has been made in environmental reporting, there is scope for significant progress in this area. *Environmental impact assessments* could be extended to cover not only public infrastructure projects but also plans, programmes and policies.

### ***Environmental policy implementation***

Luxembourg has a comprehensive body of environmental legislation, mostly based on EU law. Emission and effluent standards for industrial plants are strict and defined on the basis of the best available technology (BAT or BATNEEC). All environmental legislation has recently been combined into a single document. The shift in environmental pressures towards consumption is likely to find expression in environmental policy that puts greater emphasis on i) *incentives and consultative instruments* and ii) fuller *integration of environmental concerns* in the design, implementation and assessment of economic and sectoral policies.

The effectiveness of *monitoring, inspection and control* of compliance with environmental and nature conservation regulations should be strengthened. In this regard, environmental information, training and capacity building need improvement. Private initiative and environmental management in firms should be encouraged. The EU eco-audit programme as currently implemented does not seem to be attracting enough firms.

Polluters and resource users in Luxembourg do not usually perceive the true environmental cost of their activities or of the environmental services they use. In a few cases, *economic instruments* help internalise negative externalities. Charges for waste and waste water are set at municipal level using methods that vary by locality. These charges are on the low side, since communes usually bear only 10% of infrastructure costs, the rest being funded by the government. Waste

and waste water charges may differ by a factor of 1 to 4 even among communes belonging to the same intercommunal syndicate supplying identical services; in most cases the charges do not even cover operating costs. The lack of appropriate charges may also hamper the development of innovative waste recycling initiatives.

*Fuel taxes* are light, which has, de facto, the effect of attracting foreign customers; these account for over half of fuel sales. This “gasoline tourism” generates harmful environmental effects. The 1994 government proposals to introduce environmental taxes have not been followed by action, whether on energy, CO<sub>2</sub>, packaging or problem waste. A few communes have been involved in pilot projects on waste processing and waste water treatment. Options for better adapted, more targeted pricing of such environmental services should be considered. The 1999 government programme envisages a feasibility study on energy taxation and an “Ecobonus” programme.

# 6

## SECTORAL INTEGRATION: ENERGY\*

### 1. The Energy Sector and the Environment

#### *Situation and trends*

Luxembourg's *energy intensity* is among the highest in OECD Europe. This fact reflects the role of steelmaking, vehicle fuel consumption by non-residents (both those working in Luxembourg and others) and high energy consumption by households. Since 1990 energy intensity has fallen by 33%, but it is still 9% above the average for OECD Europe (Figure 6.1); the fall has largely been due to lower consumption by industry.

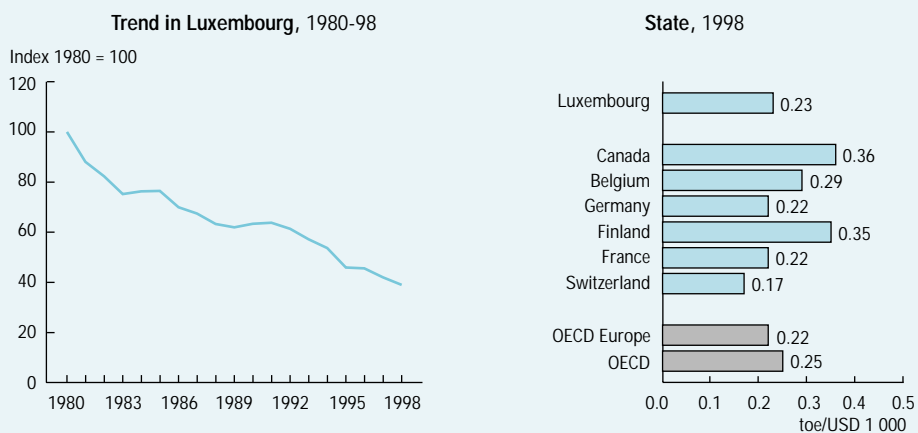
In 1998 *total primary energy supply* in Luxembourg amounted to 3.3 million tonnes of oil equivalent (Mtoe) (Figure 6.2). *Oil products* represented 62% of total supply, an increase from 1990. *Natural gas*, which is on an upward trend, accounted for 19%. Coal and other *solid fuels* came to almost 5%, down significantly from 1990's 33% due to the contraction in steelmaking and technological change in the sector.

Luxembourg depends almost entirely on *imports for its energy supply*. All oil products, coal and natural gas are imported, as is 94% of its electricity. *Electricity*, which represented 10% of total energy supply in 1990, accounted for 14% in 1998. Hydropower and co-generation provide about 6% of the electricity consumed (Table 6.1). The construction of a gas turbine/steam co-generation plant will raise the country's generation capacity to 40% of requirements, meaning lower electricity imports and higher natural gas imports starting in 2001.

*Final energy consumption* totalled 3.3 Mtoe in 1998, up 10% from 1990. Transport accounted for 49% of the total, industry for 27% and the residential/commercial sector for 23% (Figure 6.2). ARBED, the national steel concern,

\* This chapter takes the IEA review of Luxembourg's energy policy into account.

Figure 6.1 Energy intensity

Energy<sup>a</sup> per unit of GDP<sup>b</sup>

a) Total primary energy supply.

b) GDP at 1991 prices and purchasing power parities.

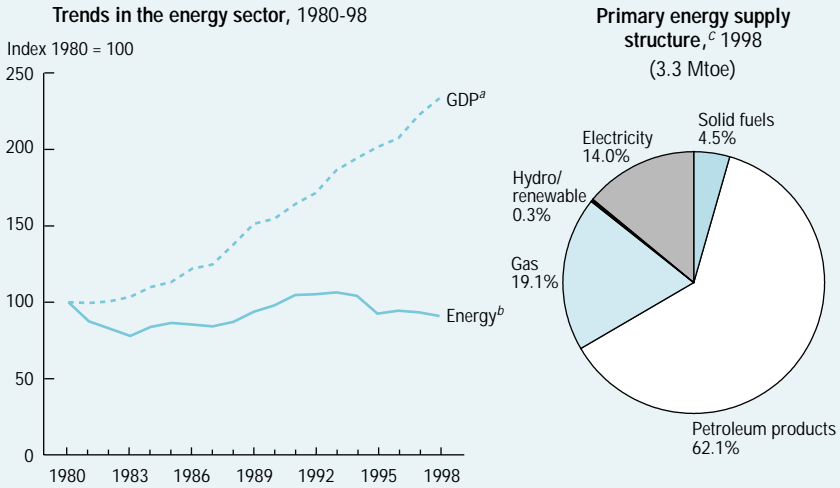
Source: IEA-OECD.

Table 6.1 Electricity generation and imports, 1998

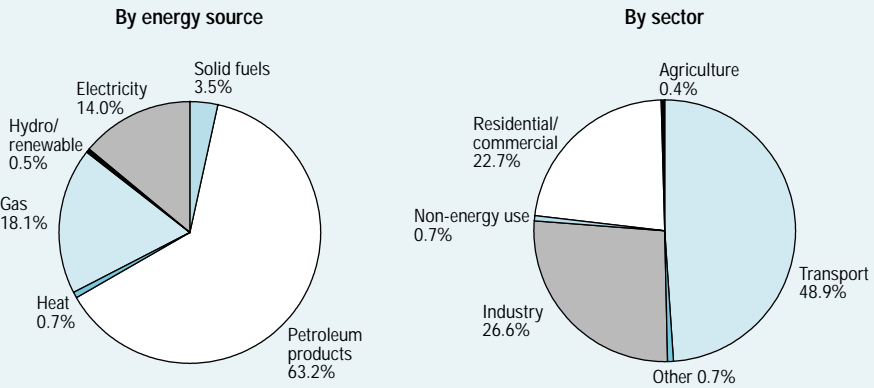
	GWh	(%)
Generation in Luxembourg	315	5.8
of which:	95	
Hydropower		1.7
Thermal power	31	0.6
Co-generation	184	3.4
Wind power	5	0.09
Biomass	0.5	–
Solar power	–	–
Net imports	5 117	94.2
of which:	1 931	
From Belgium		35.5
From Germany	3 187	58.7
<b>Total</b>	<b>5 432</b>	<b>100</b>

Source: Ministry of Economy.

Figure 6.2 Energy supply and use



**Total final energy consumption, 1998**  
 (3.3 Mtoe)



a) GDP at 1991 prices and purchasing power parities.  
 b) Total primary energy supply.  
 c) Includes electricity trade. Luxembourg imports 94% of its electricity.  
 Source: IEA-OECD.

accounted for 13% of final energy consumption in 1998, and the transport sector represented 77% of final crude oil consumption (Table 6.2).

### **Energy pressures on the environment**

Energy consumption in Luxembourg exerts a range of *pressures on the environment*. In 1998 industrial combustion accounted for 42% of total SO<sub>x</sub> emissions, and non-industrial combustion for 31% (Table 2.1). Between 1990 and 1998, however, SO<sub>x</sub> emissions fell 76% (Figure 2.1).

NO<sub>x</sub> emissions fell 27% over the same period. In 1998 mobile sources accounted for 49%, industrial combustion for 37% and non-industrial combustion for 8% (Figure 2.1 and Table 2.1). The share generated by motor vehicles has been rising steadily.

Table 6.2 **Final energy consumption, by source and sector, 1990-98**  
(million toe)<sup>a</sup>

		Industry	(%)	Transport	(%)	Residential/ commercial	(%)	Others <sup>b</sup>	(%)	Total	(%)
Oil	1990	0.28	(16.8)	1.03	(62.8)	0.31	(18.9)	0.02	(1.4)	1.64	(55.3)
	1998	0.08	(4.0)	1.59	(77.0)	0.34	(16.6)	0.04	(2.2)	2.06	(64.2)
Gas	1990	0.28	(66.5)	0.00	(0.0)	0.14	(33.5)	0.00	(0.0)	0.42	(14.2)
	1998	0.37	(63.3)	0.00	(0.0)	0.22	(36.7)	0.00	(0.0)	0.59	(18.4)
Electricity	1990	0.23	(63.4)	0.00	(1.3)	0.12	(33.3)	0.01	(2.0)	0.35	(12.0)
	1998	0.28	(62.2)	0.01	(1.6)	0.16	(34.7)	0.01	(1.5)	0.45	(14.2)
Solid fuel	1990	0.54	(98.9)	0.00	(0.0)	0.01	(1.1)	0.00	(0.0)	0.55	(18.5)
	1998	0.11	(94.5)	0.00	(0.0)	0.00	(1.7)	0.00	(0.0)	0.11	(3.5)
Other	1990	–		–		–		–		–	(0.0)
	1998	0.02	(48.8)	–	(0.0)	0.02	(51.2)	0.00	(0.0)	0.04	(1.2)
<b>Total</b>	<b>1990</b>	<b>1.32</b>	<b>(44.6)</b>	<b>1.03</b>	<b>(34.9)</b>	<b>0.57</b>	<b>(19.4)</b>	<b>0.03</b>	<b>(1.1)</b>	<b>2.96</b>	<b>(100)</b>
	<b>1998</b>	<b>0.87</b>	<b>(26.6)</b>	<b>1.59</b>	<b>(48.9)</b>	<b>0.74</b>	<b>(22.7)</b>	<b>0.06</b>	<b>(1.8)</b>	<b>3.25</b>	<b>(100)</b>
Change 1998/90 (%)			–34.5		54.4		28.8		81.7		10.1

a) Percentages of final consumption are shown in brackets.

b) Including non-energy use.

Source: IEA-OECD.

*Non-methane volatile organic compounds* (NMVOCs), mainly from motor vehicles and industrial solvent use (Table 2.1), have fallen 30% since 1990, largely because service stations have been cleaned up (Chapter 2).

Energy consumption also plays a significant role in *greenhouse gas emissions*. *CO<sub>2</sub> emissions* resulting from energy use totalled 9.1 million tonnes in 1997, down 27% from 1990 (Table 7.3). The main sources are road transport (52%), industrial combustion (26%) and non-industrial combustion (19%) (Table 2.1).

Energy generation accounts for only a small proportion of the energy consumed in Luxembourg, but it too exerts pressure on the environment. In particular the *loss of wildlife habitats* is attributable to the hydropower dams along all the main rivers (Chapter 4). The energy sector also produces *waste*, such as ash from the *household-waste incinerator* (Chapter 3).

## 2. Policy Responses

In 1999 the *Ministry of Energy* became part of the Ministry of Economic Affairs (Energy Division). The *Ministry of the Environment* is responsible for air pollution control policy. It and the Energy Division share responsibility for initiatives to improve energy efficiency and develop renewable energy sources. The *National Energy Council*, set up under the Energy Efficiency Act (1993), advises ministers on matters referred to it. The *Energy Agency* was formed in 1991 as a limited company, with the government being the main shareholder. It promotes renewables and energy efficiency, conducts feasibility studies for projects involving renewables and advises local authorities. It manages a demonstration site (Remerschen) presenting leading-edge technologies for energy generation from renewables.

The government is involved in numerous *companies and agencies* in the energy sector. For example, it has a 42% interest in the Compagnie Grand Ducale de l'Électricité (CEGEDEL), which distributes 65% of all electricity consumed in Luxembourg; the balance is supplied by the Société de Transport d'Énergie Électrique du grand-duché de Luxembourg (SOTEL), chiefly to the steel industry. The Société de Transport de Gaz (SOTEG), in which the government has a 31% interest, imports and transports natural gas. Luxgaz, 30% government controlled, builds and runs local natural gas distribution networks.

### **Objectives**

#### *Objectives in the National Sustainable Development Plan (1999)*

Concerning energy, the plan set five objectives:

- reducing *energy intensity* by 20% from the 1993 level by 2010;



- achieving a 30% reduction in energy consumption for *heating* in the residential/commercial sector by 2020;
- increasing the share of *co-generation* in final consumption of energy from the grid from about 7% in 1997 to 15% by 2010;
- doubling the proportion of *renewable energy sources* in final consumption of electricity from the grid from around 2.5% in 1997 to 5% by 2010;
- ensuring that 45% of the electricity consumed from the grid is *generated in Luxembourg* by 2005, compared with around 10% in 1997.

### *Energy conservation objectives*

The *Energy Efficiency Act* (1993) seeks to promote energy saving in all economic sectors and reduce dependence on conventional energy forms by promoting the use of new and renewable sources, co-generation plants and autonomous production of primary and secondary energy. A further aim is to help cut CO<sub>2</sub> emissions by enhancing the energy efficiency of Luxembourg's economy. The Act sets criteria to foster energy saving and provides for assistance to this end. A large number of decrees have been issued under the Act, offering subsidies for capital spending on energy-saving equipment in the industrial and residential/commercial sectors.

### *Objectives for atmospheric emissions*

In 1990 Luxembourg set targets of stabilising CO<sub>2</sub> emissions at 1990 levels by 2000 and achieving a 20% reduction by 2005. In 1994 the country ratified the United Nations Framework Convention on Climate Change. Under the EU agreement associated with the Kyoto Protocol, Luxembourg undertook to reduce its *greenhouse gas emissions* by 28% from the 1990 levels by 2008-12. This is the most ambitious reduction target among the 15 EU countries (Chapter 7).

On *emissions of conventional pollutants*, Luxembourg has adopted several quantitative targets in the framework of international commitments (Table 7.2). Furthermore, in the sustainable development plan the government set the objective of reducing SO<sub>x</sub>, NO<sub>x</sub> and VOC emissions by 70% from 1990 levels by 2010.

### **Regulatory and voluntary measures**

#### *Regulatory measures*

*Emission limit values for classified installations* are set in operating permits (Chapter 5), which call for the use of the best available technology. Combustion facilities are inspected regularly and classified installations are required to make annual emission reports.

*Fuel quality* is regulated in line with EU directives. The sale of leaded gasoline in Luxembourg ceased in 1999. The maximum level for sulphur is 0.05% by weight for diesel and 0.2% by weight for heating fuel.

A 1995 decree set *insulation standards* for new construction. Building sites are not inspected to see that the standards are met, but the architects or engineers in charge must certify that buildings comply. Fines may be incurred for non-compliance.

*Energy efficiency standards* for washing machines and spin dryers were set in 1996 under an *Ecolabel* programme. In 1997 and 1998 similar standards were set for refrigerators, freezers and boilers.

All *road vehicles* registered in Luxembourg undergo regular *technical inspection* (Chapter 2).

### *Voluntary measures*

*Voluntary agreements* are employed in the industrial and commercial sectors to encourage firms to reduce their energy consumption through greater energy efficiency. Since 1996 agreements have been concluded in a number of areas: manufacturing, hospitals, banking, insurance, hotels and catering. A voluntary agreement was concluded in 1996 between the government and 35 member firms of the Fédération des Industriels Luxembourgeois (FEDIL) with the aim of raising these firms' energy efficiency by at least 10% over 1990-2000. Several further voluntary agreements with other industrial sectors have generally had the objective of reducing these industries' energy intensity by 20% on average.

## ***Economic instruments***

### *Subsidies and tax allowances*

In 1996 the Energy Agency launched a *programme of energy saving activities in communes* to promote energy efficiency and the use of renewables. In 1997 nine communes received total *subsidies* of LUF 1.4 million, and in 1998 five communes received subsidies totalling LUF 10.3 million. The projects selected included information drives on energy efficiency, the installation of solar panels for a municipal swimming pool and a wood-fired heating system for a primary school.

Various programmes of *subsidies* and tax allowances are available to *firms*, encouraging them to improve their environmental performance. Enterprises investing in pollution control equipment and energy-saving technology are entitled to subsidies of up to 25% of the capital cost. *Accelerated depreciation* is a further means of encouraging firms to invest in more energy-efficient technology.

Since 1994 *electricity producers* have also qualified for *subsidies* on capital expenditure for generating electricity in certain ways (renewable sources, co-generation). For wind-generation facilities with capacity of at least 50 kW, the subsidy is set at 25% of the actual cost, with a ceiling of LUF 6 million. For solar power, biomass, biogas and heat pumps, the maximum grant is 25% of the capital cost, up to a ceiling of LUF 1.5 million. Until 1996 the construction of co-generation facilities also attracted grants of LUF 6 000 per kW, for the first 5 000 kW of installed capacity.

In the residential/commercial sector *subsidies* are available for *energy audits*. At the owner's request, a building will be inspected by a recognised expert. If the owner agrees to perform all the work proposed in the audit, up to 49% of audit costs are refunded, up to a ceiling of LUF 150 000 per building. Between 1990 and 1992 grants of LUF 10 000-20 000 were made to nearly 6 000 *households* to replace their heating systems and improve combustion efficiency by 5% or more.

To promote less polluting motor vehicles, the government offered *subsidies* of LUF 10 000-20 000 for purchase of *cars equipped with catalytic converters* between 1990 and 1992; over 22 000 grants were made under this programme. *Public transport* is subsidised; fares cover only 15% of operating costs (Chapter 2).

### *Energy taxes and prices*

*Energy prices* (for electricity, fuel oil and natural gas) charged to *households* in Luxembourg are 15-35% below the OECD Europe average and considerably lower than in neighbouring countries (Table 6.3), reflecting low rates of taxation. The prices of the main *domestic heating fuels* (natural gas, fuel oil) have been falling since 1996. In 1998 they were at 1985 levels, as were prices for electricity and LPG.

*Energy prices for industry* are not available, as they vary considerably by sector, by size of firm and with individual import agreements. But a 1998 survey by the National Energy Council found that average prices for electricity and natural gas paid by industrial concerns in Luxembourg were well below the EU average.

*Taxes on vehicle fuel* (Table 2.3) are among the lowest in OECD Europe. This is reflected in lower pump prices than in neighbouring countries.

VAT of 15% is charged on most energy products, but on oil products VAT varies considerably; the rate on domestic heating oil and unleaded gasoline, for instance, is 12%. The TVA on fuel for public passenger transport is also reduced. VAT on electricity and natural gas is 6%.

### 3. Environmental Performance

In recent years Luxembourg has developed *energy strategies* focusing on two main objectives: reducing demand through energy-saving measures and more efficient use, and securing a supply of energy in sufficient quantity and at acceptable prices while diversifying the range of sources. The measures taken to cut energy consumption have had a fairly limited impact and their cost-effectiveness has not been appraised. The *decoupling of economic growth and energy consumption* (Figure 6.2) since 1980 probably results from major restructuring of industry and the shift towards a service economy.

Table 6.3 Energy prices, selected OECD countries, 1998

	Electricity		Fuel oil		Natural gas	
	Industry (USD <sup>a</sup> /kWh)	Households (USD <sup>b</sup> /kWh)	Industry (USD <sup>a</sup> /toe)	Households (USD <sup>b</sup> /d <sup>f</sup> 1 000 litres)	Industry (USD <sup>a</sup> /toe)	Households (USD <sup>b</sup> /107 kcal)
Luxembourg	..	0.1099	..	189.2	..	246
Austria	0.0784	0.1538	103.7	276.7	171.8	380.7
Germany	0.0673	0.1391	..	201.5	210.9 <sup>e</sup>	360.7 <sup>e</sup>
Belgium	0.0551 <sup>e</sup>	0.1635 <sup>e</sup>	121.4	195.5	145.9 <sup>e</sup>	404.3
Finland	0.0501	0.0866	..	253.6	153.2	148.8
France	0.0467	0.1168	126.5 <sup>g</sup>	303.7	161.6	394.1
Italy	0.0948	0.1707	188.0 <sup>g</sup>	832.6	190.5	740.0
Netherlands	0.0624	0.1227	193.6 <sup>f</sup>	360.9	136.7	342.5
Switzerland	0.1011	0.0973	n.a.	136.2	265.3	317.1
OECD Europe	0.0656	0.1304	135.5	296.5	157.9	432.9 <sup>e</sup>
OECD	0.0513	0.101	137.7	283.9	134.3	357.7 <sup>e</sup>
Luxembourg price/ OECD Europe price	..	84%	..	64%	..	57%
Luxembourg price/ OECD price	..	109%	..	67%	..	69%

a) At current prices and exchange rates.

b) Corrected for purchasing power parities.

c) High-sulphur oil.

d) Light fuel oil.

e) 1997 data.

f) 1996 data.

g) 1999 data.

Source: IEA-OECD.

The *Energy Efficiency Act* (1993) has produced measures to promote energy saving in all sectors as well as the use of new and renewable energy sources; it has also given rise to regulations providing subsidies for energy-saving investment in the industrial and residential/commercial sectors. More recently Luxembourg has set ambitious energy targets in its *National Sustainable Development Plan* (1999). Achieving these targets will entail more extensive interministerial co-operation and more systematic inclusion of environmental concerns in energy policy.

### ***Energy consumption***

Luxembourg's *energy balance* shows virtually complete dependence on imports: the country generates only 1.5% of its energy supply. All oil products, solid fuel and natural gas are imported, along with 94% of electricity, the balance coming from hydropower, wind and co-generation facilities (Table 6.1). The past 20 years have been marked by a steady decline in the *energy intensity of the economy*, which since 1990 has fallen 39%, largely due to contraction in heavy consuming sectors (notably steelmaking). Despite this substantial advance, energy intensity is still slightly above the OECD Europe average (Figure 6.1).

*Oil products* are far and away the most widely used forms of energy in Luxembourg, covering 63% of needs, followed by natural gas with 18%. Over the last 20 years consumption of *solid fuels* has fallen steadily. The last blast furnace was decommissioned in 1997 and since then the steel industry has used virtually no solid fuel. At the same time *natural gas consumption* has risen steadily, nearly doubling. The government plans to extend the natural gas distribution network and bring a 350 MW gas turbine/steam plant into service in 2001. Luxembourg will thus generate over 40% of the electricity it consumes.

### ***Environmental performance by sector***

*Industry* was the leading energy consumer until 1995, when it was overtaken by the transport sector. Since 1990 *energy consumption by industry has fallen 30%* as a result not only of the contraction in steelmaking but also of greater energy efficiency and structural and technological change in the sector. Industry now accounts for 27% of total final consumption. *Voluntary agreements* have been used to raise energy efficiency in a number of manufacturing sectors. For example, the agreement between the government and FEDIL aimed to raise the energy efficiency of 35 of FEDIL's member firms by at least 10% over 1990 levels by 2000. The target appears to have been reached, indeed exceeded. Quite a number of *subsidies* have been introduced under the Energy Efficiency Act, but have met with little success.

*Transport* is the most problematic sector in terms of energy efficiency policy in Luxembourg. Since 1990 *energy consumption by the transport sector has risen by 54%*. Transport accounts for 49% of final energy consumption. The relatively low taxes on vehicle fuel are reflected in lower pump prices than in neighbouring countries. As a result, 50-70% of fuel sales are due to cross-border purchases, contributing to vehicle movements and pollutant emissions in Luxembourg. In all, some 280 000 road vehicles cross the border each day. *Vehicle fuel quality* complies with EU standards, particularly those for motor vehicle emissions. Cars and goods vehicles are regularly inspected for emission performance. Substantial efforts are needed to promote *public transport on a regional basis*, an area in which Luxembourg should work with its neighbours.

The *commercial/residential sector* accounts for 23% of energy consumption. Past policy in Luxembourg has not managed to reduce final energy consumption in this sector, and *use has risen 40% since 1990*. Relatively high household incomes, together with relatively low energy prices, have not encouraged energy saving. Further drives to promote use of insulation would bring a significant cut in domestic consumption, which accounts for over 20% of the total. Compliance with insulation standards should be more widely monitored.

### ***Economic signals***

The fact that *fuel taxes* in Luxembourg are relatively light helps drive up energy consumption for transport by residents and non-residents (those working in Luxembourg and others), as well as goods vehicle drivers in transit who are attracted by the lower pump prices (Chapter 2). The Ministry of the Environment estimates that 50-70% of *motor vehicle fuel* sales in Luxembourg are to non-residents (Table 2.4). Fuel taxes are a major source of government revenue. The tax policy does not promote internalisation of external environmental costs and runs counter to the goals of reducing energy consumption, atmospheric emissions (NO<sub>x</sub>, NMVOCs, particulates) and CO<sub>2</sub> emissions (road transport accounts for more than 50% of these). The effectiveness of government subsidies to promote energy saving and use of renewables may also be questioned, given the levels of energy consumption for transport. The government is examining the possibility of introducing a surtax on *motor vehicles*. An energy tax would appear to have greater incentive power to hold down fuel consumption.

The Luxembourg Government has introduced a range of *subsidies for renewable energy sources*. Between 1994 and 2000, such aid totalled LUF 69 million. At present, co-generation facilities no longer qualify for subsidies. Solar panels have received the most aid (292 projects, or 73% of subsidised projects, and 25% of aid volume). Next come heat pumps (20% of projects, 4% of volume), then wind generation and co-generation (16 projects, over 60% of volume), for a total

of around LUF 47 million. Although it may be of value to develop co-generation and renewable energy projects for diversification purposes, such projects should be based on stringent *economic analysis*.

In the residential/commercial sector, *insulation subsidies* of some LUF 417 million have been made since 1980. But there has been no verification of the energy savings achieved, so as to judge the efficiency and effectiveness of these measures. As heating contributes to emissions of CO<sub>2</sub> (15% of the total), NO<sub>x</sub> (5%) and SO<sub>2</sub> (15%), energy-saving measures in the residential sector should have helped bring these emissions down over the past 20 years. Yet the levels have held steady for SO<sub>2</sub>, and risen for NO<sub>x</sub> and CO<sub>2</sub>. It is quite possible that this is due to social trends (e.g. demographic growth, smaller households and expansion of suburbs).

*Part III*

**CO-OPERATION WITH  
THE INTERNATIONAL COMMUNITY**



# 7

## INTERNATIONAL CO-OPERATION

Luxembourg regularly plays a very active part in regional and worldwide co-operation and, particularly, co-operation with *neighbouring countries*. This is natural, given its location and intensity of international trade (Figures 1.1 and 1.2). As well as being a focus for international tourism, it employs large numbers of foreign workers (55% of jobs are held by resident foreigners or cross-border workers). Its economic and financial business is conducted principally with its European Union partners. On the political side, it has become a *European capital*, hosting several EU institutions.

Luxembourg's location, amid densely populated industrial regions, means it receives a *high level of pollution from other countries*; it is in its interest to encourage joint pollution control programmes, even though its own efforts have little direct impact on the pollution affecting it. Hence it is rational for Luxembourg to align its stance on environmental matters with that of its neighbours.

### 1. Implementation of EU Directives

Luxembourg endeavours to *implement EU directives promptly*, and they have substantially shaped its environmental law. Overall it is among the EU countries with the best record for *transposing* environmental directives and with the fewest environmental cases brought before the Court of Justice of the European Communities. But transposing laws and standards presents less of a problem than achieving results.

On that score, *national plans* are being prepared (on waste, for instance) or considered, and reduction programmes (for example, on nitrates and hazardous substances) have been defined. Some bathing points on the Sûre River still do not comply with EU directives. That situation will improve with the construction of the *tertiary waste water treatment facilities* that ought to have been in place by 1998 under the waste water directive; they are scheduled to come into service in 2005. The *nitrates* directive is not fully applied: the nitrate flow balance has not

been established. In 1998 the Court of Justice found against Luxembourg for having no reduction programmes for some *chemicals* (Annex II to directive 76/464); despite the steps taken after this ruling, measures to enhance water quality in terms of toxic substances and pesticides have not yet been fully applied. The *environmental impact assessment* directive has yet to be embodied in a grand-ducal decree. As for nature and wildlife, the *habitats* directive still has to be implemented. Similar delays in applying directives occur in other EU countries.

## 2. Bilateral and Regional Co-operation

### *Co-operation frameworks*

Luxembourg co-operates with *its neighbours* on numerous aspects of regional development, physical planning and the environment (e.g. water, waste, natural parks, ozone), in a range of institutional frameworks:

- bilateral;
- tripartite (water and explosives with France and Belgium, intergovernmental co-operation with France and Germany);
- Benelux (committees on the environment and on hunting and fishing);
- the Saar-Lor-Lux region (with Saar and Lorraine, and extending to the western Rhineland-Palatinate);
- the *Grande Région* (with Wallonia, Saar, Lorraine and Rhineland-Palatinate).

*Bilateral* co-operation with France and with Germany is based on the 1996 Karlsruhe quadripartite agreement on cross-border co-operation, implementing the 1980 Madrid Convention on transfrontier co-operation between territorial communities or authorities. All these activities result in closer direct links between government services, which often work together informally at local levels.

In the context of the *Grande Région* (11 million inhabitants), regular “summit” meetings have been held since 1995, involving the highest-ranking representatives of Luxembourg and its regional partners. The meetings are devoted to specific economic and social problems related to physical planning and co-operation (i.e. issues such as employment, transport and telecommunications). Environment ministers and senior environment officials in the *Grande Région* have met every year since 1996. That year, they adopted the Bastogne Declaration, which laid the foundations for co-operation, particularly as regards natural parks, woodlands, renewable energy resources and industrial brownfield sites. The 1998 summit meeting in Trier was concerned with environmentally sustainable development in the *Grande Région*.

Luxembourg, France and Germany adopted a recommendation in 1980 on mutual information and harmonisation of local authority planning in *border regions*. The recommendation, which related especially to polluting facilities less

than 15 kilometres from borders, has been implemented only to a small degree. With regard to proposals for polluting activity that may have transboundary effects, informal direct discussions provide a valuable complement to diplomatic exchanges under the Espoo Convention.

A range of bilateral activities on transboundary co-operation is in progress, under *European programmes* such as INTERREG, on subjects including natural parks, water management and transboundary water pollution. The *Upper Sûre transboundary natural park* was established with Belgium in 1999. A three-frontier park (France, Luxembourg, Germany) near Schengen, and the Luxembourg portion of a German-Luxembourg park, are in the planning stages.

The Benelux countries and Germany are co-operating on *tropospheric ozone* via an exchange programme for data collected by monitoring networks. Lorraine, Belgium, Luxembourg and Germany have drawn up an interregional master plan for *toxic waste*, but it has not been carried out. For household waste, Luxembourg and Germany operate a joint composting plant. For *flood* control in the Moselle and Sarre valleys, regional environmental leaders noted in 1999 that they attached high priority to rapid implementation of an action plan whose estimated cost is EUR 500 million.

### ***River pollution***

Most of Luxembourg (98%) is in the *Rhine* basin, via the *Moselle* and tributaries such as the Sûre and Alzette; 2% is in the *Meuse* basin via the Chiers. Luxembourg has built 212 mechanical waste water treatment plants and 117 biological treatment facilities, with total capacity of 925 000 population-equivalent; 93.5% of the population is connected to the sewage system. Government capital expenditure in this area amounted to LUF 5 billion over 1989-97. Stretches of highly polluted rivers fell from 9.7% to 6.2% over 1988-98. Luxembourg has classified its entire territory as a *sensitive area under the EU waste water directive*. Accordingly, it should have constructed a network of tertiary water treatment plants by 1998. The target is expected to be met by 2005, at a capital cost of *LUF 10 billion*.

Since 1998 Luxembourg has been a contracting party to the *Paris Convention on protection of the marine environment of the north-east Atlantic*. As such, it will have to comply with the 80 OSPAR recommendations on discharges in the Rhine and Meuse basins, particularly those concerning nitrates, phosphates, heavy metals and pesticides. This should not pose any problems, given Luxembourg's small number of chemical concerns and its existing regulations on copper, zinc and chromium.

Luxembourg takes part in the work of the *International Commission for the Protection of the Rhine against Pollution*. In particular, it is contributing to joint efforts to reintroduce salmon via fish runs.

### *The Moselle*

International co-operation on the *Moselle* is conducted through the International Commissions for the Protection of the Moselle and Sarre (CIPMS), which have working parties on water quality, on emissions and on the environment. Reports on water quality in the Moselle and Sarre are published each year. The Moselle enters Luxembourg after receiving large amounts of pollution in Lorraine and leaves the country carrying virtually all the water-borne pollutants that are discharged within Luxembourg (nitrates, phosphates, heavy metals and pesticides). The concentration of zinc in the Moselle when it enters Luxembourg is over five times the target level set by the CIPMS in 1992. Levels of PCBs, cadmium, copper, atrazin and diuron are also high.

Luxembourg's *treatment plants* on the Moselle perform primary waste water treatment only. Four facilities funded jointly by Germany and Luxembourg should improve the situation. Algal biomass has reached very high levels at Grevenmacher. The Moselle's microbiological quality is poor, making the river hazardous to use for water sports and boating, let alone bathing.

Pollution of the Moselle by *chlorides* discharged in Lorraine is a source of concern to Luxembourg. In 1993 the CIPMS approved a recommendation seeking compliance with the limit value of 200 mg/litre of chlorides in the Moselle at Koblenz, which has been exceeded since 1989. Input from the Meurthe increased from 25 kg/second to 36 between 1996 and 1997. The chloride flow entering Luxembourg in 1997 was 33 kg/second and the outgoing flow 35 kg/second, and the chloride content of the Moselle in Luxembourg was 500 mg/litre, or twice the acceptable maximum for the Rhine at the Dutch border. The CIPMS chairman wrote to the prefect of Lorraine expressing concern over a project by Soudières de Lorraine that would raise salinity in the Moselle by some 30%. This issue also has a bearing on implementation of the convention on protection of the Rhine against pollution by chlorides, concerning, for instance, polluting discharges shifting from the Rhine to the Moselle

### *Other transboundary rivers*

Luxembourg is the source of considerable pollution in the *Chiers*, which flows into France. The commissioning of the waste water facility at Petange, and its connection to sewage systems, has helped cut this pollution quite substantially. The *Upper Sûre*, which feeds Luxembourg's drinking water reserves, has received special attention as regards waste water, which comes mainly from Belgium; the construction of a joint treatment facility in Luxembourg was 85% funded by Belgium, though the latter country does not contribute to operating costs. The *Alzette* is highly polluted when it enters Luxembourg; levels should fall with the forthcoming commissioning of a treatment facility in France. Luxembourg

has funded the pumping out of mine shafts in France to maintain flow levels in the *Kaylbach*, which might otherwise dry up.

### ***Pan-European co-operation: control of transboundary air pollution***

#### *Acid deposition*

Luxembourg suffers *acid deposition* from SO<sub>2</sub> and NO<sub>x</sub> emissions, chiefly from other countries. *Luxembourg is a net importer of SO<sub>2</sub>, and a net exporter of NO<sub>x</sub>* (Table 7.1). The resulting acid precipitation contributes to damage in Luxembourg's forests. Leaf loss and other damage increased until 1996; since then a marked improvement has been observed, probably due to reduced acid deposition, chiefly as a result of emission reductions in other countries.

Furthermore, Luxembourg made significant reductions in emissions of atmospheric pollutants over 1980-99 (Table 7.2), partly through *restructuring in the steel sector* (Chapter 2). Since 1990 energy intensity has fallen by 38% (Table 5.1).

Table 7.1 **Acid deposition, 1997**

(100 tonnes)

	SO <sub>2</sub>		NO <sub>x</sub>	
	Deposition originating from Luxembourg and received in	Deposition in Luxembourg received from	Deposition originating from Luxembourg and received in	Deposition in Luxembourg received from
Luxembourg		2		4
Germany	8	5	14	7
France	5	8	12	7
Belgium	1	5	2	5
Spain	0	4	0	1
United Kingdom	1	2	1	2
Netherlands	0	1	1	2
Italy	1	1	1	0
Austria	1	0	1	0
Other countries	6	2	6	0
Subtotal	23	28 (93%)	38	24 (86%)
<b>Total</b>		<b>30 (100%)</b>		<b>28 (100%)</b>

Source: EMEP: UN-ECE.

## SO<sub>x</sub>

Luxembourg has committed itself to reducing its SO<sub>x</sub> emissions quite substantially (Table 7.2). It has more than met international objectives, cutting emissions by 85% between 1980 and 1998. Under the Göteborg Protocol, Luxembourg is supposed to cut its SO<sub>2</sub> emissions by 73% from 1990 to 2010. Achieving this should be feasible, as emissions fell by 76% over 1990-98. Per capita SO<sub>x</sub> emissions in Luxembourg, at 8.4 kg, are lower than in the three neighbouring countries, and lower than emissions in OECD Europe as a whole (29.8 kg).

## NO<sub>x</sub>

With high levels of emissions by transport and industry, Luxembourg emits *much more NO<sub>x</sub> per capita* than its three neighbours: its average of 39.6 kg is also above that of OECD Europe (28.2 kg). Despite its size, Luxembourg has one of the highest vehicle ownership rates of any OECD country. NO<sub>x</sub> emissions would be still higher if Luxembourg generated its own electricity.

Table 7.2 Atmospheric protection: international commitments

	Protocol	Obligations			Results
		Reduction (%)	Reference year	Target year	(%) (period)
Sulphur dioxide (SO <sub>2</sub> )	1985 – Helsinki	-30	1980	1993	-40 (1980-93)
	1994 – Oslo	-58	1980	2000	-85 (1980-98)
	1999 – Göteborg	-73	1990	2010	-76 (1990-98)
Nitrogen oxide (NO <sub>x</sub> )	1988 – Sofia	0	1987	1994	+3 (1987-94)
	1999 – Göteborg	-52	1990	2010	-27 (1990-98)
Non-methane volatile organic compounds (NMVOCs)	1991 – Geneva	-30	1990	1999	-30 (1990-98)
	1999 – Göteborg	-55	1990	2010	-30 (1990-98)
Persistent organic pollutants (POP)	1998 – Aarhus	Various	Various	Various	-
Heavy metals	1998 – Aarhus	various	Various	Various	-
Ammonia (NH <sub>3</sub> )	1999 – Göteborg	0%	1990	2010	0 (1990-98)
Six greenhouse gases (CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HFC, PFC, SF <sub>6</sub> )	1997 – Kyoto	-28 <sup>a</sup>	1990	2008-12	-28 (1990-98)

a) Under EU burden-sharing.

Source: OECD.

*NO<sub>x</sub> emissions have been falling since 1996*, and the goal of stabilising emissions at 1985 levels was even slightly exceeded in 1994-96. In 1998 emissions were 19% below 1985 levels. For the future, however, the target set by the Göteborg Protocol (a 52% reduction by 2010, from 1990 levels) is likely to be a problem despite the range of measures proposed to reduce emissions from vehicles and from cement and glass production, and to cut energy consumption in buildings. Hence, given that the country's road traffic is intense, the 70% reduction target set out in the sustainable development plan seems hard to achieve.

### VOCs

Emissions of *VOCs* come mainly from transport (57%) and from solvent use (22%). As these emissions have been falling steadily since 1990, Luxembourg is likely to meet the objective of *a 30% reduction by 2000* from 1990 levels. The reduction already stood at 30% in 1998 (Table 2.1).

### *Heavy metals and persistent organic pollutants*

Luxembourg has signed the 1998 Aarhus Protocols on *heavy metals* and *persistent organic pollutants*. Between 1990 and 1998 lead emissions fell by over 88%, cadmium and mercury emissions by over 66%, dioxin and furan emissions by 80% and PAH emissions by more than 72%.

## 3. Global Co-operation

### *Climate change*

Though *greenhouse gas* emissions in Luxembourg are insignificant in absolute terms, at less than 0.1% of worldwide CO<sub>2</sub> emissions, the government has always attached great importance to environmental protection with regard to climate change. Its climate change policy focuses on reducing *CO<sub>2</sub> emissions*; in this it has been considerably assisted by the *reduction in emissions from steel-making*, a consequence both of lower steel output and of the switch from blast furnaces to electric arc processes (Chapter 6). The end of coal burning and greater use of oil products and natural gas have further boosted the reduction in CO<sub>2</sub> emissions.

### *Emission trends*

*Per capita CO<sub>2</sub> emissions* amount to 20.5 tonnes a year, calculated on the basis of fuel sales in Luxembourg. This is *far above the levels in the three neighbouring countries* as well as the average for OECD Europe (7.9 tonnes), despite

the introduction of electric arc furnaces for steelmaking, which use electricity generated outside the country. In fact, Luxembourg has the highest per capita CO<sub>2</sub> emissions of any OECD country. The finding would be essentially the same even if emissions from fuel sold in Luxembourg but consumed abroad were deducted and emissions arising abroad from the generation of electricity supplied to Luxembourg were added (Table 7.3). Per unit of GDP, Luxembourg's emissions (0.62 tonne/USD 1 000) are also above the OECD Europe average (Figure 2.1).

Over 1990-97 *final energy consumption rose by 8.4% while CO<sub>2</sub> emissions fell by 20.6%*. Disregarding fuel purchased in the country and used abroad, CO<sub>2</sub> emissions from Luxembourg went from 10 to 5 million tonnes per year, a reduction of 50%. Allowing for "exported" fuel using the IPCC methodology, emissions fell from 12.4 million tonnes per year to 9.1 million tonnes, a reduction of 27% (Table 7.3). Luxembourg's CO<sub>2</sub> emissions per unit of GDP fell by 45%, against an average EU reduction of 11%.

*Emissions of CH<sub>4</sub> and N<sub>2</sub>O* come chiefly from farming and the waste sector. Methane emissions fell slightly between 1990 and 1998 (from 24 kt/year to 23) and N<sub>2</sub>O emissions are stable.

Table 7.3 Climate change: greenhouse gas emissions

(kt of CO<sub>2</sub> equivalent)

	1990	1997	Change (%)
CO <sub>2</sub>	9 880	5 866	-41
CH <sub>4</sub>	495	502	+1
N <sub>2</sub> O	196	219	+12
Total "A" <sup>a</sup>	10 571	6 587	-38
"B" Fuel sold for use outside Luxembourg	1 831	2 496	+36
"C" Electricity generated abroad for use in Luxembourg	2 292	2 852	+24
<b>Total (A + B)<sup>b</sup></b>	<b>12 402</b>	<b>9 083</b>	<b>-27</b>
<b>Total (A + C)<sup>c</sup></b>	<b>12 863</b>	<b>9 439</b>	<b>-27</b>

a) Corinair methodology.

b) IPCC methodology.

c) Emissions related to activity in Luxembourg.

Source: Ministry of the Environment.



### *Climate change policy objectives*

In 1990 the Luxembourg Government decided to *stabilise CO<sub>2</sub> emissions* at 1990 levels by 2000 and to *reduce them by 20% by 2005*. In the framework of the EU agreement on burden-sharing to implement the Kyoto Protocol, Luxembourg committed itself to reducing greenhouse gas emissions by 28% over 1990 levels by 2008-12 (Table 7.2). This is the highest reduction figure agreed by the 15 EU member states. Luxembourg drafted a national CO<sub>2</sub> emission control programme in March 1993, updated it in 1994, and in March 1995 presented a country report to the first Conference of Parties to the Framework Convention on Climate Change (FCCC).

The current strategy to cut greenhouse gas emissions is largely based on a “*no regrets*” policy. At this stage it consists of measures related to energy saving (insulation, energy audits, accelerated depreciation and energy labelling of household appliances), renewable energy sources (development of wind power stations) and co-generation (indirect assistance via the price paid for electricity fed into the grid). Renewables account for just 1% of total primary energy supply, one of the lowest rates among IEA countries. The main forms used are biomass, waste and solar (water heating). According to the Ministry of Economy’s Energy Division, the technical potential of renewables represents only 2.5% of primary energy requirements. However low prices for renewables may fall, Luxembourg is likely to continue to meet over 97% of its energy needs with imports.

The *transport sector* is a major source of CO<sub>2</sub> emissions in Luxembourg (52% in 1998), and the proportion is rising because of “gasoline tourism”, with fuel sold in Luxembourg being used elsewhere. Such transactions, stemming from fuel price differentials between Luxembourg and neighbouring countries, generate added vehicle movements and pollutant emissions in Luxembourg.

Discussions on a national programme to reduce CO<sub>2</sub> emissions are expected to result in a *national plan* by 2002, with a *multi-year programme* then being implemented. In May 1990 a national greenhouse gas reduction strategy was drawn up. Luxembourg’s air quality improvement plan is being finalised.

Luxembourg has met *all its international commitments* on CO<sub>2</sub> emissions. The target of a 28% reduction by 2010 is achievable, provided that current and proposed measures are carried through.

### ***Protection of the ozone layer***

In 1990 Luxembourg imported 75 tonnes of CFC 11 and 12, 6.7 tonnes of CFC 113, 114 and 115, and 0.6 tonne of halons. *Following the implementation of the Montreal Protocol and the relevant EU regulations, these imports rapidly ended.* Efforts at present focus on eliminating HCFCs by 2010. Methyl bromide is not used in Luxembourg.

A facility to *decontaminate* refrigerator coolant systems has been set up to *recover CFCs* and ammonia. CFCs in insulating foam are also recovered. Around 70% of discarded refrigerators, or 11 000 a year, are processed in this way. The government and communes share the cost. In a number of intercommunal syndicates, refrigerator owners must pay LUF 1 500 for freon recovery. Overall, the system seems to be satisfactory. Old refrigerators not processed in the system are exported, taken by scrap dealers or in some cases simply dumped.

### ***Protection of nature and biodiversity***

Luxembourg has long been a party to the Bonn and Berne conventions. It ratified the 1971 Ramsar wetlands convention in 1998. Luxembourg has designated 38 controlled areas under the habitats directive (35 200 hectares) and 15 special protection areas under the wild birds directive (16 500 hectares) (Table 4.2). The German-Luxembourg Our natural park has not yet been formally established on the Luxembourg side. Luxembourg is a party to the London agreement on bat conservation in Europe, and put forward its strategy in the framework of the Biodiversity Convention.

### ***Follow-up to the Rio Conference (UNCED)***

With regard to integration of social, economic and environmental policies, Luxembourg occupies a special position in the European Union, with *the lowest unemployment rate, the highest level of social benefits* and a high gross minimum wage. Groups representing employees seek to maintain these advantages.

In 1999 Luxembourg prepared a *sustainable development plan*; significant consultation still has to take place before it is finalised. The association of local authorities is seeking to promote the development of local Agenda 21 plans; a few have been completed.

### ***Environment and trade***

In the early 1990s, Luxembourg took part in work to arrange for *regional management of hazardous waste* generated in the Saar-Lor-Lux area. The work proved inconclusive, and Luxembourg's waste is exported to more distant regions.

Luxembourg takes an active part in international work on *sustainable forest management*. It backs the adoption of common European eco-labels to identify timber from sustainably managed woodlands (eco-certification), and efforts to arrive at a global convention on forests.

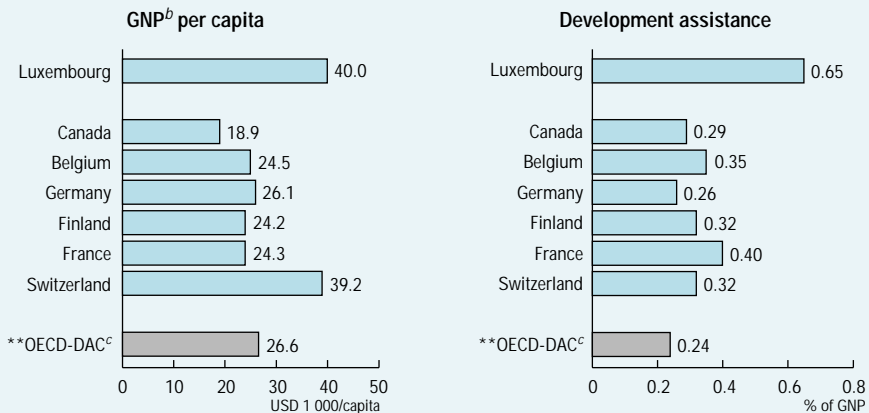
#### 4. Development Assistance and Aid to the Economies in Transition

##### Official development assistance

Luxembourg is among the few countries whose official development assistance (ODA) has risen since 1986, at which time it amounted to 0.16% of GDP. In 1998 ODA came to 0.65% of GNP (Figure 7.1). *In 2000 it is expected to reach 0.70% of GDP*, or USD 234 per capita. In 1999 the government committed itself to increasing aid to 1% of GDP by around 2004. In 1997 Luxembourg was the fifth-ranking OECD country in relative terms. Out of USD 107 million in 1997, USD 75 million was bilateral aid, slightly higher in percentage terms than the DAC average. Luxembourg's main aid recipients are Cape Verde, Namibia, Vietnam, Nicaragua, Niger, Senegal, El Salvador and Burkina Faso. The Ministry of Foreign Affairs manages around 81% of aid and the Ministry of Finance some 6%.

NGOs in Luxembourg make a significant contribution to development aid, with payments of LUF 200 million in 1998, or USD 12 per capita. Funds disbursed by or via NGOs total more than LUF 900 million, or 22% of the country's ODA.

Figure 7.1 Official development assistance, 1998<sup>a</sup>



a) Provisional data.  
 b) GNP in USD at current exchange rates.  
 c) Member countries of the OECD Development Assistance Committee.  
 Source: OECD-DAC.

### ***ODA and the environment***

The 1996 Development co-operation Act defines *sustainable economic and social development* of developing countries as one of its three objectives for co-operation, and selected environmental co-operation as one of eight priority sectors for operations. *Funding for environmental protection has been growing*, reflecting increased requests from developing countries in this sphere.

Nearly USD 1.4 million in bilateral aid was devoted in 1996 to water distribution and sewage systems. In addition, an environmental dimension was included in other bilateral projects, multilateral aid funding was devoted to the environment and a project for targeted sorting of household waste was launched. *Increasing attention is to be paid to water policy, waste collection, desertification and curbing overexploitation of fisheries*. In 1998 expenditure relating to the environment, water distribution and sewage amounted to *10% of total bilateral expenditure*; the figure expected for 1999 is 8%.

With regard to multilateral aid, Luxembourg is involved in numerous environmental projects. Mention may be made of its participation in the Global Environment Facility (GEF), to which Luxembourg has contributed LUF 400 million since 1991. The country's contribution to the GEF is 2.6 times the "normal" share for other such multilateral operations.

The co-operation department has requested Lux-Development to analyse the *environmental impact of all projects* at the project formulation stage. Impact assessments are carried out in all cases where it seems appropriate, for road projects for example. But the assessments are not passed to the Ministry of the Environment for consideration.

### ***Co-operation with the transition economies***

Luxembourg provides financial assistance to *promote transition* in Central and Eastern European countries. In 1998 this aid totalled LUF 120 million, of which LUF 18 million was for environmental purposes.

*Recipient countries* for projects in the 1990s were the Czech Republic (otter protection, renewable energy sources, organic farming), Hungary (protection of a lake), Romania (establishment of an environmental centre) and Slovakia (master plan for nature conservation). In addition, the Ministry of Finance funded technical assistance to Russia (forestry sector) and the Czech Republic (waste water) and proposed to take part in funding greenhouse gas activities of the European Bank for Reconstruction and Development.

## 5. Environmental Performance

Luxembourg has long co-operated with neighbouring countries on environmental matters at local, regional and central government levels. These various types of co-operation have brought *beneficial exchanges of information, greater understanding* of environmental problems in border regions and practical achievements at local level. *Senior regional officials with environmental responsibilities* meet annually, which is certainly a positive step. But press releases have not yet pointed to much significant progress in managing the environment at regional level. Information is supplied on activities with transboundary effects, and consultations are held, but this work will have to be stepped up as a number of international conventions and EU directives take effect.

Luxembourg makes considerable efforts to *implement EU directives and international agreements on the environment without delay*. With only a few officials dealing with international environmental questions, Luxembourg cannot take part in all the many international activities on the environment, and is sometimes delayed in ratifying treaties and introducing implementing regulation. The transposition of EU directives into Luxembourg is a high priority. The adoption of standards, however stringent, does not seem to have raised problems with competitiveness. But this approach does not seem to hold for obligations affecting the public authorities rather than industry or households. Preparing, approving and implementing strategies or plans required under directives is a drawn-out process. Public investment is funded through government subsidies and assistance rather than economic instruments such as taxes and charges. As a result, *Luxembourg has not fulfilled all its international obligations, for lack of financial resources*. While the use of subsidies to support adjustment is an exception authorised under the polluter pays principle, the lack of significant charges or taxes to fund capital expenditure for pollution control (water, air, waste) seems to be an example of failure to apply the polluter pays principle, which Luxembourg has endorsed in a number of international agreements.

### ***Bilateral and regional co-operation***

Significant headway has been made on reducing pollution in the country's rivers but Luxembourg has still not met its EU obligation to *install tertiary waste water treatment facilities*, which should have been built by 1998. The investment programme to be funded is substantial, especially since Luxembourg does not adequately apply full-cost pricing and does not collect sufficient pollution levies, either nationally or locally. For lack of independent funding, subsidies are required from government, local authorities and intercommunal syndicates.

Co-operation on *managing transboundary rivers* made substantial headway during the 1990s with the collection of environmental data and the commissioning

of numerous treatment facilities. A few bilateral water management operations (e.g. on waste water treatment and maintaining river levels) have been conducted. A regional flood control plan for the Moselle is expected to be launched.

Luxembourg became a party to the *Paris Convention* in 1998, and thus has an obligation to implement the 80 OSPAR recommendations. The burden will not be too onerous, since Luxembourg has already applied the EU directives on chemicals.

Co-operation on *pollution of the Moselle* was stepped up during the 1990s, but it will be necessary to cut polluting discharges in the countries concerned and, most of all, to reduce (rather than increase) chloride levels, which remain above the figure recommended in 1993 (200 mg/litre at Koblenz) by the international bodies dealing with commission on pollution in the Moselle and the Sarre.

*Transboundary air pollution* is covered by a range of international obligations. Luxembourg has met its commitments to cut SO<sub>x</sub> emissions, in full and ahead of time. NO<sub>x</sub> emission levels have temporarily been slightly too high given the target of stable levels from 1994 onwards. It seems probable that VOC commitments of a 30% reduction by 2000 will be met. Luxembourg's *proposed reductions by 2010 for NO<sub>x</sub> and VOCs are ambitious* for a country that cannot easily control its volume of national and international road traffic. Lead, PAHs and dioxin have been significantly reduced.

### ***Global co-operation***

Luxembourg has adopted *very ambitious objectives for reducing greenhouse gas emissions*. By 1998 it had cut its emissions of such gases by over 28% from 1990 levels, and it should also be in a position to meet the EU objective for 2008-12. This very satisfactory result is due largely to the abandonment of blast furnace methods in steelmaking. Measures to cut energy consumption have had fairly limited effects, and neither their actual effects nor their cost-effectiveness has been evaluated. In 2000, *Luxembourg remains the OECD country emitting the most CO<sub>2</sub> per capita*.

With regard to the ozone layer, the *rapid ending of CFC and halon imports*, and a system of CFC recovery from refrigerators, are success stories.

Luxembourg's ODA has increased markedly in recent years. Its level is well above average: *in 2000, Luxembourg will probably be one of the few countries to achieve the Rio target of 0.7% of GNP*. Increasing attention is paid to environmental protection: Luxembourg assigns almost 10% of its development assistance to this sector.



# **ANNEXES**

I. Selected environmental data

II. Selected economic data and trends

III.A. Selected multilateral agreements (worldwide)

III.B. Selected multilateral agreements (regional)

IV. Chronology of selected environmental events (1990-99)



**Annex I: Selected environmental data<sup>1</sup>**

	LUX	CAN	MEX	USA	JPN	KOR	AUS	NZL	AUT	BEL	CZE	DNK
<b>LAND</b>												
Total area (1 000 km <sup>2</sup> )	3 9	9 71	1 958	9 364	378	99	7 713	270	84	31	79	43
Major protected areas (% of total area) <sup>2</sup>	6.5	9.6	8.2	21.2	6.8	6.9	7.7	23.5	29.2	2.8	16.2	32.0
Nitrogenous fertiliser use (t/km <sup>2</sup> of arable land)	<i>a</i>	4.1	4.4	6.2	11.5	23.1	1.7	37.3	7.6	18.8	6.8	12.3
<b>FOREST</b>												
Forest area (% of land area).....	34.4	45.3	33.4	32.6	66.8	65.2	19.4	29.5	47.6	22.2	34.1	10.5
Use of forest resources (harvest/growth) .	0.5	0.4	0.2	0.6	0.3	0.1	..	0.6	0.6	0.9	0.7	0.6
Tropical wood imports (USD/cap.) <sup>3</sup>	<i>a</i>	0.8	0.1	1.6	18.4	11.1	4.6	2.6	0.2	12.3	0.1	4.4
<b>THREATENED SPECIES</b>												
Mammals (% of species known).....	51.6	19.2	33.2	10.5	7.7	17.0	14.9	15.2	35.4	31.6	33.3	24.0
Birds (% of species known).....	50.0	10.8	16.9	7.2	8.3	15.0	6.4	25.3	37.0	27.5	66.1	10.6
Fish (% of species known).....	27.9	6.4	5.7	2.4	11.1	1.3	0.4	0.8	65.5	54.3	29.2	18.2
<b>WATER</b>												
Water withdrawal (% of gross annual availability) .....	3.4	1.7	17.4	19.9	20.8	35.6	4.3	0.6	2.7	42.5	15.6	15.7
Fish catches (% of world catches).....	–	1.0	1.6	5.4	6.3	2.4	0.2	0.6	–	–	–	2.0
Public waste water treatment (% of population served).....	88	78	22	71	55	53	..	80	75	27	59	87
<b>AIR</b>												
Emissions of sulphur oxides (kg/cap.).....	8.4	89.7	24.4	69.3	7.2	32.9	100.6	12.3	7.1	23.6	68.0	20.7
" (kg/1 000 USD GDP) <sup>4</sup> .....	0.2	4.3	3.9	2.5	0.4	2.9	5.2	0.8	0.4	1.3	6.2	1.0
Emissions of nitrogen oxides (kg/cap.).....	39.6	67.8	17.2	80.2	11.3	27.6	118.3	45.9	21.3	32.8	41.1	46.9
" (kg/1 000 USD GDP) <sup>4</sup> .....	1.2	3.4	2.8	2.9	0.6	2.5	6.1	3.1	1.1	1.8	3.8	2.2
Emissions of carbon dioxide (t./cap.) <sup>5</sup>	20.5	15.9	3.7	20.5	9.3	9.2	16.5	8.8	7.9	12.0	11.7	11.8
" (t./1 000 USD GDP) <sup>4</sup>	0.62	0.77	0.60	0.75	0.45	0.78	0.83	0.59	0.42	0.63	1.08	0.56
<b>WASTE GENERATED</b>												
Industrial waste (kg/1 000 USD GDP) <sup>4, 6</sup>	149	..	60	..	57	71	119	33	75	74	345	25
Municipal waste (kg/cap.) <sup>7</sup>	590	500	310	720	400	400	690	350	510	480	310	560
Nuclear waste (t./Mtoe of TPES) <sup>8</sup>	–	5.6	0.3	1.0	1.9	2.1	–	–	–	1.4	1.1	–
<b>NOISE</b>												
Population exposed to leq>65dB(A) (million inh.) <sup>9</sup>	..	..	..	17.2	38.0	..	..	..	1.2	1.2	1.5	0.5

.. Not available.

– Nil or negligible.

\* Figures in italics include: for Germany: western Germany only;  
for United Kingdom: threatened species: Great Britain only.  
water withdrawal and public waste water treatment: England and Wales only.

a) Data for Luxembourg are included under Belgium.

1. Data refer to the latest available year. They include provisional figures and Secretariat estimates. Partial totals are underlined. Varying definitions can limit comparability across countries.

2. Data refer to IUCN categories I to VI; AUS, HUN, TUR: national data.

Source: OECD Environmental Data, Compendium 1999.

*Annex I: Selected environmental data<sup>1</sup>*

FIN	FRA	DEU*	GRC	HUN	ISL	IRL	ITA	NLD	NOR	POL	PRT	ESP	SWE	CHE	TUR	UKD*	OECD*
338	549	357	132	93	103	70	301	42	324	313	92	506	450	41	779	245	34 728
8.4	10.1	26.9	2.6	9.1	9.5	0.9	7.3	11.6	24.2	9.4	6.6	8.4	8.1	18.0	3.8	20.4	12.6
7.1	13.4	14.8	7.8	5.4	8.9	43.2	8.4	37.7	12.3	6.1	4.0	5.4	7.3	12.8	4.3	19.5	6.4
75.5	31.4	30.1	22.8	18.9	1.3	8.8	23.3	9.2	39.2	29.7	37.9	32.3	73.5	31.7	26.9	10.5	33.8
0.8	0.7	0.4	0.6	0.6	–	0.6	0.3	0.6	0.4	0.6	0.8	0.5	0.7	0.5	0.4	0.7	0.6
1.9	7.1	2.0	3.4	0.1	4.0	10.1	6.6	17.3	4.5	0.2	19.9	6.2	2.0	0.5	0.9	3.3	5.1
11.9	20.2	36.7	37.9	71.1	–	6.5	32.2	15.6	5.9	15.5	17.3	21.2	18.2	34.2	22.2	22.2	..
6.7	14.3	29.2	13.0	18.8	13.3	21.8	24.7	27.1	6.3	16.6	13.7	14.1	8.6	42.6	6.7	6.8	..
11.9	6.6	68.2	24.3	32.1	–	33.3	..	82.1	–	27.1	18.6	29.4	12.7	44.7	9.9	11.1	..
2.2	23.9	24.4	12.1	5.0	0.1	2.6	32.2	4.9	0.7	18.7	11.9	36.8	1.5	4.9	15.2	14.6	11.8
0.2	0.6	0.3	0.2	–	2.4	0.3	0.4	0.5	3.1	0.4	0.2	1.2	0.4	–	0.5	1.0	30.9
77	77	89	45	22	4	61	61	97	67	47	21	48	93	94	12	88	<u>59</u>
19.5	16.2	15.8	48.3	64.7	32.1	48.7	23.1	8.0	6.9	61.3	36.2	49.1	10.3	4.6	29.8	34.5	39.2
1.1	0.9	0.8	4.6	8.0	1.7	2.5	1.3	0.4	0.3	10.8	3.3	3.5	0.6	0.2	5.2	2.0	2.2
50.5	29.1	21.7	35.2	19.4	105.6	33.9	30.9	28.5	50.6	29.9	37.6	31.7	38.1	18.2	14.5	35.0	40.6
2.9	1.5	1.2	3.3	2.4	5.4	1.8	1.7	1.5	2.2	5.2	3.4	2.3	2.1	0.8	2.5	2.0	2.3
12.5	6.2	10.8	7.7	5.7	8.9	10.3	7.4	11.8	7.8	9.1	5.2	6.5	6.0	6.3	2.9	9.4	11.2
0.71	0.32	0.59	0.72	0.71	0.46	0.58	0.40	0.61	0.34	1.49	0.44	0.44	0.33	0.29	0.51	0.52	0.62
139	92	45	60	86	2	78	21	30	30	94	4	26	97	10	94	57	81
410	590	460	370	490	550	560	460	560	630	320	380	390	360	600	330	480	500
2.1	4.6	1.3	–	2.2	–	–	–	0.2	–	..	–	1.8	4.6	2.4	–	3.6	1.6
0.2	9.4	9.5	2.0	..	..	..	..	0.6	0.5	..	3.0	8.9	0.3	0.8	..	5.7	<u>124.0</u>

3. Total imports of cork and wood from non-OECD tropical countries.

4. GDP at 1991 prices and purchasing power parities.

5. CO<sub>2</sub> from energy use only; international marine bunkers are excluded.

6. Waste from manufacturing industries.

7. NZL: household waste only.

8. Waste from spent fuel arising in nuclear power plants, in tonnes of heavy metal, per million tonnes of oil equivalent of total primary energy supply.

9. Road traffic noise.

*Annex II: Selected economic data and trends<sup>1</sup>*

	LUX	CAN	MEX	USA	JPN	KOR	AUS	NZL	AUT	BEL	CZE	DNK
<b>TOTAL AREA</b> (1 000 km <sup>2</sup> ) .....	3 9	9 71	1 958	9 364	378	99 7	713	270	84	31	79	43
<b>POPULATION</b>												
Total population, 1999 (100 000 inh.)	4	305	975	2 713	1 267	469	190	38	81	102	103	53
% change (1980-1999).....	<b>18.3</b>	24.2	40.0	19.2	8.2	22.9	29.3	20.3	7.2	3.9	-0.4	3.9
Population density, 1999 (inh./km <sup>2</sup> )	<b>167.0</b>	3.1	49.8	29.0	335.4	471.8	2.5	14.0	96.5	335.0	130.4	123.5
<b>GROSS DOMESTIC PRODUCT<sup>2</sup></b>												
GDP, 1999 (billion USD).....	<b>15</b>	666	629	7 936	2 579	553	403	57	161	203	109	115
% change (1980-1999).....	<b>145.6</b>	62.4	50.9	77.9	66.9	286.1	88.8	54.1	52.0	42.0	..	52.3
per capita, 1999 (1 000 USD/cap.).....	<b>35.5</b>	21.8	6.5	29.2	20.4	11.8	21.2	15.1	19.9	19.9	10.6	21.7
<b>INDUSTRY<sup>3</sup></b>												
Value added in industry (% of GDP) ...	<b>21</b>	27	26	26	37	43	26	26	30	28	37	24
Industrial production – % change (1980-1998).....	<b>61</b>	51	60	65	45	382	53	34	65	33	-10	66
<b>AGRICULTURE</b>												
Value added in agriculture (% of GDP) <sup>4</sup>	<b>1</b>	2	6	2	2	6	3	7	1	1	4	4
<b>ENERGY SUPPLY</b>												
Total supply, 1998 (Mtoe) .....	<b>3</b>	234	148	2 182	510	163	105	17	29	58	41	21
% change (1980-1998).....	<b>-8.9</b>	21.4	49.5	20.4	47.2	296.2	49.2	85.5	22.9	26.6	-13.2	5.4
Energy intensity, 1998 (Toe/1 000 USD)	<b>0.23</b>	0.36	0.24	0.29	0.20	0.32	0.27	0.31	0.18	0.29	0.37	0.18
% change (1980-1998).....	<b>-61.0</b>	-22.5	2.5	-29.7	-10.6	11.9	-17.9	23.6	-17.4	-9.2	..	-29.9
Structure of energy supply, 1998 (%) <sup>5</sup>												
Solid fuels .....	<b>5.2</b>	16.5	10.0	27.1	18.0	21.6	48.1	10.9	22.3	15.7	52.5	33.7
Oil .....	<b>72.3</b>	34.7	62.3	39.9	51.1	56.2	33.6	38.4	43.4	42.2	20.2	45.2
Gas.....	<b>22.2</b>	28.9	21.3	22.8	11.7	7.6	16.9	24.2	23.3	21.4	18.6	19.9
Nuclear.....	-	7.9	1.6	8.5	17.0	14.3	-	-	-	20.7	8.3	-
Hydro, etc. ....	<b>0.4</b>	12.1	4.7	1.8	2.2	0.2	1.4	26.5	11.1	0.1	0.4	1.2
<b>ROAD TRANSPORT<sup>6</sup></b>												
Road traffic volumes, 1998												
billion veh.-km .....	<b>4</b>	280	54	4 223	772	75	187	29	60	85	31	44
% change (1980-1998).....	<b>73.0</b>	36.4	27.9	72.9	98.5	763.2	63.3	77.4	70.3	76.5	45.9	67.3
per capita (1 000 veh.-km/cap.) .....	<b>9.0</b>	9.2	0.6	15.7	6.1	1.6	10.0	7.9	7.5	8.3	3.0	8.3
Road vehicle stock, 1998												
10 000 vehicles.....	<b>28</b>	1 804	1 389	21 443	7 082	1 047	1 126	216	471	499	377	219
% change (1980-1998).....	<b>93.4</b>	36.5	138.4	37.6	91.1	1 883.6	55.0	37.8	67.6	43.4	95.3	32.6
per capita (veh./100 inh.) .....	<b>66</b>	60	15	80	56	23	60	58	58	49	37	41

.. Not available.

- Nil or negligible.

\* Figures in italics include western Germany only.

Source: OECD Environmental Data, Compendium 1999.

Annex II: Selected economic data and trends<sup>1</sup>

FIN	FRA	DEU*	GRC	HUN	ISL	IRL	ITA	NLD	NOR	POL	PRT	ESP	SWE	CHE	TUR	UKD	OECD*
338	549	357	132	93	103	70	301	42	324	313	92	506	450	41	779	245	34 728
52	591	822	105	101	3	37	577	158	44	387	100	394	89	71	659	594	11 086
8.1	9.7	5.0	9.2	-5.9	20.9	9.8	2.2	11.5	8.8	8.8	1.8	5.5	6.8	11.8	48.3	5.5	15.2
15.3	107.6	230.2	79.8	108.3	2.7	53.1	191.5	380.0	13.7	123.8	108.7	77.9	19.7	172.9	84.6	242.7	31.9
99	1 203	1 564	119	90	6	77	1 085	321	104	255	126	622	171	158	370	1 114	20 908
58.5	44.3	<u>42.0</u>	41.3	..	67.8	151.9	38.9	57.3	70.6	..	66.6	64.5	38.4	28.8	125.0	55.9	<u>66.5</u>
19.1	20.3	19.0	11.3	8.9	21.3	20.6	18.8	20.3	23.4	6.6	12.6	15.8	19.3	22.2	5.6	18.7	18.9
30	26	29	20	32	22	39	31	27	32	39	35	32	27	..	31	28	29
88	21	25	19	14	..	321	27	36	117	..	75	39	61	37	227	34	49
4	2	1	12	7	9	5	3	3	2	8	4	3	2	..	14	2	3
33	256	345	27	25	3	13	168	74	25	96	22	113	52	27	73	233	5 097
31.7	34.5	-4.4	69.0	-12.8	78.8	56.2	21.1	14.5	35.3	-21.9	112.3	64.4	28.0	27.5	131.6	15.7	25.5
0.35	0.22	0.22	0.23	0.29	0.47	0.19	0.16	0.24	0.25	0.39	0.18	0.19	0.32	0.17	0.19	0.21	0.25
-13.9	-4.5	<u>-37.8</u>	23.5	..	12.9	-32.7	-11.9	-25.0	-20.3	..	31.4	3.6	-3.9	0.4	0.6	-24.5	<u>-22.0</u>
35.5	10.8	25.5	36.8	17.8	2.6	23.3	8.2	13.4	9.3	71.0	19.4	18.6	19.9	5.9	40.1	18.4	23.9
32.9	35.5	40.6	58.8	28.9	31.2	54.9	56.9	37.5	34.0	18.9	72.0	54.7	30.5	49.8	42.0	35.9	41.9
10.2	12.8	21.1	2.7	38.8	-	21.2	31.1	47.6	17.1	9.8	3.2	10.3	1.3	8.7	12.4	34.2	20.6
17.4	38.8	12.2	-	14.4	-	-	-	1.4	-	-	-	13.7	36.2	24.9	-	11.3	10.9
4.0	2.1	0.5	1.7	0.1	66.2	0.7	3.8	0.1	39.5	0.2	5.5	2.7	12.1	10.7	5.5	0.2	2.8
45	491	596	59	27	2	30	495	109	31	128	55	161	73	50	50	454	8 700
67.5	66.0	47.5	187.7	42.6	99.8	62.4	118.5	61.0	63.2	187.2	153.8	127.7	64.2	39.7	237.9	87.7	76.7
8.7	8.3	7.3	5.6	2.7	6.5	8.1	8.6	6.9	7.0	3.3	5.5	4.1	8.2	7.1	0.8	7.7	7.9
231	3 230	4 427	365	273	16	138	3 433	732	221	1 055	425	1 927	415	367	516	2 997	56 468
66.9	48.8	61.0	189.0	132.0	65.3	71.9	77.2	60.5	58.3	244.0	252.7	115.0	34.7	51.1	340.4	72.7	62.4
45	55	54	35	27	58	37	60	47	50	27	43	49	47	52	8	51	51

1. Data may include provisional figures and Secretariat estimates. Partial totals are underlined.

2. GDP at 1991 prices and purchasing power parities.

3. Value added: includes mining and quarrying, manufacturing, gas, electricity and water and construction; HUN, POL: as % of total of branches at basic prices; production: excludes construction; WDEU: % change 1980-1997.

4. Agriculture, forestry, hunting, fishery, etc. HUN, POL: as % of total of branches at basic prices.

5. Breakdown excludes electricity trade.

6. Refers to motor vehicles with four or more wheels, except for Japan and Italy, which include three-wheeled goods vehicles.

**Annex III.A: Selected multilateral agreements (worldwide)**

Y = in force S = signed R = ratified D = denounced

		CAN	MEX	USA	JPN	KOR	AUS	
1949	Geneva	Conv. – Road traffic .....	Y	R		R	R	R
1963	Vienna	Conv. – Civil liability for nuclear damage .....	Y		R			
1988	Vienna	Joint protocol relating to the application of the Vienna Convention and the Paris Convention .....	Y					
1997	Vienna	Protocol to amend the Vienna convention .....						
1970	Bern	Conv. – Transport of goods by rail (CIM) .....	Y					
1971	Ramsar	Conv. – Wetlands of international importance especially as waterfowl habitat .....	Y	R	R	R	R	R
1982	Paris	Protocol .....	Y	R	R	R	R	R
1987	Regina	Regina amendment .....						
1971	Geneva	Conv. – Protection against hazards of poisoning arising from benzene (ILO 136) .....	Y					
1972	London, Moscow, Washington	Conv. – International liability for damage caused by space objects .....	Y	R	R	R	R	R
1972	Paris	Conv. – Protection of the world cultural and natural heritage .....	Y	R	R	R	R	R
1973	Washington	Conv. – International trade in endangered species of wild fauna and flora (CITES) .....	Y	R	R	R	R	R
1974	Geneva	Conv. – Prev. and control of occup. hazards caused by carcinog. subst. and agents (ILO 139) .....	Y				R	
1977	Geneva	Conv. – Protec. of workers against occup. hazards in the working env. due to air poll., noise and vibrat. (ILO 148) .....	Y					
1979	Bonn	Conv. – Conservation of migratory species of wild animals .....	Y					R
1991	London	Agreem. – Conservation of bats in Europe .....	Y					
1983	Geneva	Agreem. – Tropical timber .....	Y	R		R	R	R
1994	New York	Revised agreem. – Tropical timber .....	Y	R		R	R	R
1985	Vienna	Conv. – Protection of the ozone layer .....	Y	R	R	R	R	R
1987	Montreal	Protocol (substances that deplete the ozone layer) .....	Y	R	R	R	R	R
1990	London	Amendment to protocol .....	Y	R	R	R	R	R
1992	Copenhagen	Amendment to protocol .....	Y	R	R	R	R	R
1997	Montreal	Amendment to protocol .....	Y	R				R
1986	Vienna	Conv. – Early notification of a nuclear accident .....	Y	R	R	R	R	R
1986	Vienna	Conv. – Assistance in the case of a nuclear accident or radiological emergency .....	Y	S	R	R	R	R
1989	Basel	Conv. – Control of transboundary movements of hazardous wastes and their disposal .....	Y	R	R	S	R	R
1995		Amendment .....						
1990	Geneva	Conv. – Safety in the use of chemicals at work (ILO 170) .....	Y		R			
1992	Rio de Janeiro	Conv. – Biological diversity .....	Y	R	R	S	R	R
1992	New York	Conv. – Framework convention on climate change .....	Y	R	R	R	R	R
1997	Kyoto	Protocol .....		S	S	S	S	S
1993	Geneva	Conv. – Prevention of major industrial accidents (ILO 174) .....	Y					
1994	Vienna	Conv. – Nuclear safety .....	Y	R	R	R	R	R
1994	Paris	Conv. – Combat desertification in those countries experiencing serious drought and/or desertification, particularly in Africa .....	Y	R	R	S	R	S
1996	The Hague	Agreem. – Conservation of African-Eurasian migratory waterbirds .....						
1997	Vienna	Conv. – Supplementary compensation for nuclear damage .....				S		S



**Annex III.A: Selected multilateral agreements (worldwide) (cont.)**

Y = in force S = signed R = ratified D = denounced

		CAN	MEX	USA	JPN	KOR	AUS
1997	Vienna						
	Conv. – Joint convention on the safety of spent fuel management and on the safety of radioactive waste management .....	R		S		S	S
1997	New York						
	Conv. – Law of the non-navigational uses of international watercourses .....						
1998	Rotterdam						
	Conv. – Prior informed consent procedure for hazardous chemicals and pesticides (PIC) .....			S	S	S	S

Source: IUCN; OECD.

**Annex III.A: Selected multilateral agreements (worldwide) (cont.)**

Y = in force S = signed R = ratified D = denounced

NZL AUT BEL CZE DNK FIN FRA DEU GRC HUN ISL IRL ITA LUX NLD NOR POL PRT ESP SWE CHE TUR UKD EU

	S	S	R	R	S	S	R	S	R		S	S	S	S	R	S		R	R	S		S	
					R		S		S			S		R		S							
S	S	S	S	S	S	S	S	S	S		S	S	S	S	S	S	S	S	S	S	S	S	S



**Annex III.B: Selected multilateral agreements (regional)**

Y = in force S = signed R = ratified D = denounced

		CAN	MEX	USA	JPN	KOR	AUS	
1885	Berlin	Treaty – Regulation of Salmon Fishery in the Rhine River Basin.....						Y
1933	London	Conv. – Preservation of fauna and flora in their natural state.....						Y
1940	Washington	Conv. – Nature protection and wild life preservation in the Western Hemisphere.....						Y R R
1950	Brussels	Agreem. – Prior consultation concerning setting up near the border of permanent storage of explosive substances.....						Y
1950	Paris	Conv. – Protection of birds.....						Y
1950	Brussels	Protocole to establish a tripartite standing committee on polluted waters.....						Y
1957	Geneva	Agreem. – International carriage of dangerous goods by road (ADR).....						Y
1975	New York	Protocol.....						Y
1958	Geneva	Agreem. – Adoption of unif. cond. of approv. and recip. recogn. of approv. for motor veh. equip. and parts.....						Y
1959	Washington	Treaty – Antarctic.....						Y R R R R R
1991	Madrid	Protocol to the Antarctic treaty (environmental protection) ...						S S S S R
1960	Paris	Conv. – Third party liability in the field of nuclear energy.....						Y
1963	Brussels	Supplementary convention.....						Y
1964	Paris	Additional protocol to the convention.....						Y
1964	Paris	Additional protocol to the supplementary convention.....						Y
1982	Brussels	Protocol amending the convention.....						Y
1982	Brussels	Protocol amending the supplementary convention.....						Y
1988	Vienna	Joint protocol relating to the application of the Vienna Convention and the Paris Convention.....						Y
1961	Paris	Prot. – Constitution of an int'l commission for the protection of the Mosel against pollution.....						Y
1990	Brussels	Complementary protocol (int'l commi. for the protection of Mosel and Sarre).....						Y
1992	Maria Laach	2d compl.prot. (to int'l commi. protec. of Mosel and Sarre, and to first compl. prot.).....						Y
1963	Bern	Agreem. – International commission for the protection of the Rhine against pollution.....						Y
1976	Bonn	Supplementary agreement.....						Y
1976	Bonn	Conv. – Protection of the Rhine against chemical pollution ...						Y
1976	Bonn	Conv. – Protection of the Rhine from pollution by chlorides (modified by exchanges of letters).....						Y
1991	Brussels	Protocol.....						Y
1999	Bern	Conv. – Protection of the Rhine.....						Y
1964	Brussels	Agreem. – Measures for the conservation of Antarctic Fauna and Flora.....						Y R R R
1968	Strasbourg	Agreem. – Restriction of the use of certain detergents in washing and cleaning products.....						Y
1983	Strasbourg	Protocol.....						Y
1968	Paris	Conv. – Protection of animals during international transport.....						Y
1979	Strasbourg	Protocol.....						Y
1969	London	Conv. – Protection of the archaeological heritage.....						Y
1970	Brussels	Conv. – Benelux convention on the hunting and protection of birds.....						Y



**Annex III.B: Selected multilateral agreements (regional) (cont.)**

Y = in force S = signed R = ratified D = denounced

		CAN	MEX	USA	JPN	KOR	AUS
1972	Oslo						
	Conv. – Prevention of marine pollution by dumping from ships and aircraft .....	Y					
1983	Protocol .....	Y					
1972	London						
	Conv. – Conservation of Antarctic seals .....	Y	R		R	R	R
1974	Paris						
	Conv. – Prevention of marine pollution from land-based sources .....	Y					
1986	Paris						
	Protocol .....	Y					
1992	Paris						
	Conv. – Protection of North-East Atlantic marine env. (replace Oslo-1972 and Paris-1974) .....	Y					
1979	Bern						
	Conv. – Conservation of European wildlife and natural habitats .....	Y					
1979	Geneva						
	Conv. – Long-range transboundary air pollution .....	Y	R		R		
1984	Geneva						
	Protocol (financing of EMEP) .....	Y	R		R		
1985	Helsinki						
	Protocol (reduction of sulphur emissions or their transboundary fluxes by at least 30%) .....	Y	R				
1988	Sofia						
	Protocol (control of emissions of nitrogen oxides or their transboundary fluxes) .....	Y	R		R		
1991	Geneva						
	Protocol (control of emissions of volatile organic compounds or their transboundary fluxes) .....	Y	S		S		
1994	Oslo						
	Protocol (further reduction of sulphur emissions) .....	Y	R				
1998	Aarhus						
	Protocol (heavy metals) .....				R	S	
1998	Aarhus						
	Protocol (persistent organic pollutants) .....				R	S	
1999	Gothenburg						
	Protocol (abate acidification, eutrophication and ground-level ozone) .....				S	S	
1980	Madrid						
	Conv. – Transfrontier co-operation between territorial communities or authorities .....	Y					
1995	Strasbourg						
	Additional protocol .....	Y					
1998	Strasbourg						
	Second protocol .....	Y					
1980	Canberra						
	Conv. – Conservation of Antarctic marine living resources .....	Y	R		R	R	R
1980	Bern						
	Conv. – International carriage of dangerous goods by train (COTIF) .....						
1982	Brussels						
	Conv. – Benelux convention on nature conservation and landscape protection .....	Y					
1989	Geneva						
	Conv. – Civil liab. for damage caused during carriage of dang. goods by road, rail, and inland navig. (CRTD) .....						
1991	Espoo						
	Conv. – Environmental impact assessment in a transboundary context .....	Y	R		S		
1992	Helsinki						
	Conv. – Transboundary effects of industrial accidents .....		S		S		
1992	Helsinki						
	Conv. – Protection and use of transboundary water courses and international lakes .....	Y					
1992	La Valette						
	European Conv. – Protection of the archaeological heritage (revised) .....	Y					
1992	Vienna						
	Agreem. – Forecast, prevention and mitigation of natural and technological disasters .....						S
1993	Lugano						
	Conv. – Civil liability for damage resulting from activities dangerous to the environment .....						
1994	Lisbon						
	Treaty – Energy Charter .....	Y			S		S
1994	Lisbon						
	Protocol (energy efficiency and related environmental aspects) .....	Y			S		S
1994	Charleville-Mézières						
	Agreem.-Protection of the Meuse .....	Y					



**Annex III.B: Selected multilateral agreements (regional) (cont.)**

Y = in force S = signed R = ratified D = denounced

		CAN	MEX	USA	JPN	KOR	AUS
1996	Agreem. – Transfrontier co-operation with Saarlorlux-Rhineland-Palatinate regions .....						
1996	Karlsruhe Agreem. – Transfrontier co-operation .....						Y
1996	Strasbourg Conv. – Disposal of waste and waste water generated from navigation on the Rhine.....						
1998	Aarhus Conv. – Access to environmental information and public participation in environmental decision-making.....						
1998	Strasbourg Conv. – Protection of the environment through criminal law .						

Source: IUCN; OECD.

**Annex III.B: Selected multilateral agreements (regional) (cont.)**

Y = in force S = signed R = ratified D = denounced

NZL	AUT	BEL	CZE	DNK	FIN	FRA	DEU	GRC	HUN	ISL	IRL	ITA	LUX	NLD	NOR	POL	PRT	ESP	SWE	CHE	TUR	UKD	EU
		S				S	S						S								S		
						S	S						S										
	S					S	S						S	S							S		
S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
S	S		S	S	S	S	S	S		S		S	S						S				S

## ***Annex IV***

# **CHRONOLOGY OF SELECTED ENVIRONMENTAL EVENTS 1990-99**

### **1990**

- The government adopts the multi-annual sewerage programme drawn up by the Ministry of Physical Development and the Environment.
- The Ministry of Energy presents its “Energy Strategy for the 1990s”, which has a strong environmental focus.
- The Ministry of Physical Development and the Environment draws up an inventory of sites that would qualify as national or regional natural parks under legislation on the protection of nature and natural resources.
- Early in the year, five violent storms leave some 1.5 million cubic metres of dead wood (4 700 hectares), representing 5% of the country’s woodland.
- Following a lorry accident on the Sûre Bridge in Martelange at the Belgian-Luxembourg border, some 12 tonnes of monochloroacetic acid is discharged into the Sûre and on into Lake Esch-sur-Sûre, a drinking water reservoir.
- A national co-ordination council for the management of household and similar waste is established to facilitate co-operation between national and communal authorities.
- The SuperDrecksKëscht programme is reorganised.
- LUXENERGIE is founded to promote installation of combined heat and power plants, particularly in the capital’s Kirchberg neighborhood, site of many European institutions.
- The Hazardous Installations Act is adopted, retaining the principle that the ministry concerned with the environment grants permits and sets operating conditions.

### **1991**

- Luxembourg holds the presidency of the Council of the European Union (1st semester).
- The Energy Agency is founded as a limited company, 50% state-owned. Its main purpose is to promote renewable energy sources and energy efficiency.
- A Cabinet Decision of 28 January concerns a partial development plan on waste management.
- A grand-ducal decree of 14 July sets up a separate ministry to deal with physical development policy, the Ministry of Physical Development, effective 1 January 1992. The Ministry of the Environment adopts its current name.

**1992**

- In May, the government presents its national report for the Rio Conference. One of its commitments is to provide 0.7% of GNP in development co-operation aid by 2000. With regard to climate change, Luxembourg decides to stabilise its CO<sub>2</sub> emissions by 2000 at their 1990 level, and to reduce them by at least 20% by 2005.
- To combat destruction of the ozone layer, Luxembourg adopts national legislation phasing out the production and use of CFCs by the end of 1995, thereby strengthening the provisions of the London revision of the Montreal Protocol.
- A lively debate is launched in the Chamber of Deputies and countrywide on plans for a motorway linking the north to the centre of the country. The Ministry of the Environment sets out its views on the subject in "North Motorway, Territorial Development and Environmental Protection".

**1993**

- At Luxembourg's invitation, the environment ministers of Belgium, the Netherlands, Luxembourg (Benelux) and Germany meet at the Château de Senningen on 15 March. They adopt a joint statement on the harmonisation of information and warning systems for photochemical air pollution (summer-type smog).
- Luxembourg adopts national energy legislation focusing on energy saving and the promotion of new and renewable sources of energy.
- The Chamber of Deputies adopts the country's first Natural Parks Act.
- The Chamber of Deputies adopts an act approving the Convention on Environmental Impact Assessment in a Transboundary Context.
- The Energy Efficiency Act is adopted, significantly increasing support to industry for investment in the environment and energy savings.
- A decree on container points makes it compulsory for communal authorities to install one or more container points for the separate collection of household, problem and similar waste.

**1994**

- The Ministry of the Environment publishes Luxembourg's first State of the Environment report.
- The Ministry of the Environment publishes a ministerial circular promoting the use of best available technology by determining recommended thresholds for airborne effluent from industrial installations.
- An act approving the United Nations Framework Convention on Climate Change (FCCC) is passed.
- The Waste Prevention and Management Act is approved. It aims at preventing and minimising waste prior to recovery. In the medium term, disposal will be confined to final waste.
- An act approving the Helsinki Convention on the Transboundary Effects of Industrial Accidents is passed.



- An act approving the Convention on Biological Diversity is passed.
- The country's only landfill for industrial waste, in Ronnebiërg, is definitively closed on 31 December.

### 1995

- Luxembourg issues its national report for the Conference of the Parties to the FCCC.
- At a press conference on 17 March, the minister of the environment launches Luxembourg's campaign for European Nature Conservation Year. The initiatives fall into three broad categories: legislative proposals, awareness raising among target groups and practical nature conservation projects.
- Luxembourg adopts its first regulations on thermal insulation ("Wärmeschutzverordnung").
- The government and the Luxembourg electricity company CEGEDEL sign an agreement extending the company's concession for a further ten years and providing for diversification of the company's business with a view, in particular, to promoting renewable energy sources and combined heat and power.
- The EU directive on assessment of the environmental effects of certain plans and programmes (road construction) is transposed into domestic law.

### 1996

- An act approving the United Nations Convention to Combat Desertification is passed.
- An Environmental Technology Resource Centre (CRTE) is established to develop local expertise, provide information, maintain a technology watch and give economic players access to the best environmental techniques.
- The National Energy Council, initially established under energy legislation in 1993, is set up. The Ministry of the Environment is represented on the council.
- The Ministry of the Environment's geographical information system on the environment (GIS-Env) starts operations. Its purpose is to monitor the environment at national level and assist in decision making within the framework of administrative procedures.
- A major campaign is launched to raise awareness and inform the public about tropospheric ozone (summer smog).

### 1997

- On the occasion of the Special Session of the United Nations General Assembly (Rio+5) in June, the government approves the draft National Plan for Sustainable Development (PNDD).
- Luxembourg holds the presidency of the Council of the European Union (2nd semester).
- Luxembourg leads EU preparations for the third Conference of the Parties to the FCCC in December in Kyoto, where Luxembourg acts as EU spokesman. The conference adopts the Kyoto Protocol.
- Luxembourg bans the use and marketing of genetically modified maize (Bt-endotoxin) on its territory.

- The government introduces a bonus for maintenance of wilderness areas and the landscape, and support for environment-friendly farming methods.
- The Dupont de Nemours (Luxembourg) company site becomes the first in the Grand Duchy to be registered under EU Council Regulation (EEC) No. 1836/93 (EMAS).
- Legislation concerning the environment is published in a new Environmental Code, to be updated annually.

### 1998

- In compliance with Directive 94/43/EEC on the conservation of natural habitats and of wild fauna and flora, Luxembourg forwards its national list, approved by the government, to the European Commission. The list comprises 38 habitat sites, covering a total of 35 200 hectares, or 13.6% of national territory.
- As part of administrative reform, the Ministry of the Environment commissions a comprehensive audit on the management of the natural environment and an audit of the classified installations procedure.
- At the council of EU environment ministers in June, Luxembourg makes a commitment to reduce its greenhouse gas emissions by 28% by 2008-12 in relation to 1990 levels.
- An act approving the Ramsar Convention on Wetlands of International Importance is passed.

### 1999

- The third meeting of ministers, elected representatives and environmental officers for the Grande Région (Saar-Lorraine-Luxembourg-Rhineland Palatinate-Wallonia) takes place on 14 April at the Château de Senningen.
- The Chamber of Deputies adopts the revised Physical Development Act, introducing the idea of sustainable development into domestic legislation.
- The country's first nature park, the Upper Sûre Park, is created.
- The Ministry of the Environment draws up a draft national waste management plan, in line with prevailing legislation.
- The government gives final approval to the PNDD.
- The Ministry of the Environment presents the first edition of "The Environment in Figures".
- An act establishing the Environmental Protection Fund, providing a legal basis for this government investment fund set up in 1984, is passed.
- New legislation on classified installations, aimed at preventing and minimising pollution of the built and natural environment by incorporating the notion of sustainable development into Luxembourg business development, is approved.
- A ministerial circular lays down guidelines for nature-friendly forestry in woodland subject to the forestry regime.
- Following national elections in June, the new government opts for a focused water management policy covering every aspect of water resource management. The relevant government departments and services will be grouped into a single entity, thus creating the instrument required for genuinely integrated water management under the aegis of the Ministry of the Interior.

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