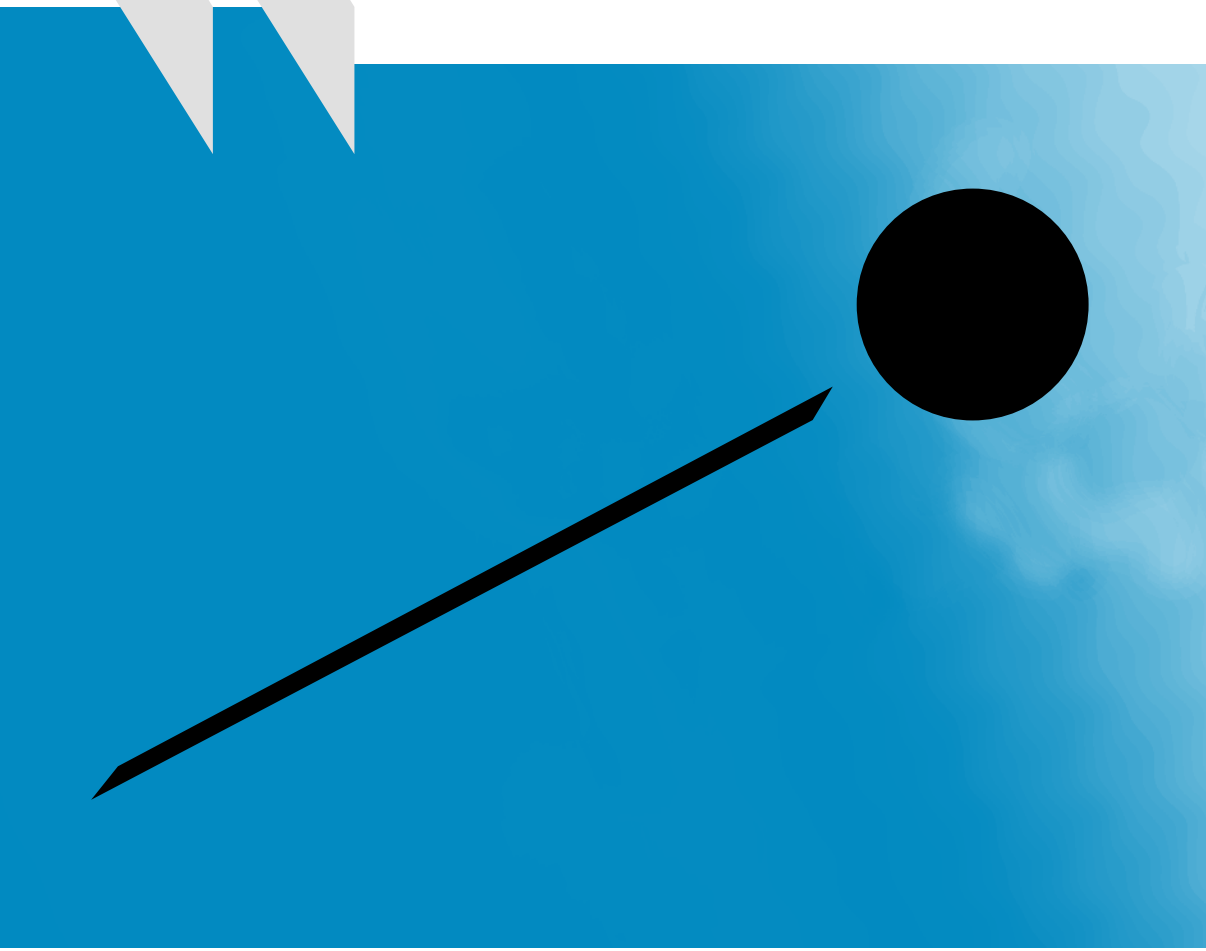
OECD Environmental Performance Reviews

LUXEMBOURG



OECD

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The OECD is a unique forum where the governments of 30 democracies work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

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FOREWORD

The principal aim of the OECD's Environmental Performance Reviews programme is to help *member countries improve their individual and collective performances in environmental management* with the following primary goals:

– to help *individual governments* assess progress;

– to promote a continuous policy *dialogue among member countries*, through a peer review process; and

– to stimulate *greater accountability* from member countries' governments towards their public opinion, within developed countries and beyond.

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 and independent reviews have been conducted for all member countries as part of the first cycle of reviews. The OECD is now engaged in the second cycle of reviews directed at p*romoting sustainable development*, with emphasis on implementation of domestic and international environmental policy, as well as on the integration of economic, social and environmental decision making.

The present report reviews environmental performance of Luxembourg. The OECD extends its most sincere thanks to all those who helped in the course of this review, to the representatives of member countries to the Working Party on Environmental Performance, and especially to the examining countries (Belgium and the United Kingdom) 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. The present review benefited from grant support from Czech Republic and Switzerland.

The OECD Working Party on Environmental Performance conducted the review of Luxembourg at its meeting on 7 October 2009 and approved its conclusions and recommendations.

Rob Visser,
Acting Director, Environment Directorate

TABLE OF CONTENTS

Part II
SUSTAINABLE DEVELOPMENT

Part III
INTERNATIONAL COMMITMENTS

REFERENCES

LIST OF FIGURES, TABLES AND BOXES

Figures

Tables

Boxes

Signs

The following signs are used in figures and tables:
.. : not available
– : nil or negligible
. : decimal point
* : indicates that not all countries are included.

Country Aggregates

OECD Europe: All European member countries of the OECD (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey and United Kingdom).

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

Country aggregates may include Secretariat estimates.

Currency

Monetary unit: euro (EUR)
In 2008, EUR 0.68 = USD 1

Cut-off Date

This report is based on information and data available up to May 2009.

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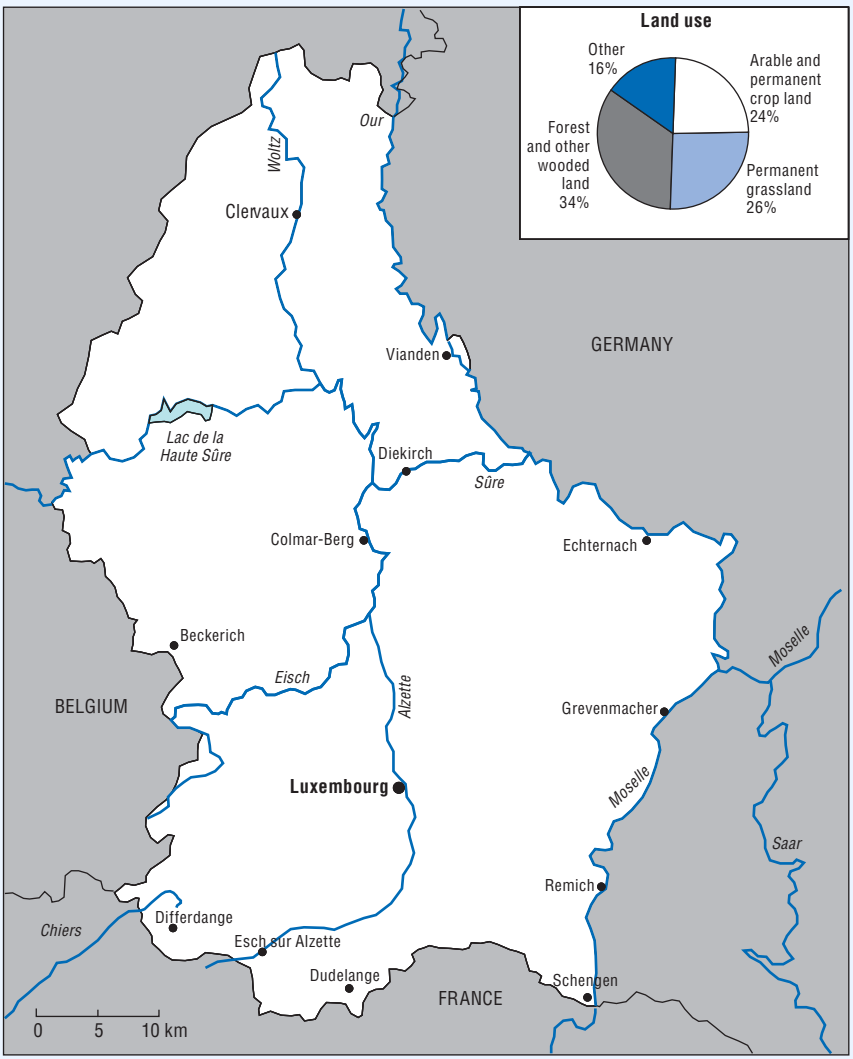
Map of Luxembourg



Source: OECD, Environment Directorate.

1

CONCLUSIONS AND RECOMMENDATIONS*

This report examines the progress that Luxembourg has made since the last OECD Environmental Performance Review, in 2000, and assesses the extent to which the country has *achieved its national objectives and respected its international commitments*. It also examines Luxembourg's progress in the context of the OECD Environmental Strategy.** The report offers 41 recommendations intended to help strengthen Luxembourg's environmental performance.

Between 2000 and 2007, Luxembourg's economy grew rapidly, by 34%, and its population rose by 9%. In 2008 and 2009, it suffered the effects of the international economic and financial crisis. Luxembourg is the richest country of the OECD, and its economy is dominated by services (mainly banking, insurance, real estate and services to business), which account for 85% of GDP. Pressures on the environment, stemming primarily from consumption (pollution from transportation, waste generation, and land use), are heavy. Luxembourg is also characterised by its international interdependence. First, with its *neighbouring countries*: its economy is highly integrated with those of Belgium, France and Germany in particular and around 90% of its trade is with Europe. Luxembourg's geographical situation and economic development have also made it a focal point in "la Grande Région". More than 40% of domestic jobs are held by non-resident border crossers, and 75% of automotive fuel is sold to vehicles not registered in Luxembourg.

Luxembourg's environmental policies have achieved significant results, but there is room for further progress, particularly regarding sanitation, nature and biodiversity conservation, greenhouse gas emissions, and – more generally –

* Conclusions and Recommendations reviewed and approved by the Working Party on Environmental Performance at its meeting on 7 October 2009.

** The objectives of the OECD Environmental Strategy are covered in the following sections of these Conclusions and Recommendations: maintaining the integrity of ecosystems (Section 1), decoupling of environmental pressures from economic growth (Section 2) and global environmental interdependence (Section 3).

sustainable development. With the current preoccupation over the financial crisis and ways of addressing it, the environment is often viewed in some political debates as a constraint on economic development. To *address these challenges*, Luxembourg will need to: *i)* pay greater attention to cost-effectiveness in implementing its environmental policies; *ii)* integrate environmental considerations more effectively into economic decisions, particularly as they relate to transportation, energy and taxation; and *iii)* pursue and expand its international co-operation on environmental issues.

1. Environmental Management

Strengthening the implementation and efficiency of environmental policies

Luxembourg has a very comprehensive set of domestic environmental laws, based largely on European legislation. It currently has *a control and inspection unit for classified facilities* and a mobile inspection unit for enforcing regulations relating to nature and forests. In 2003, the Luxembourg government adopted a *Master Programme for Territorial Planning*, as a physical planning tool at the national level. This programme provides a reference framework for the *master plans for primary sectors* (transport, landscapes, housing, and economic activity zones), which are in the process of adoption. Regulation remains an effective tool for implementing environmental policies, although voluntary instruments are now being used in many sectors. Government funds contribute to public environmental expenditure. They are financed by budgetary allocations (Environmental Protection Fund, Water Management Fund) and by partially earmarked taxes, such as fuel and vehicle taxes (Financing Fund for the Kyoto Mechanisms).

Yet Luxembourg is facing a number of environmental challenges in terms of pollution (waste water treatment, air pollution from NO_x) and unsustainable patterns of consumption (transport, energy, recreation, space). Its biodiversity and its landscapes are under threat. To address these challenges, *implementation* of environmental policies will have to be strengthened. The principles of "*polluter pays*" *and* "*user pays*" (especially for waste and water management) should be applied more effectively; greater use should be made of *economic instruments*; and the actual results of environmental policies should be measured more closely. Efforts by the central government and local authorities are not always well co-ordinated. Luxembourg has a plethora of plans and programmes, but the measures contained in those plans are not sufficiently spelled-out in terms

of their costs, timing or budgeting. Luxembourg has been slow to implement certain laws (the Sustainable Development Plan, sectoral master plans) and European directives. For example, there are gaps in Luxembourg's *implementation of the Seveso Directive*, which calls for external emergency plans that entail active obligations to notify local residents.

Recommendations:

- encourage more sustainable *modes of consumption* through regulatory and economic measures, and appropriate demand management (for example, in the areas of solid waste, mobility, public and private buildings, land use);
- reinforce the internalisation of external environmental damage; enforce the "*polluter pays*" *and* "*user pays*" *principles* more effectively (for example in the management of waste, sewage, energy and transport);
- make environmental policies more effective and efficient through the use of *economic instruments* and closer *monitoring of the results* of environmental actions;
- ensure better *co-ordination of central and local government efforts* to implement environmental and land use policies, including European directives (for example, classified facilities, water management, space and species management);
- continue to implement the law on *strategic environmental assessments*.

Air

Emissions of *several atmospheric pollutants* have been reduced over the last 10 years (SO_x, NO_x, NMVOC). *Emissions of non-methane volatile organic compounds* (NMVOC) should meet the reduction target set by the EU Directive on National Emission Ceilings (NEC) for 2010. SO_2 concentrations have been kept well below the authorised limit value for the protection of human health. Limit values for fine respirable particles (PM_{10}) have never been exceeded. A national target has been set to have 25% of home-work commuting covered by public transit by the year 2020.

However, limit values for the protection of human health from *nitrogen dioxide* (NO_2) are being exceeded in Luxembourg City, primarily because of automobile traffic. Luxembourg is not likely to meet the target for NO_x emissions set by the NEC Directive. Measures will have to be taken to control the main sources of NO_x (urban heating, industry and transportation). These

measures would help prevent the formation of ozone, of which NO_x are precursors. *Concentrations of ground-level ozone* are regularly above the pre-alert threshold for the protection of human health at several sites. The country has yet to come up with a regional ozone plan. Biosurveillance programmes for dioxins and furans (PCDD/F) in the vicinity of steel plants indicate that sometimes certain health standards are exceeded.

Recommendations:

- take more effective steps to reduce *NO_x emissions* and meet the targets of the EU Emission Ceilings Directive (NEC), including action on energy and transportation pricing;
- estimate the level of absorption of *dioxins and furans* among people living in the steelmaking basin, and reduce their exposure;
- strengthen the benefits of *climate change policy* for emissions of conventional air pollutants;
- pursue efforts to *develop public transport*, so as to achieve the 2020 objective that it covers 25% of home-work commutes.

Water

A *Water Management Administration* was created in 2004, bringing together various services under the supervision of the Ministry of the Interior and Territorial Planning in order to create an appropriate instrument for integrated water management. A *new Water Law* consolidates the various pieces of water legislation and transposes the EU Water Framework Directive and Floods Directive. The law seeks to harmonise the *structure of water pricing* and introduces the principle of full cost recovery for drinking water supply and urban sewage treatment. It introduces *an abstraction tax and a pollution tax*, which are to come into force in 2010. Draft management plans have been prepared for the country's two main river basins. A master programme for managing flood risks will be prepared for the different communes facing such risks. The national nitrogen balance has improved significantly.

Drinking water sources, however, have not been protected, despite a legal obligation to do so that dates back more than 15 years. Many *aquifers* have been contaminated by nitrates and pesticides. Implementation of the EU Water Framework Directive will not be easy: at least 40% of *surface water* is likely to fall short of the 2015 EU targets for chemical and biological quality. Only 22%

of the population is connected to a tertiary-level *waste water treatment plant*, even though the entire country is classified as a sensitive zone. The legal obligation to recover 100% of water service costs by 2010 will not be met without major pricing adjustments. *Financial assistance to the communes* from the Water Management Fund has been doubled to help them to cover 90% of sewerage and sewage treatment investments. *Rural development policies* have focused more on farm modernisation and the continued use of agricultural land than on targeted protection of water resources.

Recommendations:

- implement the new Water Law; in particular, *promote river basin management* through the Water Management Administration and the water district management plans;
- apply the "*user pays*" *and* "*polluter pays*" *principles* to water pricing for households, industry and agriculture; ensure financing for *tertiary-level waste water treatment plants* required by the EU Urban Waste Water Directive;
- consider the establishment, on a voluntary basis, of *sustainable management plans at the farm level*, in order to make farmers more accountable for managing inputs, water and biodiversity;
- *strengthen control of drinking water quality*; delineate drinking water protection areas around aquifers and protect them.

Waste and materials

Luxembourg has for many years been pursuing an *active policy* of waste and materials management. The *legislative and regulatory framework* is comprehensive, in accordance with European legislation, and there is a *General Waste Management Plan* that sets qualitative and quantitative objectives. There are many activities relating to information, awareness and advice. During the review period, *municipal waste* increased less quickly than GDP (relative decoupling); *collection and recycling rates* also improved, and are among the highest in Europe; and residual mixed waste remained stable. There has been significant progress with "*problem*" household and industrial *waste*. There is now a legal basis for managing them, and this ensures greater consistency at the national level. Luxembourg industry makes heavy use of *secondary raw materials*, and self-sufficiency is guaranteed for the disposal of municipal waste. Significant progress has also been made with respect to *inert waste*.

Municipal waste production per capita, however, is among the highest in the OECD, although cross-border workers contribute to that production. The targets of 30% reduction in specific disposable waste and bulky waste has been missed. Municipal waste management still suffers from a *lack of coherent planning* at the national level, which makes it difficult to exploit synergies. As a result, the quality of sorting is uneven and there is considerable unexploited recovery potential, particularly for organic components and plastics from municipal waste. The *polluter pays principle* is only partially applied, and prices vary among the communes. There has been little progress in managing *waste from the health sector*: it is no longer co-ordinated, and self-sufficiency is not guaranteed for the treatment and disposal of infectious waste. Despite a survey of *contaminated sites*, there is no plan for rehabilitating them, and there is no assured funding for cleaning-up orphan sites.

Recommendations:

- implement the *General Waste Management Plan* with more efficient measures for achieving the principal objectives, and with the necessary financial and other means;
- establish harmonised and differentiated pricing for municipal waste management across the country, based on the *polluter pays principle* and cost recovery;
- achieve *economies of scale* by encouraging communes to co-operate more effectively and co-ordinate their actions (collection methods, selective sorting, recycling programmes);
- co-ordinate the management of *hospital* and similar *waste*, in partnership with interested parties in Luxembourg and the neighbouring countries;
- establish a multiyear clean-up and rehabilitation plan for *contaminated sites*, including orphan sites, and specify how they will be funded;
- establish a database in support of a policy to enhance *resource productivity* and identify the best measures for achieving it (*e.g.* use of new technologies and innovation).

Nature and biodiversity

Luxembourg today has institutional, legislative and financial frameworks for implementing a nature and biodiversity conservation policy. The objectives are spelled out in the *National Plan for Sustainable Development* (1999) and the *National Plan for the Conservation of Nature* (2007). Luxembourg has thus

made up for most of its lag in setting the framework for nature and biodiversity conservation. A *registry* of biotopes is now used to identify the most important ones and ensure they are taken into account in land use planning. A Natural Environment *Observatory* will make it easier to monitor landscape changes that could affect biodiversity. The European *Natura 2000* Programme has fostered the protection of natural spaces (which increased from 6.5% to around 17.5% of the national territory during the review period). Initiatives to restore watercourses are contributing to biodiversity and to flood prevention, particularly in the context of agreements signed between the central government and the inter-communal syndicates. There is now more assistance for promoting sustainable forestry practices among private landowners.

However, the number of threatened species is still high and there is continuing pressure on biodiversity caused by fragmentation of the territory, urban sprawl, and transportation infrastructure. Despite a significant increase in protected areas, they are still far from fulfilling their potential to support biodiversity: they have few management plans and many of those that exist are just now being put into effect. The economic services derived from ecosystems (relating for example to climate change, flood prevention and water purification) are generally *underestimated*. *Agro-environmental subsidies,* specified in the EU framework, are not sufficiently utilised, and there is still need for a rural

Recommendations:

- establish *two strong conservation areas* of sufficient size (for example IUCN categories I to III), one in a forest zone and one in a farming area, to serve as *biodiversity reservoirs*;
- develop and implement management plans, enhance biological productivity in the *protected areas* (protected zones, Natura 2000 zones, natural parks, Ramsar zones); establish *biological corridors* linking the Natura 2000 zones in order to facilitate migration of fauna and flora;
- pursue partnerships between the *central government and the communes* on joint conservation and habitat rehabilitation projects;
- make greater use of economic instruments to encourage landowners to *adopt sustainable farming and forestry practices* that will favour biodiversity; develop programmes to pay for the economic services that ecosystems provide, particularly aquatic and forest ecosystems;
- establish *forest management programmes* to rejuvenate the forest so that it can supply biomass for energy production and to enhance its capacity to sequester CO_2.

conservation policy that integrates natural habitat restoration into farm management. *Sustainable management of privately owned forests* is still difficult to implement because of the fragmentation of properties.

2. Towards Sustainable Development

Integrating environmental concerns into economic decisions

Despite its growing GDP and population, Luxembourg has made progress in *decoupling* environmental pressures from economic growth. Generally speaking, such decoupling has been relative, except for SO_x and NO_x emissions, where decoupling has been absolute. A 2004 law laid the basis for the National Plan for Sustainable Development, which is to be renewed every four years and linked to sectoral plans. A participatory follow-up process (assessment report and indicators) has also been established. The law created an Interdepartmental Commission on Sustainable Development (CIDD) and a Superior Council for Sustainable Development (CSDD) comprising representatives of civil society. Progress has been made in integrating environmental concerns into certain sectoral policies such as transportation, with priority given to *public transport* and an increase in the Rail Fund, but efforts have been inadequate in other sectors. With regard to the *taxation of transportation and energy*, the annual vehicle tax is now calculated as a function of CO_2 emissions, and a fuel tax (the "Kyoto cent") has been introduced to combat climate change. A National Plan for Energy Efficiency has been introduced, together with economic incentives targeted at the construction industry, and a national body has been created to provide information and advice on energy savings and renewable energy.

However, decoupling problems persist, especially for *CO_2 emissions*. Trends in the transport and energy sectors are of concern, particularly as the "*motorisation rate*" is among the highest in the OECD, and taking account of sales of fuel to non-residents, Luxembourg's economy is the most carbon-intensive in the OECD in per capita terms. The country's wealth also generates pressures from household consumption and other economic activities. The 1999 National Plan for Sustainable Development, mostly implemented by the Ministry of the Environment, is to be replaced by a new plan for which a draft, approved by the government in 2009, has yet to be adopted. The *gasoline price gap* between Luxembourg and neighbouring countries should be reduced to encourage fuel savings and to reduce the emissions caused by fuel exports (transit, cross-border workers, "gas pump tourists"). These exports in fact account for 75% of fuel sales in Luxembourg. Some tax provisions, such as the

commuter head tax, are potentially damaging to the environment. A comprehensive "*green tax reform*" as recommended in the previous review, has not been undertaken. Environmental policies lack a *long-term vision*. The environment is still often seen in some political debates as a constraint on economic development. R&D efforts (the environmental component of the CORE Programme), ecotechnologies (the new 2009 Action Plan), energy savings (2008 National Energy Efficiency Plan) and the promotion of public transport are all part of a *new conception of the environment as an economic opportunity*. But as Luxembourg looks ahead post-crisis, it is not certain that environmental action will receive greater priority, beyond the country's European commitments.

Recommendations:

- develop a "*green package*" as part of efforts to sustain economic activity and to emerge from the crisis, with a proactive and *long-term environmental vision*;
- promote *synergies* between the environment and R&D, technology, exports, energy savings and resource productivity in the context of diversifying the national economy;
- adopt and *implement* the National Plan for Sustainable Development; adopt and implement the sectoral master plans;
- identify and eliminate *subsidies* and tax provisions that are potentially damaging to the environment;
- review, revise and increase, when necessary, environmental taxes and charges, in particular on transportation and energy, perhaps in the context of a *broader tax reform*;
- review *subsidies* for energy savings and renewable energy, and assess their economic efficiency and environmental effectiveness.

Integrating environmental and social decisions

During the period under review, a number of *health indicators* have improved: life expectancy is up, while the child mortality rate is down by half and is now half the OECD average; the dioxin content of maternal milk is lower. Health risk factors, and environmental ones in particular, are regularly checked and the results are often published. Luxembourg has adopted electromagnetic field exposure limits that are stricter than those in the European recommendation are. With regard to *environmental democracy*, Luxembourg ratified the Aarhus Convention in 2005, and its Protocol on Pollutant Release and Transfer Registers

in 2006. The recent trend in legislation and case law has facilitated *access to justice* for environmental protection associations. A public mediator has been appointed. The state provides financial assistance to NGOs dedicated to environmental protection and to local and regional initiatives for implementing the *Action 21* Programme, and they have multiplied with this support. New legislative provisions have strengthened the *role of the communes*, inter-communal co-operation, and *partnership with the central government* in nature conservation. The Ministry of the Environment conducts regular environmental awareness campaigns. The University of Luxembourg has a programme for research on environmental technologies and is helping prepare a national strategy for *sustainable development education*.

Although Luxembourg has a high standard of living, some of its health indicators are worrying: for example, the death rate from respiratory diseases is higher than the OECD average. Children are more exposed to *health hazards relating to air pollution*, noise and road accidents than in other EU countries. A "noise map" has been prepared, but no measures have been taken to *combat noise*. There has been little strategic thinking about the links between health and environmental conditions. Greater attention should be paid to the potential economic benefits that would flow from better environmental conditions and a healthier lifestyle. With respect to *environmental information*, there has been little progress in collecting and publishing environmental data, and the country is falling behind in its national and international reporting obligations; people are not always informed about public consultations; inadequate use of environmental indicators hampers environmental governance and planning; the *links between*

Recommendations:

- design and implement a national plan for better *integration of environmental and health policies*;
- improve the production and dissemination of *environmental information* for timely compliance with national obligations and international commitments; seek synergies among the different players;
- analyse the *interactions of environmental policy with the economy* (for example, expenditure data); develop environmental accounting and material flow accounts;
- pursue local initiatives for implementing the *Action 21* Programme;
- develop environmental *education*, particularly in secondary and higher education, as part of the new National Plan for Sustainable Development.

the economy and the environment have not been studied; there is no regular collection of data on public and private spending on environmental protection nor material flows analysis, part of the OECD Council Recommendation on Resource Productivity.

3. International Co-operation

Among OECD DAC members, Luxembourg is one of the most generous donors. In 2008, it devoted 0.92% of GNI to *official development assistance,* exceeding the United Nations target of 0.7% and approaching its own objective of 1%. Around 8% of total bilateral aid goes to environmental protection, water supply and sanitation. The government is committed to enlisting public support for efforts to adapt to climate change. *Regional co-operation* with neighbouring countries on nature and water conservation has been boosted within the context of the "Grande Région" and the International Commissions for the Protection of the Moselle and the Sarre. Despite some delays, Luxembourg transposed the main European environmental directives into its domestic legislation during the period under review. Luxembourg's presidency of the European Union, in the first half of 2005, helped win adoption of the guideline to "Encourage the sustainable use of resources and strengthen the synergies between environmental protection and growth" of the Lisbon Strategy. In 2008 Luxembourg adopted a national plan for implementing the Stockholm Convention, detailing measures taken and progress achieved in reducing or eliminating *persistent organic pollutants* (POPs). Real progress has been made concerning trade in hazardous substances (hazardous waste, chemical products, POPs, ozone-depleting substances) and environmentally responsible business conduct (for example implementation of the OECD Guidelines for Multinational Enterprises).

In 2007, GHG emissions were at their 1990 level, and Luxembourg's action plan will not be enough to achieve the *ambitious target* (–28% below 1990 levels) set under the *Kyoto Protocol* and the EU Burden-sharing Agreement. CO_2 emissions per capita are the highest in the OECD (although a significant portion comes from international road transport). The sector shares of GHG emissions have changed radically since 1990: *i)* emissions from the steel industry have sharply declined with replacement of blast furnaces by electric arc furnaces; *ii) transport emissions* have risen with the growing number of cross-border travellers and higher export sales of diesel and gasoline, reflecting lower prices in Luxembourg *vis-à-vis* neighbouring countries. Luxembourg will need to rely heavily on *flexible mechanisms* (estimated at about EUR 360 million) to achieve its GHG targets. The country is unlikely to meet its NO_x *emission* reduction

goals (52% below 1990 by 2010) set under the Gothenburg Protocol to the Convention on Long-range Transboundary Air Pollution. Compliance with international commitments is lagging, particularly with respect to the *EU environmental directives*. Luxembourg has been cited on several occasions for infractions of European environmental legislation (urban waste water, nitrates, integrated prevention and reduction of pollution). These lags could be overcome by devoting more resources to meeting international commitments and by giving greater economic and diplomatic priority to the environment.

Recommendations:

- continue to strengthen the environmental dimension of *official development assistance* (environmental projects, environmental impact assessments of other projects, climate change adaptation);
- speed up and reinforce implementation of the measures adopted for achieving the Kyoto target; prepare for *post-Kyoto* by integrating climate change objectives into energy, construction and transport policies (for example, energy efficiency, energy charges and taxes, transport charges and taxes);
- expand co-operation mechanisms through the international commissions on transboundary waters (for example, mutual evaluation of management plans and action programmes);
- fulfil obligations and reinforce co-operation regarding *air pollution* in Europe (European directives, Gothenburg and Aarhus protocols); promote and contribute to the implementation of a *regional plan for ground-level ozone;*
- implement the National Plan for the *Stockholm Convention*, including for substances recently added;
- promote international environmental co-operation and step up *environmental diplomacy* efforts in Europe and around the world.

2

AIR AND WATER*

Features

- Nitrogen oxide emissions (NO_x)
- Ground-level ozone concentrations
- Water quality
- Governance for integrated water management
- Financing the water policy

* This chapter assesses progress over the last 10 years and in particular since the Environmental Performance Review published by the OECD in 2000. It also examines performance against the targets in the 2001 OECD Environmental Strategy.

Recommendations

The following recommendations are part of the overall conclusions and recommendations of the environmental performance review of Luxembourg:

- take more effective steps to reduce *NO_x emissions* and meet the targets of the EU Emission Ceilings Directive (NEC), including action on energy and transportation pricing;
- estimate the level of absorption of *dioxins and furans* among people living in the steelmaking basin, and reduce their exposure;
- strengthen the benefits of *climate change policy* for emissions of conventional air pollutants;
- pursue efforts to *develop public transport*, so as to achieve the 2020 objective that it covers 25% of home-work commutes;
- implement the new Water Law; in particular, *promote river basin management* through the Water Management Administration and the water district management plans;
- apply the "*user pays*" *and* "*polluter pays*" *principles* to water pricing for households, industry and agriculture; ensure financing for *tertiary-level waste water treatment plants* required by the EU Urban Waste Water Directive;
- consider the establishment, on a voluntary basis, of *sustainable management plans at the farm level*, in order to make farmers more accountable for managing inputs, water and biodiversity;
- *strengthen control of drinking water quality*; delineate drinking water protection areas around aquifers and protect them.

Conclusions

Air

Emissions of *several atmospheric pollutants* have been reduced over the last 10 years (SO_x, NO_x, NMVOC). *Emissions of non-methane volatile organic compounds* (NMVOC) should meet the reduction target set by the EU Directive on National Emission Ceilings (NEC) for 2010. SO_2 concentrations have been kept well below the authorised limit value for the protection of human health. Limit values for fine respirable particles (PM_{10}) have never been exceeded. A national target has been set to have 25% of home-work commuting covered by public transit by the year 2020.

However, limit values for the protection of human health from *nitrogen dioxide* (NO_2) are being exceeded in Luxembourg City, primarily because of automobile

traffic. Luxembourg is not likely to meet the target for NO_x emissions set by the NEC Directive. Measures will have to be taken to control the main sources of NO_x (urban heating, industry and transportation). These measures would help prevent the formation of ozone, of which NO_x are precursors. *Concentrations of ground-level ozone* are regularly above the pre-alert threshold for the protection of human health at several sites. The country has yet to come up with a regional ozone plan. Biosurveillance programmes for dioxins and furans (PCDD/F) in the vicinity of steel plants indicate that sometimes certain health standards are exceeded.

Water

A *Water Management Administration* was created in 2004, bringing together various services under the supervision of the Ministry of the Interior and Territorial Planning in order to create an appropriate instrument for integrated water management. A *new Water Law* consolidates the various pieces of water legislation and transposes the EU Water Framework Directive and Floods Directive. The law seeks to harmonise the *structure of water pricing* and introduces the principle of full cost recovery for drinking water supply and urban sewage treatment. It introduces *an abstraction tax and a pollution tax*, which are to come into force in 2010. Draft management plans have been prepared for the country's two main river basins. A master programme for managing flood risks will be prepared for the different communes facing such risks. The national nitrogen balance has improved significantly.

Drinking water sources, however, have not been protected, despite a legal obligation to do so that dates back more than 15 years. Many *aquifers* have been contaminated by nitrates and pesticides. Implementation of the EU Water Framework Directive will not be easy: at least 40% of *surface water* is likely to fall short of the 2015 EU targets for chemical and biological quality. Only 22% of the population is connected to a tertiary-level *waste water treatment plant*, even though the entire country is classified as a sensitive zone. The legal obligation to recover 100% of water service costs by 2010 will not be met without major pricing adjustments. *Financial assistance to the communes* from the Water Management Fund has been doubled to help them to cover 90% of sewerage and sewage treatment investments. *Rural development policies* have focused more on farm modernisation and the continued use of agricultural land than on targeted protection of water resources.

♦ ♦ ♦

Luxembourg's principal objectives for *air management* to the year 2010 are set out in the National Programme for Reducing Emissions of SO_2, NO_x, VOC and NH_3, which transposes the European Union (EU) Directive on National Emission Ceilings (NEC Directive 2001/81/EC) into national law. Luxembourg must also meet the objectives of the new EU Directive on Ambient Air Quality (2008/50/EC). For the coming years, the Environment Administration is tasked with establishing an action plan to improve ambient air quality for Luxembourg City and its surroundings, in accordance with Directive 96/62/EC on Ambient Air Quality Assessment and Management.

The principal objectives for *water management* to the year 2015 are established in the Water Act of 19 December 2008, which transposes the EU Water Framework Directive (2000/60/EC) and the EU Floods Directive (2007/60/EC) into Luxembourg law. The Water Act also consolidates legal provisions relating to water management. In particular, it repeals the amended Water Protection and Management Act of 29 July 1993, which had generalised the issuance of permits for water withdrawals and discharges and provided for establishing protected areas around drinking water sources, rounding out in qualitative terms the quantitative aspects of the amended Watercourse Protection and Improvement Act of 16 May 1929.

Luxembourg must also meet its *international commitments*, particularly in the context of the International Commissions for the Protection of the Moselle and the Sarre (CIPMS), the International Commission for the Protection of the Meuse, and the Geneva Convention on Long-range Transboundary Air Pollution (LRTAP) (Chapter 7).

1. Air Management

1.1 Air quality

In the context of preparations for transposing Directive 2008/50/EC on Ambient Air Quality, the Environment Administration is *evaluating how well the existing air quality monitoring network* fits the directive's requirements. This exercise should allow for a better documentation of the monitoring network.

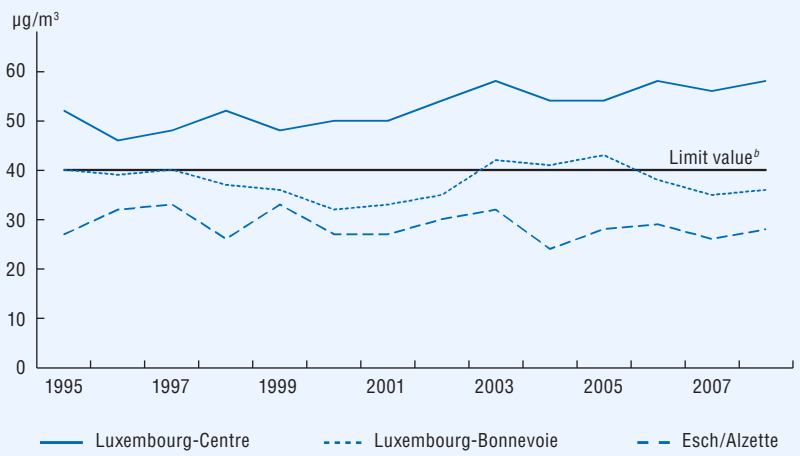
Luxembourg has established *three air quality monitoring zones*: the Canton of Luxembourg (30% of the population), with the capital city and its immediate surroundings; the Canton of Esch/Alzette (30% of the population), which is quite highly industrialised; and a zone comprising the remaining 10 cantons, which are largely rural (40% of the population).

SO_2 concentrations have remained well below the limit values for the protection of both human health and ecosystems. Concentrations of carbon monoxide (CO) also comply with the limit value for the protection of human health, as do those of benzene and of lead (which is found essentially in suspended dust particles).

In the case of *nitrogen dioxide* (NO_2), a limit value of 40 µg/m^3 (annual average) has been set for 2010 for the protection of human health. Luxembourg City has been breaching this limit value (Figure 2.1). In addition, since 2000, Luxembourg City has exceeded the hourly average of 200 µg/m^3 several times, although never more than the 18 exceedances allowed per year. The main cause is automobile traffic. The introduction of catalytic converters (in 1993 for gasoline-powered vehicles and in 1997 for diesel vehicles) and renewal of the automobile fleet have not been enough to improve the situation. In rural areas, the limit value of 30 µg/m^3 (annual average) for the protection of ecosystems has been respected.

Levels of *fine particulate matter* (PM_{10}) do not seem to pose a major problem for human health. Over the last 10 years, the limit value of 40 µg/m^3 (annual average) has never been exceeded. The annual averages in Luxembourg City and Esch-Alzette have dropped from 30 µg/m^3 in the 1990s to 25 µg/m^3 in recent years. Exceedances of

Figure 2.1 **Air pollution by NO_2,**[a] 1995-2008

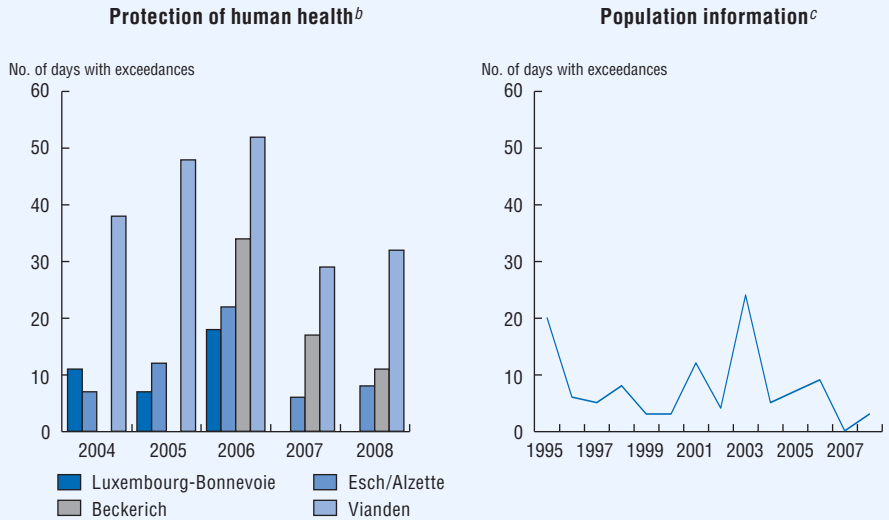


a) Annual mean concentration.
b) Limit value of 40 µg/m³ set by Directive 2008/50/EC on Ambient Air Quality.
Source: Ministry of the Environment.

the 50 µg/m^3 daily average in these two monitoring zones have also declined since the 1990s, and are now below the 35 exceedances allowed per year. Studies were recently conducted to detect the presence of arsenic, cadmium, nickel and benzo[a]pyrene in PM_{10} fine dusts: the initial results show that the target values set for 31 December 2012 (6 ng/m^3, 5 ng/m^3, 20 ng/m^3 and 1 ng/m^3 respectively) have not been exceeded. Depending on the testing site, the level varies from 10% to 80% of the target value.

Over the past decade, in urban and rural areas alike, there have been 10 to 30 occasions every summer when *ground-level ozone concentrations* have exceeded the summer pre-alert threshold of 160 µg/m^3 (human health threshold measured hourly), and up to 10 exceedances of the reporting threshold (180 µg/m^3)[1] (Figure 2.2). The large number of daily exceedances in 2003 was the result of a very sunny summer with unusually high temperatures. The alert threshold (one-hour

Figure 2.2 **Ground-level ozone peaks**[a]



a) Tresholds set by Directive 2008/50/EC on Ambient Air Quality, which replaces Directive 2002/3/EC.
b) Number of days with exceedances of a maximum daily of 120 µg/m^3 (8h running averages); with effect from 1 January 2010, the 120 µg/m^3 threshold shall not be exceeded on more than 25 days per calendar year (averaged over 3 years).
c) Number of days with exceedances of the 180 µg/m^3 threshold (hourly average). Summertime data.
Source: Ministry of the Environment.

average concentrations above 240 µg/m^3 over a period of at least three consecutive hours) has not been exceeded. A weather-simulation programme is in preparation for anticipating future ozone peaks and advising the public. The driving code was modified recently to impose a maximum speed limit of 90 km/hour on motorways when the pre-alert threshold has been exceeded.

With transposition of the EU Directive relating to Ozone in Ambient Air (2002/3/EC) in 2003, Luxembourg has *set new target values* for 2010 and 2020, and established new reporting and alert thresholds.[2] For the protection of human health, a daily maximum (sliding values over eight hours) of 120 µg/m^3 has been set. As of 2010, this daily maximum must not be exceeded more than 25 times per calendar year (three-year average); as of 2020, it must not be exceeded at all. Since 2004, it has been exceeded every year at Vianden, a canton located in the Ardennes in the North East of the country.

As required by Directive 96/62/CE on Ambient Air Quality Assessment and Management, an *Air Quality Plan for the City of Luxembourg* is under consideration. The main objective is to limit the exceeding of limit values for nitrogen oxide in the city centre. The leading measures proposed include an accelerated renewal of the city bus fleet, creation of a tramway, and prohibition of trucks in certain critical sectors of the city.

1.2 Air pollutant emissions

After dropping sharply (–80%) during the 1990s, as a result of advances in industrial combustion, *SO_X emissions* in Luxembourg continued to decline (–12%) during the period under review (Table 2.1). The rising market share of low sulphur fuels, encouraged by tax incentives, has played an important role here. SO_X emissions per unit of GDP have remained well below the average of European OECD countries (Figure 2.3).

NO_X emissions fell during the 1990s (–25%) reflecting efforts involving industrial combustion and, to a lesser degree, mobile sources. NO_X emissions from these two sources have continued downward (Table 2.1). NO_X emissions by unit of GDP have remained well below the OECD Europe average (Figure 2.3). Nevertheless, Luxembourg is likely to fall short of the 52% reduction objective between 1990 and 2010 set by the Gothenburg Protocol, which is equivalent to the ceiling in the NEC Directive (2001/81/EC) (Table 7.4). An important factor in being able to comply with the ceiling involves reducing emissions from the glass industry, whose operating permit will be reviewed in order to require appropriate technical equipment to reduce NO_X emissions. After dropping significantly in the 1990s,

Table 2.1 **Air pollutant emissions,**[a, b] by source, 2000-06

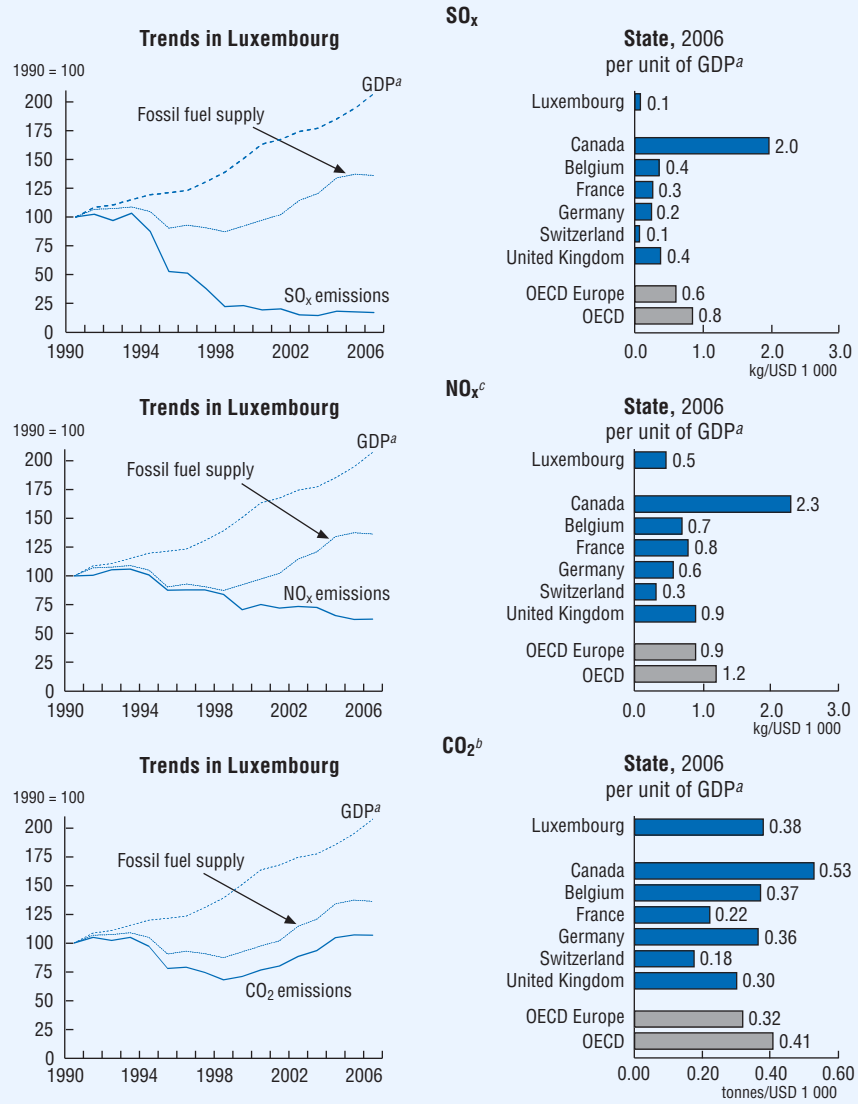
		SO_x	(%)	NO_x	(%)	NMVOC	(%)
Power plants	2000	0.0	*1*	0.4	*3*	0.2	*2*
	2006	0.0	*1*	1.2	*9*	0.3	*3*
Industrial combustion	2000	1.4	*50*	6.6	*39*	0.1	*1*
	2006	1.4	*59*	5.2	*37*	0.05	*0*
Non-industrial combustion	2000	1.0	*36*	1.4	*9*	1.2	*9*
	2006	0.8	*34*	1.5	*11*	1.2	*11*
Industrial processes	2000	0.0	*0*	0.0	*0*	0.0	*0*
	2006	0.0	*0*	0.0	*0*	0.0	*0*
Mobile sources	2000	0.4	*13*	8.0	*47*	5.8	*45*
	2006	0.2	*6*	5.8	*41*	2.9	*27*
Miscellaneous	2000	–	–	0.4	*2*	5.6	*43*
	2006	–	–	0.3	*2*	6.4	*59*
Total	2000	2.8	*100*	16.8	*100*	12.3	*100*
	2006	2.4	*100*	14.0	*100*	10.3	*100*
Change 2000-06 (%)			*–12*		*–17*		*–16*

a) SO_x, NO_x and NMVOC in thousands of tonnes; SO_x = SO_2 equivalent; NO_x = NO_2 equivalent.
b) Excludes emissions resulting from exports of road fuels.
Source: Environment Administration.

emissions of non-methane volatile organic compounds (NMVOC) have declined further since 2000, reflecting continued progress with mobile sources (Table 2.1). Luxembourg's NMVOC emissions per unit of GDP have remained well below the OECD Europe average, and they are likely to meet the NEC Directive target for 2010 (Ecotec, 2008). There are many kinds of NMVOC, and many different emission sources. The expected improvements will come essentially from reducing the use of organic solvents in paints and varnishes (Directive 2004/42/EC) or from vapour recovery at service stations (Directive 1994/63/EC). The latter measure is subsidised by the Ministry of the Environment. As of 2008, all installations using organic solvents must respect limit values on emissions (Directive 1999/13/EC)

The Luxembourg steelmaking basin has three electric-arc steel mills, located close to each other in an urban setting (Esch-Schifflange, Esch-Belval and Differdange). Taking a three kilometre radius as the conventional impact zone, 55 000 people are concerned, or 12% of the national population. *Emissions of dioxins and furans* (PCDD/F) *from the steel mills*, in operation since 1997, are regularly measured by licensed agencies. To supervise operating conditions more effectively,

Figure 2.3 **Air pollutant emissions**



a) GDP at 2000 prices and purchasing power parities.
b) Emissions from energy use only; excludes international marine and aviation bunkers; sectoral approach.
c) Exclude emissions from road fuel exports.
Source: OECD-IEA (2008), *CO_2 Emissions from Fuel Combustion*; OECD (2008), *OECD Economic Outlook No. 84*; OECD-IEA (2008), *Energy Balances of OECD Countries*.

the Environment Administration has been conducting supplementary measurement campaigns. Since 2001, PCDD/F emissions have been below the limit value of 0.1 ng/m^3 most of the time, but there were exceedances in 2003 (Esch-Schifflange), 2005 (Esch-Belval) and 2008 (Differdange) (Ministry of the Environment, 2008, 2009). PCDD/F accumulation in leafy vegetable crops[3] is measured by a network of monitoring points in the immediate vicinity of the steel mills; the preventive health threshold is still being exceeded occasionally, particularly at Schifflange.[4] In a study of PCDD/F concentrations in soils, a significant percentage of soil samples were found to be incompatible with unrestricted farming use (30% in 1993/94, 25% in 2006).[5]

1.3 Assessment

The 2000 OECD review made the following recommendations:

– define and implement the measures needed to meet commitments on *emissions to air* (NO_x and NMVOC), 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;

– develop and implement a regional plan for the prevention and control of *tropospheric ozone* in co-operation with neighbouring countries.

There is as yet no *regional ozone plan*, and the last of these recommendations remains pertinent. Given the limited size of the national territory, Luxembourg cannot win the battle against ground-level ozone if it limits itself to national measures. The import of ozone precursors from bordering regions makes co-operation necessary, and co-operation with Belgium has been given priority as the prevailing winds come from that direction. The co-operation is planned on two levels. First, at the level of information and forecasting, an agreement is under negotiation with Brussels' Interregional Committee of the Environment (CELINE) to enable Luxembourg to participate in forecasting concentrations of ozone and fine particles. This undertaking is being carried out within the Environment Administration's project to better inform the public in general, and sensitive populations in particular, about air quality trends. In a second phase, Luxembourg is expecting to establish, with the Belgian authorities, an action plan for reducing ozone precursors. Related negotiations have yet to be undertaken.

All the other recommendations from 2000 point toward preventing ozone formation and its attendant health effects (Chapter 6), *i.e.* to *reducing the emissions of precursors* (NO_x and NMVOC). To what extent has Luxembourg addressed these recommendations?

The question arises in particular for NO_x emissions. The main sources of NO_x emissions in Luxembourg are *urban heating*, industry (especially the glass factories) and transportation.[6] For urban heating, measures are needed to address household energy prices (Chapter 5). Over the longer term, a key measure will be to improve the energy performance of buildings, which will require implementation of Directive 2002/91/EC. Such measures should help reduce conventional pollutants such as NO_x, as well as greenhouse gases. As for *glassmaking*, discussions are underway regarding the best available technology (BAT) for reducing NO_x emissions. To the extent that glass factories participate in the European Emission Trading System (ETS), which will evolve after 2013 (when the national allocation plans are to be replaced by a European quota, and all emission rights are to be auctioned), the glass factories will be driven by market incentives to reduce their CO_2 emissions (and their NO_x emissions as well).

With regard to *transport*, progress with NO_x emissions can be expected as a result of stricter European *vehicle* standards applied to commercial vehicles in October 2008 (Euro V) and to private vehicles in September 2009 (Euro 5). The Euro 5 standards are more permissive for diesel vehicles (0.18 g NO_x/km) than for gasoline vehicles (0.06 g/km), but the diesel standard is to be lowered to 0.08 g/km in 2014 (Euro 6). The vehicle fleet renewal rate is already high, and will be further accelerated by the impact of subsidies for "green" vehicle purchases (since 2007) and the scrapping bonus (as of 2009).[7]

In any case, these vehicle-related measures will not by themselves offset the impact of the projected increase in road traffic. With *relatively low fuel taxes* and no road tolls for private cars, there is nothing to discourage the use of cars licensed in Luxembourg or elsewhere (Chapters 5 and 7). Something will have to be done about road fuel prices. The climate levy (the "Kyoto cent") is far too low (2 centimes per litre for gasoline, 2.5 centimes for diesel) to have any impact on private vehicle use. Its purpose, indeed, is to finance the Kyoto Mechanisms Fund (Chapter 7). In time, once the ETS is in place, the climate levy will have to be geared to the price of emission rights in that system. Like Germany, Belgium, Denmark, the Netherlands and Sweden, Luxembourg has since 2001 been charging a tax – the "*Eurovignette*" – on trucks using its highways. In Luxembourg, this tax (or user fee) is based on pollutant emissions (EURO standards) and the truck's number of axles.[8] Tolls, potentially varying according to the time of day (to reduce congestion), should be introduced for private cars.

To succeed in limiting automobile use and the externalities it generates, especially for the environment, there will have to be viable alternatives in the form of attractively priced *urban transport services* that will win monthly or yearly subscribers. The experience of other European cities shows that this cannot be done without subsidies. Yet it is recommendable to increase the portion of transit operating costs paid by users (fare revenues) *vis-à-vis* other sources of financing (government, municipalities, employers), in order to avoid needlessly burdening the national budget and to generate revenues for maintaining and expanding transit infrastructure, particularly rail. The Rail Fund already receives a budget allocation three times as large as the Road Fund (Chapter 5). Only 15% of cross-border workers now take public transport to work in Luxembourg (OECD, 2007). Introduction of a single transit pass for the entire "Grande Région" would certainly improve the situation. In 2002, the Luxembourg government came out in favour of a common transport system, with a target date of 2020, and a modal share of 25% for public transport and 75% for private motorised transport (Chapter 5).

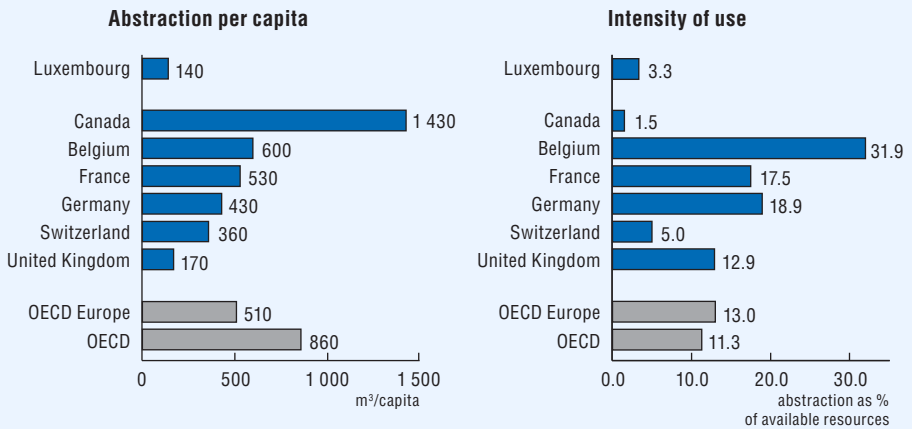
2. Water Management

2.1 The state of resources

Water supply

The intensity of use of available resources on all fronts (households, industry and agriculture) is low in comparison to the OECD average (Figure 2.4), reflecting the low

Figure 2.4 **Freshwater use,** 2007[a]



a) Or latest available year.
Source: OECD Environment Directorate.

agricultural share of abstractions. At 150 litres per capita, daily household consumption is in the middle range of OECD countries. There is little loss through leakage from the water supply systems, many of which have been upgraded over the last 10 years.

Underground water supplies 57% of the 44 million m^3 of drinking water delivered in Luxembourg. In the *southern industrial region*, industries and utilities must draw from the water table of the Luxembourg sandstone (*grès de Luxembourg*) aquifer located in the centre of the country, and from the Esch-sur-Sûre reservoir in the north, to cover their water needs.[9] Under the Water Act, there must be a balance between depletion and renewal of underground waters so that they will be in good condition no later than 2015. The preference given to surface tapping over groundwater pumping eliminates the risk of overexploitation of the sandstone aquifer, which alone supplies more than half of the country's drinking water.

On the other hand, the Esch-sur-Sûre reservoir, which provides 43% of the public networks' water supply in the country, is in a critical state of eutrophication, reflected in the algae blooms that appear in the late summer. While the demand for water from industry has decreased with the improvement of industrial processes, notably in the metallurgy sector, household consumption has increased by 1.35% per year over the last 15 years, reflecting the country's strong demographic growth and steady increase in cross-border workers. The population of Luxembourg is likely to continue to rise; estimates are that it could reach 560 000 to 605 000 inhabitants by 2024, bringing an overall increase in drinking water delivery needs (estimated at between 47 and 51 million m^3). To insure the *sufficiency of the drinking water supply,* new sources (underground and surface) will have to be developed.

Sewage treatment

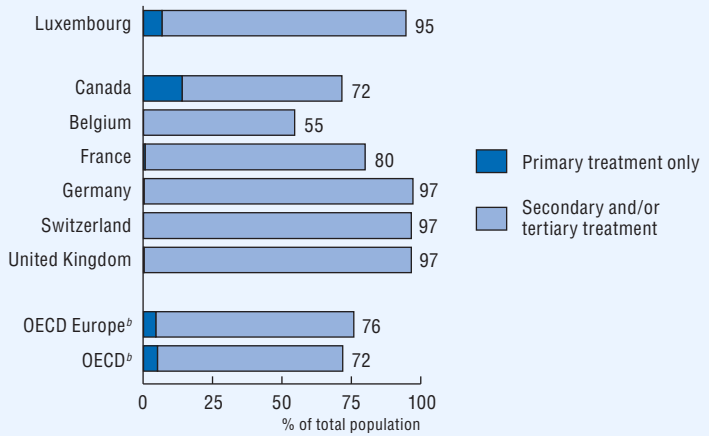
The proportion of the population connected to a *waste water treatment plant*, at 95%, is well above the OECD average (Figure 2.5). However, only 22% is connected to a tertiary treatment station, even though the entire country is classified as a sensitive area under the EU Urban Waste Water Treatment Directive (1991/271/EEC).

A *dual-channel system* that separates rainwater (which can re-infiltrate the water table naturally) and sewage (which requires purification) is still missing for the most part, except in the cities of Luxembourg and Esch-sur-Alzette and in new housing developments.[10]

Surface water quality

According to the Water Act, all surface water bodies[11] must be protected, improved or restored to meet the definition of "good status" by the end of 2015. There is still a long way to go. The Water Management Administration (AGE) estimates that at least 40% of surface water bodies (watercourses and reservoirs) will

Figure 2.5 **Population connected to public waste water treatment plant,** 2007[a]



a) Or latest available year.
b) Secretariat estimates.
Source: OECD Environment Directorate.

not meet the 2015 chemical and biological quality targets of the EU Water Framework Directive. While the pollution level in watercourses has diminished slightly in recent years,[12] *11% of watercourses by length are still heavily polluted* and 42% moderately polluted (Table 2.2). In the Moselle basin, nearly 20% of measurement stations show that chemical quality is average to poor, and more than 50% record average to poor biological quality (Table 2.3). Mention should be made of the Alzette, a tributary of the Sûre, which receives the waste water (although treated) of three-quarters of the Luxembourg population.

In 2005, a CIPMS programme revealed a widespread presence of *PCBs* in fish and suspended matter in the watercourses analysed, with peaks in the Moselle (France and Germany), the Sarre, and to a lesser extent the Sûre and the Our. PCB pollution sources have not been clearly identified in Luxembourg, where the authorities have issued warnings about the consumption of eels (which generally have the highest PCB concentrations).[13]

With regard to *new contaminants*, the Alzette and the Mess, two watercourses located in industrialised and heavily anthropised environments, have been found to have xenobiotic pollution from antibiotics, analgesics and hormones (Pailler *et al*., 2008). These pollutants have defied elimination by the purification plants.

Table 2.2 **Pollution of watercourses,** 2003-08[a]

(% of length)

Pollution	2003	2004	2005	2006	2007	2008
None	1	0	0	0	0	0
Low	40	44	47	42	42	48
Moderate	34	37	31	40	44	42
Heavy	18	15	20	16	12	10
Very heavy	7	4	2	2	2	0
Total	100	100	100	100	100	100

a) This new statistical series, begun in 2003, covers 692 km of watercourses.
Source: Ministry of the Interior and Territorial Development, 2009.

Table 2.3 **Quality of Moselle basin watercourses,** 2005

(% of stations)

Quality classification	Biological quality[a]	Chemical quality[b]
Very good	8	66
Good	41	15
Average	26	11
Fair	19	6
Poor	6	2
Total	100	100

a) 63 sampling stations.
b) 173 sampling stations.
Source: International Commissions for Protection of the Moselle and the Sarre (2005).

Groundwater quality

According to the Water Act, all bodies of groundwater must be protected, improved and restored to good status by the end of 2015. The main groundwater pollutants are *nitrates and pesticides*. The nitrogen balance at the national level has improved considerably since the early 1990s, dropping from 200 kg N/hectare to 111 kg N/ha in 2004 (last available year)[14] (OECD, 2008a). However, a recent study

showed that 40% of the surface area that drains into drinking water sources discharges water that contains 25 to 50 mg/l of nitrates, and some of the sources show a clear trend toward deterioration (Ministry of the Interior and Territorial Development, 2009). At the national level, half of the nitrogen inputs comes from the use of chemical fertilisers, and a third from livestock effluents; the rest is atmospherically deposited. According to initial estimates, Luxembourg would seem to have more pesticide pollution than the bordering areas of the "Grande Région" (Table 2.4).[15] More than 50% of groundwater sources are polluted by certain pesticides, sometimes at concentrations that exceed the legal limit of 100 ng/litre.[16] This reflects not only the fact that the Luxembourg sandstone aquifer is more vulnerable to pollution than the aquifers of neighbouring regions, but also a lack of protection for the abstraction areas.[17]

According to the Water Act, every abstraction area of water intended for human consumption must be protected by the end of 2015, or the operating license will be withdrawn. Little progress has been made in this area despite a legal obligation that dates back more than 15 years.[18] The measures needed relate essentially to agricultural pollutants. *In the absence of defined protection zones around tapping* or

Table 2.4 **Presence of pesticides in groundwater,** 2009[a]

(% of drinking water sources where pesticides have been detected)

Pesticides	Grès de Luxembourg aquifer (Luxembourg)	Rhineland-Palatinate (Germany)	Wallonia (Belgium)	Lorraine (France)
DEA[b]	58	9	31	41
Atrazine	53	9	27	41
BAM[c]	49	5	27	–
Bentazone	28	9	12	–
DMST[d]	4	–	–	–
Isoproturon	1	–	–	7
Chlortoluron	1	–	–	9
Simazine	–	6	–	–
Bromacile	–	–	6	–

a) Interim report.
b) Desethyl-atrazine.
c) Dichlorobenzamide.
d) n, n-dimethylsulfamide.
Source: AGE.

drilling points (with the exception of the health protection zones surrounding the Esch-sur-Sûre dam), the Chamber of Agriculture has sponsored initiatives to protect 6 000 hectares, half of which is used for farming. The AGE has a key role to play in delineating (and overseeing) the abstraction zones. In March 2009, the AGE published guidelines on this subject.

While water abstraction is subject to ministerial authorisation, the great number of *illegal wells*, which is estimated at double or triple those duly authorised, increases the risk of infiltration from harmful substances and degradation of the microbiological and/or physico-chemical quality of groundwater. The recent institution of an abstraction tax should put an end to these practices.

Drinking water quality

Before 2004, the monitoring of drinking water quality was shared by the Environment Administration's Water Division and the Health Department's Health Inspectorate. Since then, the Water Management Administration, as the official monitoring body, has regularly monitored the quality of all drinking water resources (250 catchment sources, 50 drilling holes and the Esch-sur-Sûre reservoir).

Suppliers are responsible for *monitoring the quality of the water they deliver for human consumption*. The Grand Ducal Regulation of 7 October 2002, which transposes Directive 98/83/EC on the quality of water destined for human consumption, requires drinking water suppliers to audit their infrastructures and the state of water resources.[19] As of the end of October 2009, 80 of the 116 communes and the seven inter-communal syndicates had finished their audit.

Bathing water quality

The EU Bathing Water Directive (2006/7/EC), transposed by the Grand Ducal Regulation of 19 May 2009 which identified special protection measures and monitoring programmes for bathing water quality, sets a minimum quality threshold to be reached by the end of 2015: at that time, water quality must be "sufficient" (in a range of four quality levels: poor, sufficient, good or excellent). A report by the European Commission published in June 2009 on bathing water quality in 2008 found a *net improvement over previous years*. In 2008, the mandatory quality threshold was met in all 20 bathing zones, three of which had been closed to swimming for more than 15 years. However, around half of the zones still fail to meet the guidance value because of poor bacteriological quality as defined by Directive 2006/7/EC.[20] All of these are located in the upper Sûre, the lower Sûre and the Our. The quality shortfall results primarily from inadequate treatment of sewage in ageing treatment plants located along the Alzette and the Sûre. According to

European regulations, a bathing water profile must be established by the beginning of 2011, covering pollution sources and the placement of water monitoring points.

2.2 Water pricing

The syndicates set the selling price for the communes (Box 2.1). Depending on the commune, the tariff structure may be based on volumetric rates or on increasing-block or decreasing-block rates, and it usually contains a fixed element. This *diversity of pricing structures is often geared to social considerations*. In communes where

Box 2.1 The role of the inter-communal syndicates in water pricing

The *communes* are legally required to provide for the collection, removal and treatment of urban waste water and the management of rainwater run-off in urban areas. They are not allowed to subcontract these services to specialised firms. The drinking water management system leaves the communes with the choice of relying on their own water supply sources (this is the case for 25 of the 116 communes in Luxembourg), of relying, through the communal syndicates, on water from the Esch-sur-Sûre Syndicate (SEBES), or of having a mixed arrangement. Four inter-communal syndicates* and Luxembourg City are members of SEBES and deliver drinking water abstracted from the Esch-sur-Sûre reservoir. For sewage, there are 11 syndicates, each covering several communes. Some communes manage their sewer networks and treatment plants on their own.

In the management of drinking water, it should be possible to *increase co-operation among the syndicates* and thereby achieve synergies while keeping water prices at an advantageous level (Syvicol, 2008). In comparison with neighbouring countries, Luxembourg has a fairly high number of sewage treatment syndicates, which suggests there might be potential economies of scale in this sector as well. A reduction in the number of communes (to 70 or 80) and the creation of urban communities as part of the government's proposed "territorial reform" would facilitate such a shift of governance in the area of water services. There is a proposal (Commission of the Chamber of Deputies concerning territorial reform) to consider integrating certain aspects of sewage management at the national level (sewage sludge, self-monitoring laboratory, public submission of purchasing), through a mixed government-municipal syndicate in which all the country's communes would be represented. Experience in other OECD countries suggests that *making more room for private initiative* would help move the tariff structure toward full cost recovery for water services.

* The syndicates for the southern region, the eastern region, the central region, and the Ardennes.

prices rise by block, the first block is much more important for large families than for single persons. In communes that apply a volumetric rate, the rate is lower for large families than for single persons. But there have been no studies of the degree of cross-subsidy between well-off families and those on modest incomes (OECD, 2003).

The Water Act calls for *standardising pricing principles* as of 1 January 2010, at which time "users will pay the service costs related to water use, including costs for the environment and the resource, taking into account the user pays and polluter pays principles". Apart from water supply and sanitation service charges, which go to the service providers (syndicates), the law sets an abstraction tax and a pollution tax, whose proceeds are earmarked for the Water Management Fund ("water pays for water"), in violation of the budgetary principle that revenues should not be pre-allocated.[21] *Charges and taxes will have to be applied in the same way to households, businesses*[22] *and the agricultural sector.*

Water charges

The *drinking water charge* comprises a fixed portion (proportionate to the pipe diameter at the meter) and a variable portion, which depends on consumption. Similarly, the *sewage charge* includes a fixed portion (proportionate to the number of "average population equivalent") and a variable portion (proportionate to the volume of water drawn by the user from the public system). The inclusion of a fixed element in the price reduces the impact of the price signal on consumption. Moreover, some facilities receive government assistance (subsidy) for the first investment through the Water Management Fund, which allows them to charge lower rates to communes and beneficiary commune syndicates. This assistance does not however contribute to a price reduction for the user, as the communes are obliged to pass on the full cost of the investment.

The *capital and operating cost recovery rate* is around 80% for water supply and 50% for sewage treatment.[23] The legal obligation to recover 100% of costs by 2010 will not be respected without major price adjustments. Some communes are planning to double the price of water, while others are opposed to any increase. The government intends to offer financial compensation to communes in the north, where water service costs are higher because population density is lower. The details of such an equalisation mechanism will be established by the budgetary law.

A draft law on *social assistance* has been introduced to ensure basic necessities to people in need: these include medical care, housing, food, clothing, mobility, drinking water, and domestic power supply. This assistance would be provided through a subsidy, as a supplement to the social measures and allowances provided by other laws and regulations. The draft law is intended not to exempt poor families from

paying their water bill (which would encourage wastage) but rather to help them pay it.[24] The Water Act also allows the communes to subsidise the poorest households through a cost-of-living allowance for drinking water.

Taxes

Beginning in 2010, anyone who draws surface water or groundwater will have to pay an *abstraction tax*, based on the volume of water drawn (measured by a metering device installed by the user). The rate is set at 0.10 EUR/m^3. In addition to the public operators, which deliver 44 million m^3 of water annually (70% for the public network, 30% for industry),[25] the agri-food industry abstracts 4 million m^3 of underground water of drinking water quality, but not all abstractions have a metering device (OECD, 2008b).

The discharge of waste water into surface or underground waters is subject to a *pollution tax*. The tax is proportionate to the units of pollutant load (*unité de charge polluante,* UCP) in the water discharged. It is set at 1 euro per UCP. It must be paid when any of the following thresholds is exceeded: 250 kg/year for chemical oxygen demand (COD); 125 kg/year for nitrogen (N); 15 kg/year for phosphorus (P); or 5.2 kg/year for suspended particulate matter (SPM).[26] The volume of water discharged is equal to the volume of water drawn in the public distribution network. The pollutant load contained in 150 litres of waste water that an inhabitant is assumed to produce each day (one "population equivalent") is calculated by a formula.[27] A 10 to 20% reduction in the tax is offered to communes that have installed rainwater treatment and management facilities in their network. For industry, the number of UCPs considered for calculating the tax is based on the authorised pollutant load as a proxy. If that load is exceeded, however, the tax may be increased.[28] It can also be reduced upon a simple declaration if the pollutant load is at least 20% less than what would result from the discharge authorisation.

Water Management Fund

The Water Management Fund was created in 1999 to finance sewage treatment.[29] Between 2000 and 2007, the Fund spent approximately EUR 200 million on sanitation projects (Table 2.5).

The Fund is financed by budgetary allocations. A budgetary grant of EUR 15 million has been allocated to the Fund annually since 2000. In addition, a further EUR 213 million in supplementary grants was allocated to the Fund between 2000 and 2007. The *deterioration of the country's economic situation* resulted in an absence of supplementary budgetary allocations in 2008 and 2009. Nevertheless, subsidies allocated to communes and commune syndicates are rising

Table 2.5 **Water Management Fund,** 2000-09

(EUR million)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009[a]
Budget allocation to	45	55	45	45	15	15	28	85	15	18[b]
normal	15	15	15	15	15	15	15	15	15	18
supplementary	30	40	30	30	0	0	13	70	0	0
Expenditure	20	25	20	20	20	15	15	26	65	70
Balance as of 31 December	25	55	80	105	100	100	113	172	122	70

a) Preliminary data.
Source: AGE.

significantly (EUR 65 million in 2008, EUR 70 million expected in 2009), as the AGE has access to the balance available in the Fund. It is expected that allocation of the abstraction and pollution taxes to the Fund will bring revenues up to around EUR 10 million per year as of 2011.[30] The Fund is considering resorting to loans from the European Investment Bank, if need be, to avoid slowing the development of sanitation and waste water treatment infrastructures in the coming years.

The Fund can cover up to *90% of the commune's capital costs for sewerage and sewage treatment*. The Water Act expands the scope of the Fund. It authorises coverage of: up to 50% for measures to protect water resources intended for human consumption (with the exception of agricultural activity); up to 50% of the cost of flood risk abatement;[31] and up to 100% of watercourse rehabilitation costs.[32] The law also allows the Fund to cover up to 100% of expenditure on projects recognised as being of national interest and intended, among other things, to safeguard the quality of surface and groundwater or to protect available water resources over the long term. The Fund should distribute its revenues on the basis of a cost-benefit analysis of the projects selected.

3. Governance

In 1999, the government opted for a comprehensive water management policy designed to bring the different aspects of the water economy together and thereby create the *tool needed for truly integrated water management*. The Water Management Administration, which reports to the Minister of the Interior, was

created in 2004, absorbing the various units responsible for water protection and management that had previously operated within the other technical administrations (Agriculture, Environment, Waters and Forests, Bridges and Roads, State Energy Service, Health Department, and Department of Territorial Development).[33] The AGE is also responsible for the water police (inspection and law enforcement).

Management by river basin

The Water Act requires the AGE to draw up a "*water district management plan*" for each of the two large river basins of Luxembourg (the Moselle and the Chiers). The two plans, which are to be published in 2009, are supposed to be designed for integration into the international river basin management plans for the Rhine and the Meuse, respectively.[34] There has been considerable progress on this score: draft management plans have been prepared for the river basins, and were put to consultation with the public and the communes in January 2009.

The Water Act calls for the establishment of a "*general communal plan for the urban water cycle*" for each commune. The plan must contain an inventory of underground waters, water supply and sanitation infrastructure; areas listed in the protected zones registry of the AGE,[35] and flood-prone areas. These communal plans are to lay the basis for preparing a national urban water cycle plan.

The water district management plans and the National Plan for the Urban Water Cycle could usefully be compared with the *investment plans for public water supply and sanitation* which, in Luxembourg, are geared to specific river basins, for the sake of coherent management.[36] The Water Act requires cost recovery for services related to water use, and the AGE has a key role as arbitrator of pricing needs between the stakeholders (communes, industry and agriculture), which are represented within the Water Management Committee, the government advisory body for water protection and management matters. The Water Management Fund itself is administered by a management committee that includes representatives of the ministries with responsibilities for water management, the budget, agriculture, health and the environment. In the scientific area, creation a Water Observatory composed of academic experts is expected.

The delineation and management of protected areas (under the amended Law of 19 January 2004 on the Protection of Nature and Natural Resources), which can include water bodies, falls to the *Waters and Forests Administration*, which reports to the Minister of Environment. Close co-operation between the AGE and the Waters and Forests Administration is essential because, at the river basin scale, these water bodies are indispensable for the conservation of watercourses and their proper ecological functioning.

Flood risk management

Flooding is the most *significant natural hazard* in Luxembourg, both because of the damage it causes and because of the number of communes affected. Over the last few decades, Luxembourg has suffered numerous bouts of flooding, in 1983 on the Moselle and in 1993, 1995 and 2003 in the Sûre basin.[37] Since 1995, the government has been covering 50% of the costs of flood control measures.

According to the Water Act, the AGE is to work with the communes and the administrations concerned to establish a *master plan for flood risk management*, reflecting the objectives of the European Floods Directive (2007/60/EC). The objectives are: *i)* by 2011, to identify watercourses that pose a potential flooding threat;[38] *ii)* by the end of 2013, to map flood-prone areas; and *iii)* by the end of 2015, to draw up management plans to reduce flood damage to property, persons and the environment. Between 1998 and 2000, the Territorial Development Department established a partial management plan for flood zones and retention zones for various communities affected by high waters. In 2000-09, a Flood Vulnerability Atlas was posted on line on the Internet. Beyond the conventional dike-building measures, the management plans should pay due attention to improving the eco-morphological structure of riverbeds and the restoration of natural water retention areas. Here again, the costs are borne by the communes, which may however receive government subsidies amounting to 50% (or 80% for intercommunal works).

The mapping of flood zones and flood risks is to be superimposed as an integral part of the *communes' general land use plans*. In particular, new urban development must be prohibited in flood zones unless the retention volume lost can be offset and unless they do not increase risks downstream and upstream. Agricultural restrictions can also be imposed (in the surroundings of flood zones), with a view to limiting the leaching of pollutants.

Other actions are helping to reduce flood risks. First, *surface water management* seeks to keep watercourses flowing freely and to maintain their banks in good condition. Maintenance focuses on riverbeds and on the vegetation of banks, riparian zones and floodplains. Up to 50% of the costs incurred are borne by the government. Next, the *rehabilitation of watercourses* and their associated wetlands is enhancing their flood control function. A number of rehabilitation projects that involve local communities and citizens at the watershed level are now underway, in the context of "watercourse partnerships" (Box 4.2). The costs of rehabilitation are borne by the communes, which may however receive state subsidies of up to 100%. Achieving *sound hydro-morphological status for watercourses*, as required by the Water Act, will depend to a large extent on co-operation with riparian owners for maintaining vegetation along river banks and/or state purchase of the river banks.[39] In the Moselle

basin, 55% of river shoreline shows no hydro-morphological alteration; 31% is altered, and the remaining 14% is heavily modified (CIPMS, 2005).

Concerted actions with neighbouring countries have led to implementation of a Flood Action Plan (with Germany, Belgium and France), under the aegis of the International Commissions for the Protection of the Moselle and the Sarre, and to closer co-operation regarding flood risk information (with France and Germany) (Box 7.2).

Management of agricultural pollutants

The 2005 move to the "*Single Payment Scheme*" has been positive for the environment, as it eliminates the incentives to gear production other than through market orientation, which formerly were adding to the risk of having farmers disregard the environment (Box 2.2). On the other hand, *rural development measures* are focused much more (to the extent of 70%) on modernising farms and maintaining agricultural activity than on protecting the environment (Table 2.6). The premium for maintaining the countryside and landscapes is intended above all to prevent the conversion of permanent prairies and pastures into cultivated lands, and hence to preserve farming activity (with additional compensatory payments for agriculturally less favoured areas). It involves little in the way of ecological targets or measures for achieving them. This no doubt explains why so many farmers have signed up for the premium since it was introduced in 1997.[40] When it comes to water management, the 2007-13 Rural Development Programme calls for a 50% increase in lands under agri-environmental contract in areas that are sensitive in terms of drinking water protection. Strict protection of watercourses will not be affected by cross-compliance conditions attached to the premium, as buffer zones along watercourses are already mandatory under the Nitrates Directive, which applies to the entire country.

The voluntary adoption of a *sustainable development plan at the farm level* should make the agricultural profession more responsible. Payments under the Common Agricultural Policy would then be conditional on implementation of the plan, as certified by agents accredited by the Ministry of Agriculture, Viticulture and Rural Development. This approach would also serve to target measures more effectively, something that is not facilitated by the Nitrates Directive's classification of the entire territory as a vulnerable zone.

Box 2.2 **Key elements of Luxembourg's agricultural policy**

Since 2005, there has been a steady increase in *government support* and in the proportion it represents in net farm income (Figure 2.6). Council Regulation (EC) No. 1290/2005 of 21 June 2005 on Financing of the Common Agricultural Policy (adopted under Luxembourg's presidency) created two European agricultural funds: the European Agricultural Guarantee Fund (EAGF), to finance market intervention and other measures, and the European Agricultural Fund for Rural Development (EAFRD), to finance rural development in areas that are home to more than 55% of the country's population and cover more than 90% of the Grand Duchy's territory. The regulation came into force on 1 January 2007.*

The bulk of the EAGF budget goes to financing the "*single payment*", a decoupled payment (not directly linked to output) that was introduced in 2005. The payment is awarded based on the eligible area in 2005 and comprises a regional component and an individual component ("top-up"). Previous payments were replaced in their entirety by the single payment (total decoupling); the single payment involves budgetary outlays of EUR 37 million a year (since 2007).

The EAFRD is more modestly funded, at EUR 13 million a year over the period 2007-13. It is supplemented by a national budget envelope of EUR 40 million a year to cover the expenditure of the 2007-13 Rural Development Programme (PDR). Agri-environmental payments account for around 30% of the overall PDR budget envelope, or EUR 15 million a year (national budget plus European co-financing). The most important agri-environmental measure is the "*premium for the upkeep of the landscape and the contryside*", designed to maintain agricultural activity on lands suitable for farming, vineyards and horticulture, using forms of exploitation that are adapted to the natural setting and landscape, and respectful of the environment. This premium was introduced in 1997 in the context of Regulation (EC) 2078/1992. The Regulation of 17 October 2008 establishes the terms of payment and control over the new premium programme.

Applicants for the landscape and countryside maintenance premium undertake to respect certain conditions for five years after the first payment. Since 2007, these *conditions* have been mandatory. Organic fertiliser use in water protection zones must be kept to a maximum of 130 kg N/ha instead of the 170 kg N/ha allowed by the Nitrates Directive (1991/676/EC). A buffer strip of at least three metres must be established for agricultural activities along watercourses. In addition, the creation and maintenance of permanent grassland and pastureland permanently vegetated is encouraged to minimise the use of pesticides and fertilisers.

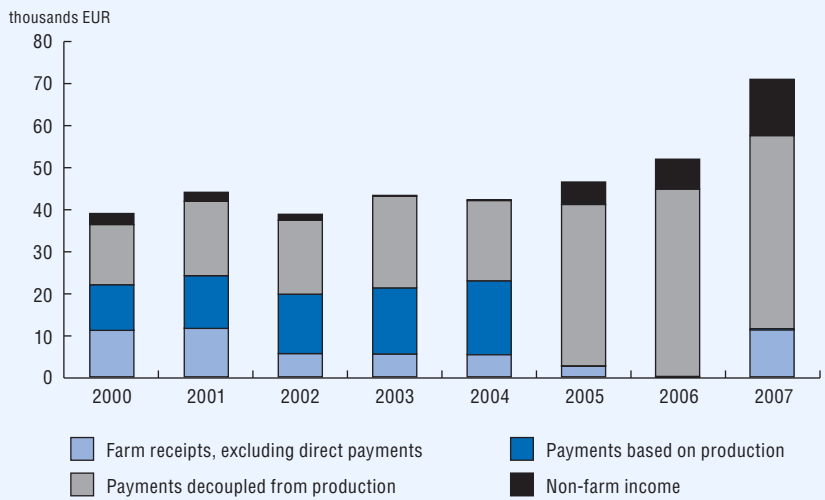
* Consistent with EC Regulation 1782/2003.
Source: Ministry of Agriculture, Viticulture and Rural Development (2007).

Table 2.6 **Rural Development Programme,** 2007-13[a]
(EUR million)

Measures	Public expenditure		
	Total	*of which:* commitments 2000-06	*of which:* European co-financing (EAFRD)[b]
Axis 1: increasing the competitiveness	128	25	25
of which: modernising farms	98	25	..
of which: improving the economic value of forests	4	–	..
Axis 2: Enhancing the environment and the countryside	212	8	54
of which: compensatory payments	104	–	..
of which: agri-environmental payments	107	8	24
of which: sylvi-environmental payments	0.6	–	0.2
Axis 3: improving the quality of life in rural areas	15	2	6
of which: basic services for the rural economy	6	1	..
Axis 4: local development strategies	13	–	5
Total	368	35	90

a) Expenditure cover the period 2007-13, or 7 years.
b) European Agricultural Fund for Rural Development.
Source: Ministry of Agriculture, Viticulture and Rural Development (2007).

Figure 2.6 **Trends in farm income components,** 2000-07



Source: Ministry of Agriculture, Viticulture and Rural Development.

Notes

1. Luxembourg has six stations – three rural and three urban – for permanent measurement and recording of ground-level ozone concentrations.
2. Replaced by the Directive 2008/50/EC.
3. Kale and leaf celery.
4. This holds for washed vegetables for human consumption (threshold of 3 pg WHO-TEQ/g dry matter) and for unwashed vegetables for use as animal feed (threshold of 0.85 pg WHO-TEQ/g dry matter), 1 pg = 10^{-12} gram, World Health Organisation-Toxic Equivalent Quantity (WHO-TEQ).
5. Samples exceeding the guidance value of 5 ng I-TEQ/kg dry matter, or $5x10^{-9}$ gram International-Toxic Equivalent Quantity (I-TEQ), which is the German standard.
6. Transport accounts for the predominant share, largely because of cross-border commuter traffic (OECD, 2007) and the fact that 75% of fuel sales are to non-residents (Chapter 5).
7. The National Statistics Office (STATEC) estimates at 6.2 years the average age of private and commercial vehicles registered in Luxembourg on 1 January 2008 (compared to a European average of around 8 years).
8. This can be paid by the year, by month, by week, or by day.
9. A modelling study now underway should determine the natural rate of recharge of the deep aquifer in the south of Luxembourg, which contains waters fit for human consumption.
10. The Water Law requires housing developments to have a separate system.
11. With the exception of artificial water bodies (those created by human activities) or those that have been highly modified (through physical alterations due to human activity).
12. 10% by length went from heavily to moderately polluted.
13. Polychlorinated biphenyls (PCBs) can cause cancers and endocrine disruption.
14. Over the same period the phosphorus balance nationwide declined from 60 kg/ha to less than 10 kg/ha.
15. In addition to the Grand Duchy of Luxembourg, the "Grande Région" includes Lorraine, the Saar and Rhineland-Palatinate, Wallonia, and the French- and German-speaking communities of Belgium.
16. Most concentrations are below 50 ng/litre.
17. Moreover, Luxembourg banned the use of Atrazine only in 2006 (*versus* 1990 in Rhineland-Palatinate, 2003 in Lorraine, and 2004 in Wallonia).
18. Amended Law of 29 July 1993 on Water Protection and Management.
19. Following a formal notice from the European Commission, the Regulation was modified in 2007 to strengthen the role of the Commission in granting derogations to water suppliers for non compliance with chemical parameters. Under the Regulation, such derogations may be granted, on request, provided they do not create potential human health hazards and where there is no other reasonable means to maintain water supply in the area.

20. Directive 2006/7/EC retains only two of the three bacteriological parameters included in the old Directive 1976/160/EEC, namely intestinal enterococci and escherichia coli (which are assimilated with the parametres for thermotolerant coliform and fecal streptococcus).
21. A draft law was in fact prepared in May 1995, calling for a fee on the discharge of industrial and domestic waste waters, but it was eventually withdrawn.
22. Then their consumption exceeds 8 000 m^3 a year or their pollutant load exceeds 300 average population equivalent.
23. The average billing rate for drinking water is 1.5 to 1.7 EUR/m^3 *versus* a cost of 2.20 EUR/m^3. The average sewage treatment billing rate is 1.0 to 1.2 EUR/m^3 *versus* a cost of 2.30 EUR/m^3. In 2008, the selling price for water in Luxembourg City was set at 2.15 EUR/m^3 and a rate of 1.40 EUR/m^3 consumed was charged for waste water, whether or not it was discharged into the public sewers.
24. The poorest households can never be deprived of water, however, something that is not always explicit in the legislation of other OECD countries.
25. Withdrawals for irrigation are negligible.
26. Total UCPs are determined from coefficients (1 kg COD = 0.5 UCP; 1 kg N = 1 UCP ; 1 kg P = 7 UCP and 1 kg SPM = 0.3 UCP).
27. 1/5 x (waste water/150) + (COD/120) + (N/12) + (P/1.8)+(SPM/70).
28. The AGE monitors compliance with the authorised pollutant load.
29. Article 41 of the 24 December 1999 Law setting the government budget for fiscal year 2000.
30. The total revenues provided by these two taxes could potentially reach EUR 11.5 million per year on the basis of an annual consumption of 40 million m^3 and a rate of EUR 0.10/m^3 for the abstraction tax and EUR 0.19/m^3 for the pollution tax. The two taxes will be imposed as from 2010, with taxes for the year 2010 being collected in 2011.
31. 80% if the measures are taken at the national level; 100% if the projects are recognised as being of national interest.
32. 50% for simple improvement and maintenance works on watercourses; 100% if projects are recognised as being of national interest. Rehabilitation ("*renaturation*") is defined as restoring a watercourse to close to its natural condition.
33. Law of 28 May 2004 creating the Water Management Administration.
34. The plans must then be re-examined and updated by the end of 2015, and every six years thereafter.
35. That registry contains drinking water abstraction zones, zones designated for the protection of economically important aquatic species, and bathing areas.
36. Luxembourg contains seven river basins (Alzette, Basse-Sûre, Chiers, Haute-Sûre, Moselle, Our and Woltz).
37. Luxembourg has also experienced periods of drought, for example during the summers of 2003 and 2005.
38. The AGE is to establish a water flow modelling system for these watercourses as a flood forecasting tool.
39. The natural physical characteristics of rivers (variations in depth, current, bed structure and substrate, bank structure, slope, channel pattern, etc.) determine their capacity to host species. This is called hydromorphology.
40. The scheme applied to 122 000 ha over the period 2000-06, or 96% of declared farmland.

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3

WASTE AND MATERIALS MANAGEMENT*

Features

- Waste reduction and materials recovery
- Secondary raw materials and the circular economy
- The SuperDrecksKëscht® management concept
- Financing and planning of municipal waste management

* This chapter assesses progress over the last 10 years and in particular since the Environmental Performance Review published by the OECD in 2000. It also examines performance against the targets in the 2001 OECD Environmental Strategy.

Recommendations

The following recommendations are part of the overall conclusions and recommendations of the environmental performance review of Luxembourg:

- implement the *General Waste Management Plan* with more efficient measures for achieving the principal objectives, and with the necessary financial and other means;
- establish harmonised and differentiated pricing for municipal waste management across the country, based on the *polluter pays principle* and cost recovery;
- achieve *economies of scale* by encouraging communes to co-operate more effectively and co-ordinate their actions (collection methods, selective sorting, recycling programmes);
- co-ordinate the management of *hospital* and similar *waste*, in partnership with interested parties in Luxembourg and the neighbouring countries;
- establish a multiyear clean-up and rehabilitation plan for *contaminated sites*, including orphan sites, and specify how they will be funded;
- establish a database in support of a policy to enhance *resource productivity* and identify the best measures for achieving it (*e.g.* use of new technologies and innovation).

Conclusions

Luxembourg has for many years been pursuing an *active policy* of waste and materials management. The *legislative and regulatory framework* is comprehensive, in accordance with European legislation, and there is a *General Waste Management Plan* that sets qualitative and quantitative objectives. There are many activities relating to information, awareness and advice. During the review period, *municipal waste* increased less quickly than GDP (relative decoupling); *collection and recycling rates* also improved, and are among the highest in Europe; and residual mixed waste remained stable. There has been significant progress with "*problem*" household and industrial *waste*. There is now a legal basis for managing them, and this ensures greater consistency at the national level. Luxembourg industry makes heavy use of *secondary raw materials*, and self-sufficiency is guaranteed for the disposal of municipal waste. Significant progress has also been made with respect to *inert waste*.

Municipal waste production per capita, however, is among the highest in the OECD, although cross-border workers contribute to that production. The targets of 30% reduction in specific disposable waste and bulky waste has been missed.

Municipal waste management still suffers from a *lack of coherent planning* at the national level, which makes it difficult to exploit synergies. As a result the quality of sorting is uneven and there is considerable unexploited recovery potential, particularly for organic components and plastics from municipal waste. The *polluter pays principle* is only partially applied, and prices vary among the communes. There has been little progress in managing *waste from the health sector*: it is no longer co-ordinated, and self-sufficiency is not guaranteed for the treatment and disposal of infectious waste. Despite a survey of *contaminated sites*, there is no plan for rehabilitating them, and there is no assured funding for cleaning-up orphan sites.

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1. Management and Action Framework

Luxembourg has for many years been pursuing an active policy of waste management based on *prevention and recovery* with a view to minimising environmental impact and supplying high-quality *secondary raw materials*. It gives priority to recovering materials for reintroduction into the economic circuit. Incineration with energy recovery is not deemed equivalent to materials recovery when its primary purpose is waste disposal.

1.1 Legislative and regulatory framework

The legislative and regulatory framework is complete and in line with European legislation. It is based on the *amended Waste Prevention and Management Act* (PGD, 1994), which calls for full-cost pricing at every stage of waste management and sets the following goals: *i)* preventing and reducing waste production and pollution from waste; *ii)* recovery through reuse, recycling or any other environmentally appropriate method; and *iii)* disposal of final waste in environmentally and economically appropriate ways.

Other laws and *grand-ducal regulations* concerning specific waste flows supplement the PGD Act and transpose *European legislation* into national law (movements of hazardous waste, packaging waste, waste oils, PCBs, waste incineration, sewage sludge, waste electrical and electronic equipment [WEEE], batteries, etc.). European legislation plays an increasing role in determining policies and establishing objectives. Luxembourg must also comply with other *international commitments* relating to transboundary waste movements and to the ecological management of waste and resource productivity.

1.2 Planning and implementation

The *General Waste Management Plan* (PGGD) sets guidelines for policy implementation and defines *qualitative and quantitative objectives*. It is prepared by the Environment Administration in consultation with the parties concerned (government departments, communes, inter-communal syndicates, professional associations and NGOs) and includes sector-specific plans for the broad waste categories (Box 3.1). A revised version of the initial plan (adopted by the Cabinet in 2000) is now under preparation (Ministry of the Environment, 2009).

Classified installations are to appoint a "waste management officer" and prepare a *Waste Prevention and Management Plan* (PPGD) that will assess the potential for prevention and recycling. The firms must integrate this plan into any license or license amendment application. The PPGDs must be reviewed every three years, and regular reports must be submitted on them. Hospitals and similar institutions are subject to the same system.

Waste management is monitored by a *National Co-ordination Council* (for household waste) and by *multipartite monitoring commissions* (for waste subject to extended producer responsibility). A *database* has been established to track waste production and management. It is updated from the annual *activity reports* received from the communes, the inter-communal syndicates, recycling establishments and licensed agencies, business waste balance sheets and waste movement notification forms.

Elimination, treatment and recycling facilities are regularly inspected (for emissions, surface and groundwater impact, management quality, etc.). *Domestic and international movements* of waste are subject to authorisation and specific notification procedures.

2. Current Situation

2.1 Objectives

Luxembourg's performance with waste and materials management can be evaluated on the basis of the *management principles* set forth in the PGD Act, the PGGD 2000, and the thematic strategies of European Union, as well as the *quantitative targets* of the 1999 National Plan for Sustainable Development, the PGGD (2000) and European legislation (Table 3.1). Additional benchmarks can be found in the recommendations of the OECD Council and the *recommendations made by the OECD* in the previous review[1] (Table 3.2).

Box 3.1 **Institutional framework and responsibilities**

The *communes* are responsible for: *i)* management of household, bulky and similar waste, including organic waste; *ii)* support for the collection of "problem waste" (availability of recycling centres; parking for collection trucks); and *iii)* the collection of waste from housing construction. All the communes belong to one of three large *inter-communal syndicates (SIC)* that handle waste disposal and recovery. Other syndicates run specific installations or services (*e.g.* composting facilities). Private enterprises play an important role in household rubbish collection.

The communes have communal autonomy in defining waste management measures (including collection, recovery and disposal methods and public information and awareness-raising). They can delegate all or part of their responsibilities for waste management to syndicates and they set the waste management charges.

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*, the supervisory authority for the communes, oversees waste management expenditure, local authority regulations, and the formation of inter-communal syndicates. It ratifies the methods for calculating municipal waste management taxes and ensures their legality. With its national land use planning and occupancy responsibilities, it is involved in establishing the national network for inert waste disposal.

The *Ministry of Finance, through its Customs and Excise Administration,* oversees and controls cross-border waste movements, in co-operation with the national police, and monitors compliance with regulations related to extended producer responsibility together with the Environment Administration.

The *National Co-ordination Council* for household waste management includes the inter-communal syndicates, the Ministry of the Environment, the Environment Administration, and the Ministry of the Interior. It is chaired by the Minister of the Environment.

Responsibility for managing non-household waste falls to the *producers and holders of that waste*, *i.e.* the operators of industrial, service, commercial or hospital facilities, which may call upon private sector firms to fulfil their obligations and co-ordinate management in specific sectors.

The management of waste subject to extended producer responsibility is handled for the account of its producers by *government-licensed private agencies* (Valorlux for packaging, Ecotrel for WEEE). Scrapped vehicle management is organised and monitored by Febelauto for the account of importers, for both Belgium and Luxembourg. Management of packaging waste, WEEE and batteries is monitored at the national level by the multipartite commissions, comprising representatives of various ministries, departments, trade groups and inter-communal syndicates.

Source: OECD, Environment Directorate.

Table 3.1 **Quantified national targets**

General Waste Management Plan (2000) (2005 targets; base year 1999)	National Plan for Sustainable Development (1999) (2010 targets; base year 1999)	Results obtained
HOUSEHOLD, BULKY AND SIMILAR WASTE		
Final waste (specific quantity) reduction rate: 30%	Waste for disposal, per capita: reduction rate: 50%	1999: 455 kg/cap. 2005: 425 kg/cap. 2007: 388 kg/cap. Reduction rate: 15%
Organic waste recycling rate: 75% landfill: reduction to 75% of 1995 amount (by end 2006); 50% (by end 2009); 35% (by end 2016) – [European target]	Organic waste: recovery rate: 80%	Total estimated at 113 000 tonnes Recovery rate (2007): 66%. Estimated at 31% of residual waste in 2005 → unused recovery potential. Disposal to landfill: 2016 target achieved
Other recoverable waste recycling rate: 45%	Other recyclable waste: recovery rate: 50%	Volume unknown → target not measurable
Packaging waste recovery rate: 55% recycling rate: 45% (15% for each material) Calculated from reported amounts put on the market.		Total recovery rate 1999: 54.5% (excl. incineration) 2005: 88.1% (with incineration) 2006: 92.5% (with incineration). Total recycling rate 2006: 67.1% (Valorlux) recycling rate per material: 1999: from 26% (plastics) to 76% (glass) 2005: from 30% (plastics) to 92% (glass) 2006: from 32% (plastics) to 93% (glass)
Problem waste separate collection rate: 70%	Problem waste: separate collection rate: 75%	2005: rate estimated at 85.7%[a] 1999: SDK 1 398 tonnes 2005: SDK 2 159 tonnes 2008: SDK 2 444 tonnes
Waste electrical and electronic equipment (WEEE) – separate collection rate: 4 kg/inh. by end 2006 (European target)		2007: 8.5 kg/cap.
Bulky waste (specific quantity) reduction rate: 30%		1999: 11 kg/cap. (PDR) 2007: 16 kg/cap. (PDR) Increase of 41%
INERT WASTE		
Prevention rate: 20% Total recovery rate: 30% Recovery rate (excl. landfills): 15%	Recovery rate: 25%	Prevention rate: → target not measurable. Total recovery rate (estimate): in 1999: 35%; in 2005: 45.2% Recovery rate (excl. landfills) in 2005: 26.4% (= 45.2-18.8)

Table 3.1 **Quantified national targets** *(cont.)*

General Waste Management Plan (2000) (2005 targets; base year 1999)	National Plan for Sustainable Development (1999) (2010 targets; base year 1999)	Results obtained
INDUSTRIAL, SERVICE AND COMMERCIAL WASTE		
Prevention rate: 15% Recovery rate: 80%	Waste for disposal: reduction rate: 15% recovery rate: 75%	Volume unknown → target not measurable
HOSPITAL AND SIMILAR WASTE		
Prevention rate: 5% Recovery rate: 30%		→ Target not measurable

a) Estimate based on quantities collected by SDK and on a 2004/5 analysis of residual quantities in household rubbish.
Source: Environment Administration; OECD, Environment Directorate.

2.2 Trends in waste generation and management

Municipal waste

Under the impact of separate collection and recovery measures, there has been further *decoupling* between municipal waste, residual waste for disposal and GDP over the period under review. The volume of waste that must be dealt with has been growing less quickly than GDP, although at a rate close to growth in private consumption, while both population and cross-border employment have been rising (at 10% and 55% respectively). Waste generation per capita[2] (at 690 kg) is among the highest in the OECD, reflecting the impact of high incomes on consumption levels and trends (Figure 3.1)

With *separate collection*, some 44% of total waste can now be recovered. Recovery volumes are rising, reflecting the growing network of recycling centres and active public awareness about trash sorting. Municipal waste collection amounts to more than 300 kg per capita every year, making Luxembourg's performance *among the best*. The national and European recycling targets for packaging, waste oils and WEEE have been achieved, in some cases before the target date. Collection and recovery rates are among the best in Europe. Most of the waste collected is exported for recycling (primarily to Germany, Belgium, France and the Netherlands). Organic waste is also recovered.

Table 3.2 **Implementation of OECD recommendations**

OECD recommendations (2000)	Steps taken and results obtained
Finalise and implement the National Waste Management Plan.	Cabinet adopted the first Plan in December 2000. A revised plan is under preparation.
Emphasise 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).	Separate collection and the network of recycling centres have been reinforced, and significant progress has been made in raising public and business awareness through the efforts of SuperDrecksKëscht®. Projects conducted in collaboration with the private sector are encouraging the prevention of consumer waste generation. These measures have produced concrete results: volumes of waste collected separately have gone up, and collection and recycling rates are among the highest in Europe; municipal waste volumes have stabilised, despite population growth, and specific waste quantities have declined. There has been little progress in enforcing the polluter pays principle in municipal waste management, and harmonised and differentiated taxation has not yet been introduced in all communes.
Assure more efficient utilisation of municipal waste treatment capacity.	Pre-treatment of waste for disposal has been reinforced to reduce fermentability and volume before it is sent to landfill, and to separate recoverable components of high caloric value before incineration. A new, more energy-efficient incinerator is under construction. Self-sufficiency is guaranteed for coming years.
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.	There has been good progress in implementing laws for establishing and updating the Waste Prevention and Management Plans (PPGDs), and SuperDrecksKëscht® fir Betriber (SDK) efforts have improved waste prevention. Since 2005, SDK has had a legal basis ensuring its continuity and making it more coherent across the country. Its business membership has more than tripled since 2000.
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.	Final industrial waste volumes have declined with the closure of one mill and efforts at prevention and ecological management have diverted much waste from disposal to recovery. Application of the proximity principle is subject to some limitations. As final industrial waste declines, there is now less rationale for the Luxembourg facilities. Disposal takes place in neighbouring countries and does not require the negotiation of agreements. Physico-chemical treatment capacities for industrial waste far exceed the volumes generated in Luxembourg.

Table 3.2 **Implementation of OECD recommendations** *(cont.)*

OECD recommendations (2000)	Steps taken and results obtained
Manage hospital waste effectively, respecting the proximity principle.	Infectious hospital waste is still being sent abroad for disposal. Efforts are underway to improve sorting at source and to reduce the volume of this waste, and more establishments have joined the SDK. The outcome is still inadequate, and hospital waste management suffers from a lack of coherence and co-ordination. The proximity principle is only partially respected.
Speed up the establishment of a register of polluted sites and the cleanup of contaminated sites.	There has been a register of polluted sites since 2006. Sites are cleaned up as land-use needs dictate, or when pollution is found. Priority is given to old steel mills and other industrial sites. Financing for the cleanup of orphan contaminated sites is not guaranteed. Studies are under way.

Source: OECD, Environment Directorate.

Volumes of *residual mixed waste* have remained stable since 1999. More than two-thirds of this waste is incinerated with energy recovery (72%), while the remainder goes to landfills (28%). The objective of reducing landfill-destined biodegradable waste to 35% of the 1995 level by 2016 has already been achieved.

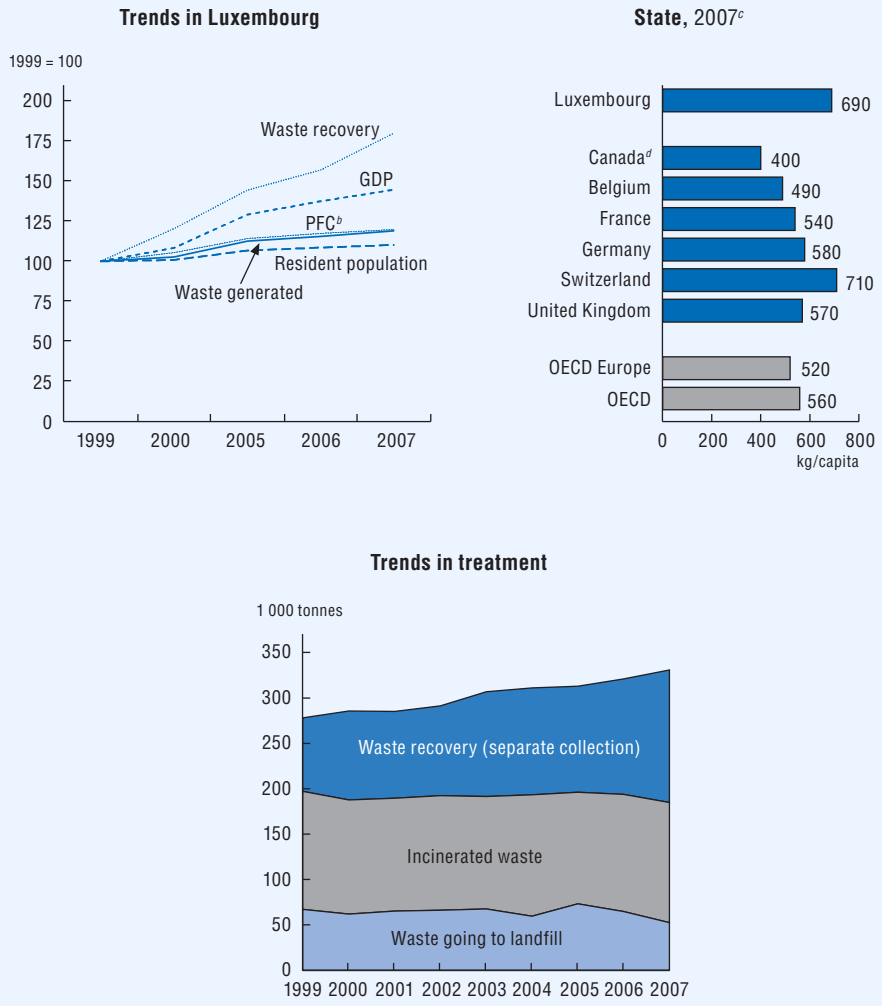
However, the 30% reduction target for *specific waste for disposal*, set in the 2000 PGGD, has not been met. The proportion of *organic matter and plastics* in door-to-door residual waste collection remains high (31% for biological waste; 25% for paper and cardboard; 17% for plastics). This points to an *unexploited potential for reduction and recovery*. The high proportion of organic material also reduces the caloric content of this waste and increases the likelihood of fermentation and greenhouse gas emission. The goal of reducing the volume of *bulky waste* by 30% has not been achieved. Most of this waste is sent to landfills or incinerated without pre-sorting.

In order to make further progress and to take full advantage of the municipal waste *recovery potential*, Luxembourg will have to place greater emphasis on the *quality of sorting and of recyclable materials*, and create municipal facilities for marketing them so as to reduce costs.

Industrial, commercial and service waste

In 2008, 398 000 tonnes of industrial, commercial and service waste were subject to notification[3] of which 329 000 tonnes were exported to Germany, France,

Figure 3.1 **Municipal waste generation**[a]



a) When interpreting national figures, it should be kept in mind that definitions and survey methods can vary among countries. According to the definition used by the OECD, municipal waste refers to waste collected by or on behalf of municipalities. It includes waste originating from households, commerce and trade, bulky waste and similar waste treated in the same installations.
b) Final private consumption.
c) Or latest available year.
d) Household waste only.
Source: OECD, Environment Directorate; OECD (2008), *OECD Economic Outlook No. 84*; Environment Administration.

Belgium and the Netherlands and 69 000 tonnes were transferred within the country. Added to this are 13 000 tonnes of *sewage sludge*, most of which is used in agriculture (51%) or composted (42%), and 10.5 million tonnes of *inert waste*, consisting primarily of construction materials (76% excavated earth), demolition waste and road maintenance waste.

Final industrial waste declined during the period under review, reflecting the combined impact of the closure of a mill and implementation of PPGDs by businesses.

3. Waste Reduction and Materials Recovery

Luxembourg has few levers available for influencing the design or composition of products. It can however act on consumer habits and on household and business participation in selective sorting and in waste prevention and ecological management programmes. Its policy is to introduce separate collection and appropriate management systems, together with information targeted at households and consumers, as well as advisory services, training and assistance to businesses.

3.1 Municipal waste

For 20 years now, separate collection of municipal waste has been based on both mobile and fixed collection, a network of 24 recycling centres (PDR) and a programme of regular public information. Separate collection applies to all recoverable items and "problem waste". The volumes collected by voluntary delivery to PDRs have more than doubled since 1999.

Used objects

The market for used objects encourages the reduction of such waste (particularly bulky items). Many PDRs have set up a "*trading post*". One of the three inter-communal syndicates, SIDEC, has established an exchange that is accessible by Internet. The *Objectif Plein Emploi* ("Target Full Employment") network, covering 50 communes, sponsors co-operative undertakings and sustainable local development projects, and has a "*virtual store*" offering used items reconditioned by former job-seekers.

Organic waste

Municipal organic waste[4] is estimated at around 113 000 tonnes a year, of which 66% is collected separately for recovery. Separate collection now covers nearly the entire population, and the volumes collected have risen by more than 50%. Over 90% is composted, and the remainder fermented. Individual composting is being

encouraged. The compost is given a quality label[5] and is marketed in Luxembourg[6] (at more than 13 000 tonnes a year).

However, organic waste still accounts for a third of residual waste for disposal. *The collection methods and the rates* charged vary greatly from one commune to the next. The volumes collected separately do not always find their way into the recovery systems. More and more households have installed garbage-grinding units in their sinks and are now disposing of their kitchen waste through the sewer system. Only a minority of communes are respecting the legal requirement for recovery (PGD Act). The recycling target (75%) and management harmonisation goals (PGGD 2000) have not been achieved. The network of composting facilities, which has been expanded since the last review, is not well distributed geographically and the facilities are not up to European regulatory standards. New facilities are planned, particularly for biomethanisation, to help meet national renewable energy targets.

Problem waste

Since 1985, the "SuperDrecksKëscht®" (SDK programme) has brought *significant progress* (Box 3.2). Volumes collected from households[7] have risen by 74% since 1999, to more than 5 kg per capita in 2008 (70% of the total generated) (Figure 3.2). Efforts relating to particular flows achieved a separate collection rate of 52% for dry batteries in 2007, exceeding the 45% stipulated for 2016 in European legislation. The waste collected by SDK is *pre-treated and packaged* before being exported, primarily to Belgium. Edible fats and oils are transformed into *biofuel* that is used in SDK facilities or to power its vehicles.

Packaging waste

Since 1998, *firms that package goods* or sell packaged goods are required to take the packaging back and to achieve minimum recovery and recycling rates. In 1995, the private sector set up a non-profit body, *Valorlux*, to meet these obligations, and it was licensed in 2000 by the Environment Ministry. Valorlux contributes financially to separated collection systems *in all communes*, and with 92 of them (73% of the population), it organises house-to-house collection for the "PMC" portions (plastics, metals and drink cartons). Its *costs are almost fully covered* by participants' contributions[8] (there are nearly 1 000 member firms).

Packaging accounts for around 25% of household waste. An important and growing portion of this waste is collected, recovered and recycled, but a good deal of it still finds its way into residual household rubbish (Table 3.1). The recycling is mainly done in neighbouring countries. Steel packaging is recycled in Luxembourg, by the steel industry.

Box 3.2 **The SuperDrecksKëscht® (SDK): a success story in managing problem waste**

SDK is a programme for managing problem waste sponsored by the Environment Ministry in co-operation with the communes (household component) and the *Chambre des Métiers* (Trades Council) (business component). The Environment Administration is responsible for co-ordinating and overseeing the programme. The SDK is based on the principles of *prevention, reduction and recovery* of waste: *i)* all recyclable materials are processed to recover a maximum of secondary materials, and all problem substances are treated to *minimise their impact on the environment*; and *ii)* substance flows, from generation to transformation into new raw materials or until their disposal in an environmentally-friendly manner, must be clearly presented so that they can be audited at any time. The SDK programme is ISO 14001 certified and has had a legal basis since 2005.

The household component (*SuperDrecksKëscht® fir Birger*) has been handling household waste since 1985. It includes:

- collection by mobile containers, collection at fixed recycling centres, and home pickup on request;
- actions targeting particular flows of waste, in co-operation with private partners (*e.g.* for batteries, medications and syringes);
- numerous information and awareness campaigns, in the schools and elsewhere.

The business component (*SuperDrecksKëscht® fir Betriber*), in place since 1992, concerns non-household waste generated by businesses and by public and private establishments. Participation is voluntary and is done by contract. It includes:

- *assistance* and *advice* for certifying ecological management of waste, with *i)* a situation report on waste management in the firm, and help in preparing the waste balance sheets; *ii)* assistance in preparing the firm's Waste Prevention and Management Plan (PPGD); *iii)* assistance in implementing the PPGD (separate collection, storage, treatment, finding of licensed enterprises, prevention of waste generation through use of durable materials or introduction of environmentally-friendly production methods); and *iv)* information, training and awareness activities for employees;
- collection of small quantities of waste on request;
- collection of particular flows in co-operation with public and private sector partners.

Quality label

A *quality label* (ISO 14024 certified in 2009) is awarded to service firms and waste transport companies that manage their waste in an environmentally responsible manner consistent with the SDK concept. Compliance with management criteria is audited once a year. Firms that have had the label for five consecutive years are audited only every two years. The list of certified firms is published on the Internet.

Box 3.2 **The SuperDrecksKëscht® (SDK): a success story in managing problem waste** *(cont.)*

Financing

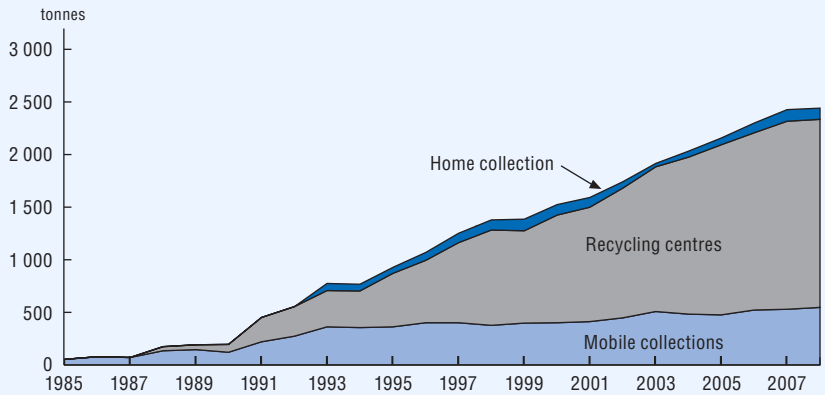
The cost of the household component is fully covered by the government through the Environment Protection Fund. The cost of the business component is shared: assistance, advisory and training services are financed by the government, while waste collection and treatment is covered by the firms.

Franchise contracts

Since 2007, the SDK concept has been exported in the form of franchise contracts that are available to public authorities and to public and private establishments in other countries seeking to institute a waste management system along the lines of the Luxembourg model.

Source: Environment Administration, *www.sdk.lu.*

Figure 3.2 **Separate collection of problem household waste,** 1985-2008



Source: Environment Administration.

Waste electrical and electronic equipment (WEEE)

Since 2005, *importers and producers* have been responsible for treating and recycling the electrical and electronic equipment they sell in Luxembourg. The government has signed an agreement with the various parties concerned to determine the methods of management. Ecotrel, a non-profit association created in 2004 and licensed by the Environment Ministry, is responsible for household and similar waste. Its activities are financed by *recycling fees*, which are paid by its members and passed on to consumers.[9] The *separate collection* target for household WEEE (4 kg per capita at the end of 2006) has been exceeded by a wide margin. With 8.5 kg of waste collected per capita per year, Luxembourg's performance is *among the best* in Europe. Around 70% of old refrigerators are collected and exported to Germany for processing and recovery of CFCs. After treatment, the insulating foam is marketed as an oil absorbent.

3.2 Preventing consumer waste generation

To prevent the generation of consumer waste, the emphasis is on informing the public about the products that generate waste, components that are hazardous to the environment and health, and available substitutes. These efforts rely on joint public- and private-sector initiatives, and on economic instruments.

The "*éco-sac*" ("eco-bag") project: with 1.25 million multiple-use bags sold in 2008, and a user rate of nearly 65%, the 38% target set for 31 January 2008 has been far exceeded. Bagless purchases have been growing, and the sale of throwaway bags has dropped by 84% since 2004, their rate of use at less than 25%. The "*clever akafen*" ("buy smart") campaign promotes products designed to minimise waste throughout their lifecycle, to facilitate recycling of their various components, or to make them less hazardous. It applies to batteries, light bulbs, paints and detergents. Sales of these products are growing.

3.3 Industrial, commercial and service waste

The main instruments for achieving waste prevention targets and reintroducing materials into the economic circuit are the Waste Prevention and Management Plans (PPGDs) and the advice provided to businesses by the SDK *SuperDrecksKëscht® fir Betriber* programme.

Waste Prevention and Management Plans (PPGDs)

The PPGDs require firms to evaluate their prevention and recycling potential and institute ecological management of their waste. More than 3 000 firms have established a plan since 1995. Good progress was made over the review period in implementing the legal provisions in terms of establishing PPGDs. The PPGDs now have to be updated more systematically, and their preparation and implementation are fully co-ordinated with the SDK programme.

The SDK programme for businesses: SuperDrecksKëscht® fir Betriber

The SDK programme is intended to reduce the volume of waste generated. *Participating firms* receive *advice* on ecological management of their non-household waste in the context of their PPGD. Waste collection in limited quantities is organised upon request. Collection of particular flows is done in collaboration with public/ private sector partners (*e.g.* the Ministry of Agriculture for the collection of plastic silage wrap). The SDK is co-ordinated with other collection and treatment programmes. The *cost* of collecting and treating waste is borne by the firms; the state covers the cost of information and advisory services (Box 3.2).

The number of firms participating in the SDK *has risen sharply* and stood at 2 815 at the end of 2008 (representing 50% of total employment in Luxembourg) (Figure 3.3). More than half of those firms have earned the SDK *quality label* awarded by the Environment Administration and the Chambre des Métiers (Trades Council). The SDK concept is now being exported through *franchise contracts*.

Use of secondary raw materials

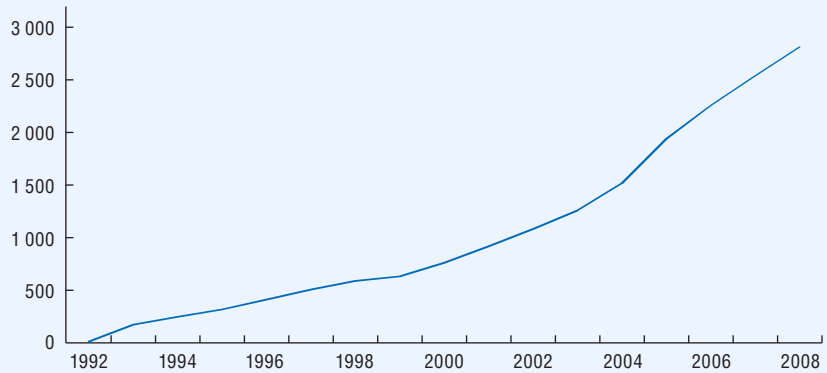
Several industries established in Luxembourg are using waste as secondary raw materials or as backup or replacement fuel in their production processes. Most of these materials are imported. They consist primarily of scrap iron, aluminium, copper, glass, plastic and tires, but they also include combustible waste such as solvents and sludges (Table 3.3). Waste recovery in the production process is subject to authorisation and pre-testing.

The "recycling exchange"

The recovery of materials from waste generated by industry and commerce is encouraged by a "recycling exchange" instituted by the government (Environment Ministry and Environment Administration) and the business associations concerned (FEDIL). The exchange serves as an intermediary between buyers and sellers of recyclable waste and reusable products. It is co-ordinated with other exchanges in the "Grande Région" and beyond,[10] and is open to private participants.

Figure 3.3 **The SDK action for companies**

Trends in the number of member companies



Source: Environment Administration, 2009.

Table 3.3 **Production, recovery and recycling, selected material flows,** 2006

(1 000 tonnes)

Waste	Glass	Ferrous metals	Aluminium	Plastic
Generated domestically	48.8	173.3	4.7	20.1
Collected for recycling	48.8	173.3	4.7	20.1
Imported for recycling	18.6	2 693.9	167.3	25.9
Exported for recycling	48.8	173.3	4.7	20.1
Waste recycled domestically	18.6	2 693.9	167.3	25.9

Source: Environment Administration.

Although it attracted more than 12 000 visitors in 2008, the exchange is fulfilling its role only partially. Most of the major industrial firms have their own networks and are fully familiar with the markets for primary and secondary raw materials. The value added by the exchange is therefore marginal. It could play a more important role for small and medium-sized enterprises (SMEs) if it had greater visibility on the websites

of the Federations of Commerce and Industry, and if it focused on materials with a high recovery potential. Luxembourg could benefit from the experience of other OECD countries in this area and look for synergies elsewhere in the "Grande Région".

Recycling centres

Small quantities of household-type waste generated by businesses are accepted under certain conditions in the recycling centres. The acceptance rules and the financing methods are not co-ordinated, and firms often contribute nothing to funding the facilities. This creates competitive distortions and complicates PDR management. To remedy the situation will require clarification and harmonisation of the conditions of access and procedures for acceptance (including the rates charged) for business waste at all the PDRs, followed by establishment of a national network of recycling centres specifically designed for businesses under the aegis of the SDK, as proposed in the revised PGGD.

3.4 Optimising material flows and resource productivity

The ecological management of materials and waste has been a legal obligation since 1994, and is at the heart of the revised PGGD, which stresses the "resource" and "circular economy" aspects of waste management. Putting it into practice will require additional preventive efforts and closer integration of waste and resource management within firms, together with promoting the use of secondary raw materials and developing markets for these materials. This can only happen in a broader geographic space than Luxembourg, and will require the search for synergies with neighbouring countries and beyond.

With many industries that are heavy consumers of secondary materials, and with a well-established business coaching and assistance system, the conditions are ripe for *analysing material flows and product lifecycles*[11] and expanding capacities for research and advice to firms in this field. The *principle of resource productivity* should be integrated into all policies and sectors of activity (construction, logistics, manufacturing, commerce, etc.) and associated with measures to promote research and "green innovation". This could be done in the context of the Ecotechnologies Action Plan, with a view to supporting economic activity.

4. Treatment and Disposal of Final Waste

4.1 Municipal waste

Thanks to the ongoing efforts at reduction and recovery, Luxembourg is assured a high degree of *self-sufficiency* when it comes to disposal of municipal waste over

the coming years. The three inter-communal syndicates operate, respectively, *two controlled landfills*[12] and an *incineration plant*.[13] The incinerator handles around 135 000 tonnes of waste a year, 10% of it from other inter-communal syndicates. Thermal treatment costs around EUR 0.10/kg of waste.[14] The incinerator generates 5 700 tonnes of hazardous waste every year, as well as 29 000 tonnes of slag; most of this waste is exported to Germany, including the slag which, until June 2008, was recovered in Luxembourg.

4.2 Non-household waste

Since the 2000 review, volumes of *final industrial waste* have declined due to the closing of one mill and the recovery efforts of businesses, which have diverted many types of waste from disposal to recovery. The remaining quantities are such that domestic facilities are less justified than in the past. Non-household waste for *disposal is exported* to specialised facilities in neighbouring countries, primarily in Germany. The total quantities exported vary from one year to the next.

With the commissioning in 1998 of a facility for *physico-chemical treatment of special waste* (emulsions, water-oil mixtures, oils, acids and bases, waste containing chromium, cyanide, industrial sludges), the country is guaranteed self-sufficiency in this area. Its annual capacity of 60 000 tonnes far exceeds domestic needs, and it operates primarily with imported materials.

5. Particular Flows

5.1 Hospital and similar waste

In 2001, the *flow of hospital waste for disposal* was estimated at around 2 900 tonnes, of which 6% was infectious. Since the hospital incinerators were closed in 1997, this waste is *exported* to specialised incinerators located primarily in Belgium, but also in Germany, France and the Netherlands. Exports subject to notification are rising. Hospital-type waste *generated by other sources* is often added to household waste and thus escapes any special monitoring.

Despite greater efforts to sort waste at source, and the growing number of participants in the SDK programme, the *management of waste from the health sector lacks coherence and co-ordination*. In comparison to the first OECD review, the situation has on the whole deteriorated. Since the Hospital Waste Management Association was disbanded, waste is now managed directly by the operators. Self-sufficiency in treatment and disposal is not guaranteed. A study of material flows in one of the country's major hospital centres showed that, for the same environmental

cost, a national infectious waste treatment and incineration system could offer an economic advantage over export. As the effectiveness of waste management in the health sector is also a concern in neighbouring regions, an effort could be made to step up co-operation within the "Grande Région". There will have to be a more detailed study of the economic and environmental costs and benefits of different options. This should be based on a thorough analysis of existing volumes and flows, and should be done in partnership with all the parties concerned in Luxembourg and in the neighbouring countries.

5.2 Inert waste

Inert waste is managed by the producers or holders of such waste, who are required to see to separate collection, prior sorting and establishment of disposal and recovery facilities. Since 2006, there has also been a *sectoral Master Plan* that establishes a *national network of landfill centres* for inert waste in accordance with the proximity principle.[15] The *volume* of inert waste generated, which is closely linked to construction activity, has risen in recent years.

6. Financing and Coherent Management

6.1 Expenditure and costs

There is no available overview of public or private expenditure and revenues associated with waste management. The current PGGD does not include a financial aspect, or any cost-benefit analysis of the measures proposed and the targets set.

6.2 Funding for municipal waste management

The funding of municipal waste management is based on a combination of *local council taxes*[16] *and government subsidies*. The Ministry of the Environment reimburses up to 25% of the capital cost of inter-communal facilities for household and similar waste disposal, up to 40% of the capital costs of communal and inter-communal PDRs, up to 60% of the capital costs of composting or bio-methane projects for organic waste and sewage sludge, and up to 100% of the costs of handling problem household waste through the SDK programme. In 2008, 68% of spending by the *Environmental Protection Fund* (EUR 9 million) went to waste prevention and management.

Little progress has been made since 2000 in terms of applying the polluter pays principle (PPP) to municipal waste management and *harmonising the local council*

tax rates. Fifteen communes[17] (home to around a third of the country's population) are applying a harmonised and differentiated tax that respects the PPP: it involves weighing and identifying dustbins at collection time and is combined with an effective system of separate collection for recyclable items. The system includes a flat-rate tax, a charge for the collection of residual waste,[18] and differentiated charges for separate collection (geared to weight and the type of material). In these communes, residual waste volumes for disposal have been reduced by 50% in two years, and specific waste volumes are 30% lower than in the other communes.[19]

The planned extension of this system to cover the entire national territory has however been held back by communal autonomy. Most of the communes are still calculating their charges without any regard to the real costs, often taking as their basis the size of the dustbin. Moreover, the *calculation base and the level of communal taxes* still vary between syndicates and even between communes within the same syndicate (Table 3.4). There are also persistent differences in the charges for collecting *organic waste* and specific types of waste such as bulky items or used tires (Table 3.5). With respect to *bulky waste*, more than half of the communes base their charges on actual quantities removed. Other communes apply no charges or set them without regard to actual quantities and management costs (Ministry of the Environment, 2009; OECD, 2007).

Table 3.4 **Municipal taxes on residual household waste,** 2006

Base of calculation	Number of communes	% of national resident population	Generation[a] of residual household waste (kg/cap.)
1. Household size	3	*2.7*	257
2. Dustbin size	91	*66.0*	245
3. Dustbin size and household size	2	*1.7*	162
4. Flat tax for small dustbins, number of emptyings for bins > 660 l	0	*0.0*	
5. Number of emptyings with minimum of mandatory emptyings	0	*0.0*	
6. Weight of rubbish and number of emptyings	8	*6.3*	161
7. Bin size and number of emptyings	12	*22.3*	195
8. Number of emptyings	0	*0.0*	

a) Annual average.
Source: Environment Administration.

Table 3.5 **Other municipal waste taxes**, 2006

Bulky waste Method of taxation	Number of communes	Items subject to specific taxes	Number of communes
PPP not respected		Glass	4
No tax	41	Paper	12
Acceptance refused	0	Paper/cardboard	0
Annual tax	4	Organic kitchen waste	15
Access tax	1	Green waste	3
Miscellaneous	4	Metals	13
Total	50	Construction waste	9
		Wood	1
PPP respected			
Tax geared to volume	50		
Tax geared to loading time	1		
Tax geared to weight (per kg)	8		
Tax per bag collected	2		
Collection via PDR	5		
Total	66		

Source: Environment Administration.

6.3 Assessment

Economic instruments were used increasingly over the review period to achieve the objectives of reduction-at-source and recovery, but their use is still limited. They have been applied for the recovery of waste flows that are now subject to compulsory management, and for reducing or preventing certain kinds of consumer waste. Yet despite this progress, Luxembourg is far from applying the PPP fully to municipal waste management. Only a third of the country's residents pay for waste management services in proportion to actual waste generation and the cost of facilities. Many communes subsidise their public services, with the result that taxes and calculation methods vary even for the same service. The incentive effect that municipal taxes should have on households is being only partially exploited.

Combined with a lack of consistency in the management of certain waste flows, this makes it hard to develop the *synergies* needed to achieve objectives. With separate collection firmly established for 20 years now, and a generally solid management performance, Luxembourg will need to bring greater coherence to implementing its waste policy throughout the country if it is to progress further. To this end, it is essential for the communes to sign on to the national management

objectives defined in the legislation and the PGGD. In areas where more coherence is needed and where implementation of the 2000 PGGD has lagged, the adoption of compulsory sector plans might be considered (*e.g.* for organic waste).

In particular, the *PPP should be fully applied* to municipal waste management along with nationwide *financial incentives* based on harmonised and differentiated pricing. This will have to be done in ways that respect municipal autonomy while achieving more active and effective co-ordination at the national level. Communes belonging to the same inter-communal syndicate could consider pooling waste management costs across their territory and then applying harmonised rates for the same services.

Beyond a strategic environmental assessment of the PGGD, there is a need to conduct an *economic assessment* of the costs and benefits of the targets set and the measures proposed, and to add a financial component to the revised PGGD. This is especially important for measures to take greater advantage of the remaining recovery potential.

7. Polluted Sites and Soils

Under the 1994 PGD Act, the communes were required to establish a *register* of old landfills and other contaminated sites within five years after the law came into force. Work on the register began in 2000, supervised by the Environment Administration, and was completed in 2006. The register inventories some 14 000 polluted or potentially polluted sites, either still in use or abandoned. It is designed as a planning tool and can be consulted via Internet by the communes (secured access) and by businesses and individuals (public access). The *cleanup and rehabilitation of contaminated sites* is progressing, with priority attention to land use needs or cases of pollution. There is as yet no multiyear plan for the cleanup and rehabilitation of contaminated sites.

There is no provision for *financing* the cleanup and rehabilitation of sites where the responsible party is unknown or insolvent. An inventory of these orphan sites is under way, and a study has been commissioned to identify financing and operational arrangements for a guarantee fund to clean up these sites.

Notes

1. *OECD Environmental Performance Reviews: Luxembourg* (2000).
2. Cross-border workers contribute to this waste generation.
3. National transfers and exports.
4. "Green waste" from households and municipal services, kitchen waste from households, public institutions and certain service and commercial establishments.
5. RAL-Gütezeichen Kompost.
6. The main users are agriculture (36%), soil substrate production (31%), households (12%), communes (12%), and horticulture (4%).
7. Of which paints account for 34%, edible fats 14%, batteries 11% and asbestos cement 9%. The composition varies with market prices for secondary raw materials. High prices can trigger illegal collection that may cause SDK collections to drop (as happened with lead batteries between 2003 and 2008).
8. Calculated according to the type of packaging and the number of units sold.
9. Ranging from EUR 0.09 for small household appliances to EUR 8.6 for large refrigeration equipment.
10. Recycling exchange of the Chambers of Commerce and Industry of Germany (IHK); waste exchange of the Chambers of Commerce and Industry of France "Codlor": Moselle, Meuse, Meurthe et Moselle, Vosges.
11. The Environmental Technology Resource Centre (CRTE) has done pilot studies under the Integrated and Sustainable Analysis and Management (AGID) Project financed by the FEDER structural funds.
12. Total remaining capacity is around 1.3 million m^3 and the remaining capacity is estimated at 40 years.
13. The theoretical treatment capacity is 150 000 tonnes a year.
14. The acceptance price per ton is EUR 96.7 for household waste, EUR 128.9 for bulky waste, and EUR 178.5 for similar waste.
15. The current network comprises 15 landfills (11 active, 4 planned), privately managed (by quarry operators and construction firms). Each site is associated with a specific region and must be equipped with infrastructure for separating and recovering waste. The sites planned will require additional lands to be leased from private owners, and negotiation of the associated contracts.
16. The taxes and charges paid by users of waste management services are voted by the municipal council and then approved by the Minister of the Interior. The inter-communal syndicates can recommend rates, but the final decision lies with the municipal council, consistent with the principle of communal autonomy.
17. Compared to 12 communes at the time of the first OECD review. Nearly all these communes are members of the Inter-communal Syndicate for Public Hygiene of the Canton of Capellen (SICA).
18. Calculated as a function of weight or the number of times a dustbin is emptied.
19. 197 kg/capita *versus* 284 kg/capita, according to a study conducted in 2004-2005.

Selected Sources

The government documents, OECD documents and other documents used as sources for this chapter included the following. Also, see list of websites at the end of this report.

Government of the Grand Duchy of Luxembourg (2006), *Rapport national sur la mise en œuvre de la politique de développement durable*, Luxembourg.

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Ministry of the Environment (2009), *Projet de Plan général de gestion des déchets* (March 2009 version), Luxembourg.

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OECD (2007), *OECD Territorial Reviews: Luxembourg*, OECD, Paris.

OECD (2000), *OECD Environmental Reviews: Luxembourg*, OECD, Paris.

4

NATURE AND BIODIVERSITY*

Features

- Conservation: institutional, legislative, planning and financial frameworks
- Protected areas
- Regional planning
- International co-operation

* This chapter assesses progress over the last 10 years and in particular since the Environmental Performance Review published by the OECD in 2000. It also examines performance against the targets in the 2001 OECD Environmental Strategy.

Recommendations

The following recommendations are part of the overall conclusions and recommendations of the environmental performance review of Luxembourg:

- establish *two strong conservation areas* of sufficient size (for example IUCN categories I to III), one in a forest zone and one in a farming area, to serve as *biodiversity reservoirs*;
- develop and implement management plans, enhance biological productivity in the *protected areas* (protected zones, Natura 2000 zones, natural parks, Ramsar zones); establish *biological corridors* linking the Natura 2000 zones in order to facilitate migration of fauna and flora;
- pursue partnerships between the *central government and the communes* on joint conservation and habitat rehabilitation projects;
- make greater use of economic instruments to encourage landowners to *adopt sustainable farming and forestry practices* that will favour biodiversity; develop programmes to pay for the economic services that ecosystems provide, particularly aquatic and forest ecosystems;
- establish *forest management programmes* to rejuvenate the forest so that it can supply biomass for energy production and to enhance its capacity to sequester CO_2.

Conclusions

Luxembourg today has institutional, legislative and financial frameworks for implementing a nature and biodiversity conservation policy. The objectives are spelled out in the *National Plan for Sustainable Development* (1999) and the *National Plan for the Conservation of Nature* (2007). Luxembourg has thus made up for most of its lag in setting the framework for nature and biodiversity conservation. A *registry* of biotopes is now used to identify the most important ones and ensure they are taken into account in land use planning. A Natural Environment *Observatory* will make it easier to monitor landscape changes that could affect biodiversity. The European *Natura 2000* Programme has fostered the protection of natural spaces (which increased from 6.5% to around 17.5% of the national territory during the review period). Initiatives to restore watercourses are contributing to biodiversity and to flood prevention, particularly in the context of agreements signed between the central government and the inter-communal syndicates. There is now more assistance for promoting sustainable forestry practices among private landowners.

However, the number of threatened species is still high and there is continuing pressure on biodiversity caused by fragmentation of the territory, urban sprawl, and transportation infrastructure. Despite a significant increase in protected areas, they are still far from fulfilling their potential to support biodiversity: they have few management plans and many of those that exist are just now being put into effect. The economic services derived from ecosystems (relating for example to climate change, flood prevention and water purification) are generally *underestimated*. *Agro-environmental subsidies,* specified in the EU framework, are not sufficiently utilised, and there is still need for a rural conservation policy that integrates natural habitat restoration into farm management. *Sustainable management of privately owned forests* is still difficult to implement because of the fragmentation of properties.

♦ ♦ ♦

1. Objectives

Luxembourg has adopted *ambitious objectives* for the protection of nature and biodiversity. These objectives are set forth in the National Plan for Sustainable Development (PNDD) of 1999 and the National Plan for Nature Conservation (PNPN) of 2007. The European Directives on Birds and Habitats have taken this ambition further with implementation of the Natura 2000 Network in 2008, covering 45 260 hectares. Luxembourg is also a party to the main international conventions in this matter.

In 1999, the PNDD, although lacking a statutory basis, defined the *main objectives* relating to biodiversity and nature:

- to create a national biodiversity network covering 15% of the country by 2005;[1] to create a national network of naturally developing forests representing 5% of woodland by 2010;[2]
- to convert 10% of farmland to environment-friendly farming and conservation by 2005;
- to stabilise annual land consumption by 2005 and then reduce it by 50% by 2010;[3]
- to restore the ecological functions of all rivers and their alluvial areas by 2010.

In 2007, Cabinet adopted nature and biodiversity targets through a *National Nature Conservation Plan* (PNPN) covering the years 2007-11. It has two strategic goals: *i)* to halt the loss of biodiversity by 2010, in particular by maintaining and restoring threatened species and habitats of national or Community interest; and

ii) to preserve and re-establish ecosystem services and processes at the landscape and national scales. To achieve these two goals, *7 targets and 41 actions* are identified, to a horizon of 2011.

Performance can also be assessed in light of the *recommendations from the OECD Environmental Review of Luxembourg* (OECD, 2000) (Table 4.1). Substantial progress has been made in the designation of protected zones, but not in their management.

2. Status of Species and their Habitats

2.1 Terrestrial and aquatic species

The status of *animal species* is still a matter of concern. The totality of reptile species and around one-quarter of bird, fish, amphibian and vascular plant species are threatened (Figure 4.1). The proportion of threatened mammal species in Luxembourg is among the highest in the OECD. Some bird species including the black stork, the northern hobby and the red kite have been de-listed, while many species associated with farmland have been classified as threatened. An excessive increase in populations of wild boar, red deer and roe deer is causing economic and ecological damage to forests. Their numbers are swelling because there are fewer hunters (2 500 in 1970 but only 2 000 in 2007) and because of a rigid system of nine-year leases for hunting grounds. In contrast to big game, species that inhabit mixed farm-woodland settings such as the partridge and the rabbit are still declining.

The extinction rate of *vascular plants* (7.6%) in Luxembourg is well above the rate in neighbouring countries (PNPN, 2007). Woodland plants face much less threat of extinction (17%) than plants associated with farmland (34%) (MAVDR, 2005). The ciliated gentian and the prickly poppy, which normally thrive on nutrient-poor dry grasslands, are being displaced towards roadsides or fields because of intensive use of mineral fertilisers. Finally, the proportion of threatened plants is high (from 42% to 55%) in aquatic habitats, along watercourses and ponds, in wetlands and grasslands, and on meadows and dry moors (Table 4.2).

2.2 Habitats

Annex I to the European Habitats Directive includes 200 habitat types, of which 31 are represented in Luxembourg. Of these, eight are “priority habitats” that are under threat. They include certain types of dry meadows, alluvial forests and ravine forests. The proportion of species threatened varies greatly according to their principal habitat.

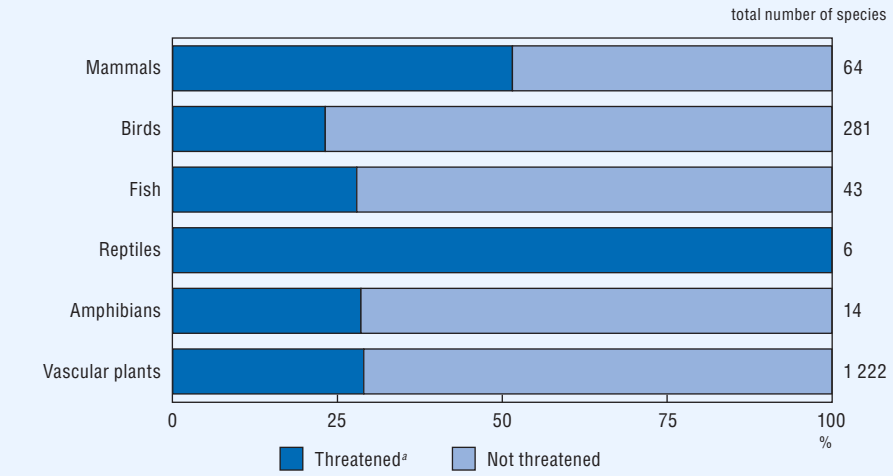
Table 4.1 **Implementation of OECD recommendations** (2000 Review)

Recommendation	Performance
Use information on species and their habitats more effectively to define *priorities* for nature conservation and build public awareness of these priorities.	A 2004 audit of protection of the natural environment found that the scientific basis was inadequate, particularly for monitoring implementation of the Natura 2000 Network. The 2005 law lays the basis for partnership in the conservation of nature and natural resources and institutes a natural environment observatory. A register of biotopes is now being compiled. A public awareness campaign was launched in 2008.
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.	Establishment of a Natura 2000 Network (17.5% of the territory) has begun. A second natural park has been designated (the Our Natural Park) but its management plan has yet to be developed.
Strengthen protection of conservation areas by establishing and applying multiyear *management plans* for existing SPAs (special protection areas) and for special conservation areas.	Delays in adoption of management plans for the Natura 2000 areas (17 out of 47 are now being developed) mean they are not contributing as effectively as they should.
Boost resources for nature conservation and promote partnerships among central and local government and social partners.	The law of 3 August 2005 authorises the Minister to sign partnership agreements for protecting nature and natural resources, with the syndicates of communes working in this area and with the natural park syndicates.
Control water pollution and continue rehabilitation of *aquatic ecosystems*	Projects for rehabilitating watercourses have been carried out. Eutrophication of surface waters is aggravated by nitrate runoff. Although fertiliser volumes have diminished, they are still high by EU15 and OECD average (OECD, 2008).
Continue efforts towards *sustainable forestry*	Forest certification (FSC and PEFC) has progressed well for public forests, but less so for private forests. A national forest reserves network of 1 563 ha has been established. Despite these efforts, the Luxembourg forest is still relatively old and unproductive.
Significantly step up *agri-environmental* efforts as well as measures to promote *sustainable physical development* (partnerships, inter-communal syndicates, and integration of nature conservation concerns in agriculture policy, progress towards sustainable farming and tourism practices).	Since 2002, there has been a system for providing assistance to land owners and to farming and forestry operators in safeguarding biodiversity (natural habitats, threatened fauna and flora). Only 3 500 ha have benefited from financial support. The assistance schemes are now being updated.

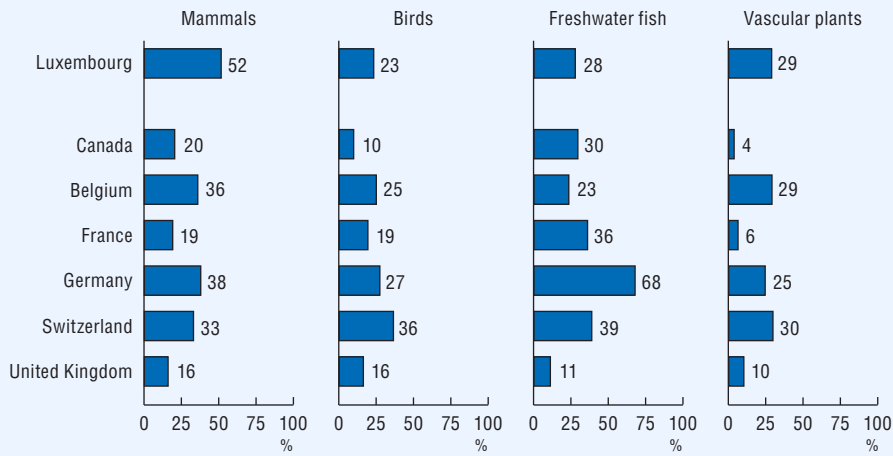
Source: OECD, Environment Directorate.

Figure 4.1 **Fauna and flora**

State in Luxembourg, 2007



Threatened species[a]



a) IUCN categories "critically endangered", "endangered" and "vulnerable" in % of known species.
Source: OECD Environment Directorate.

Table 4.2 **Threatened habitats and plant species**

Principal habitat	Proportion of plants threatened (%)
Aquatic habitats and springs	*42.6*
Shores of watercourses and ponds	*48.1*
Swamps, wetlands and humid meadows	*48.0*
Dry grasslands, mesophile meadows and moors	*55.6*

Source: Ministry of the Environment.

Landscape changes

Luxembourg's territory underwent *major transformations* over the period 1962-99: scrubland and secondary forest landscapes as well as overgrown vacant lots increased by 64% and 43%, respectively, while wetlands were reduced by 82%, orchards by 58% and solitary trees by 55%. Changes in agricultural area in use caused the destruction of rare biotopes of great ecological value in open settings (such as dry grasslands and wetlands). The expansion of the forest area accentuated the disappearance of these threatened biotopes.

Moreover, changes in the composition and *structure of landscapes and biotopes* have also been caused by urban sprawl and the encroachment of commercial and industrial zones, the expansion of infrastructure (transportation and technical equipment), farmland consolidation, drainage, and shifting farming practices (Ministry of the Environment, 2007) (Box 4.1).

Fragmentation and loss of continuity

In addition to net losses of habitat, habitat productivity has also been undermined by the loss of continuity, particularly by expansion of the road network and other linear infrastructure. An assessment of the degree of landscape fragmentation shows that Luxembourg is among the most seriously affected of European countries. Since 1960, nearly 28.5% of hedges and tree rows have been lost, and more than 50% of solitary trees have been eliminated (Ministry of the Environment, 2007).

Disruption of watercourses

The spread of industrial and urban development and the intensification of agriculture have caused a *degradation of watercourses and their associated wetlands*.

Channelling of watercourses, drainage of wetlands and swamps to expand farmland, and backfill activities have led to the disappearance of rare fauna and flora habitats (Ministry of the Environment and Ministry of the Interior and Territorial Development, 2007).[4] The channelling works, when accompanied by bank protection structures, cause bed subsidence in watercourses that affects the level of the water table, drying out natural aquatic settings. It is important to preserve and reinforce the *economic services provided by aquatic ecosystems*.

The reduction of watercourses to simple drainage ditches changes their hydraulic regime, destroys their *flood regulation function*, and exacerbates erosion of banks and shorelines. The areas most affected are often those downstream, through loss of retention surface and increased flows when waters are high. In the context of climate change, preserving natural flood regulation capacities is of even greater economic and ecological importance. In Luxembourg, rains caused by westerly atmospheric flows have increased sharply.[5] In the Attert basin, flooding was rare between 1964 and 1979, but has increased since the 1980s (*Maison de l'eau*, 2004).

Box 4.1 **The biotopes register**

The 2007 National Plan for Nature Conservation calls for the creation of a register of biotopes in need of protection (Article 17 of the 2004 Act on the Conservation of Nature and Natural Resources). The register is intended to: *i) identify precisely those biotopes* and habitats subject to strict protection under Article 17, and *ii)* help respond to pressure from farmers eager to restrict application of Article 17.

The biotopes register will also be an important basis for planning, and especially for *amending the general land-use plans* that are submitted to the Environment Ministry. Data from the biotopes register will be integrated into the updates to these land-use plans, which must be completed by 2010. The Environment Ministry and the communes will share the cost of the studies.

This *register* is being constructed by: *i)* compiling maps of open areas produced by biological stations and foundations; and *ii)* conducting specific inventories to fill the remaining gaps. A pilot inventory was carried out in 2007 in 29 communes.

The register will focus on *rare and threatened biotopes* where field identification is difficult, in particular: *Molina* (purple moor grass) meadows, nutrient-poor hay meadows, *Caltha palustris* meadows, dry meadows (of all kinds, including those with *Juniperus communis*); *Nardus* grass formations; moors; ponds, marshes, swamps, peat bogs, areas covered by reeds or rushes, megaphorbic meadows; springs; and orchards (as defined by the Ministry of the Environment).

A decline in the concentration of dissolved oxygen in channelled watercourses *reduces their ability to self-purify*. The artificial embankment of water channels destroys the riparian and alluvial forest cover that serves as a buffer between the terrestrial and aquatic environment, filtering out fertilisers, pesticides and other substances that harm water quality. This has economic as well as ecological consequences. In a heavily agricultural and urbanised country such as Luxembourg, it results in a need for more sophisticated and costly waste water treatment plants (Ministry of the Environment and Ministry of the Interior and Territorial Development, 2007).

Forest habitats

With the retreat of farming over the last century, the *forest area has increased* from 83 400 ha to 89 150 ha, covering 34% of the national territory as a whole (ranging from 42% in Oeslind to 31% in Gutland). The Ardennes region is the most heavily wooded. Private forests, which are extremely fragmented[6] and generally neglected, represent 54% of the country's forest. Three professional foresters have been assigned to help private owners promote sustainable forestry. Standing timber volumes per hectare are high.

The Luxembourg forest contains no natural forest and has been strongly stamped by *human activity*.[7] Old-growth forests (over 100 years) cover 16 800 ha, or 61% of the broadleaved forest. Conifer groves are younger, because their production cycle is shorter. Total reforestation between 1985 and 2005 covered 8 250 ha, *versus* 12 800 ha during the previous period, despite the massive tree planting campaign after the storms of 1984 and 1989-90. As a whole, the Luxembourg forest is relatively *old*.

Observations on the *phytosanitary state* of Luxembourg forest show sharp degradation of the forest, which appears today to have stabilised (MAVDR, 2005). The declining health of these forests results from complex factors that include air pollution (causing acidification and eutrophication), climate change, diseases due to insect infestations, impoverishment of forest soils, and deficiencies in magnesium and calcium. The situation has been aggravated by replanting with a poor choice of species and inappropriate forestry activities.

Two-thirds of the forest cover consists of *single-story stands*. These can have an adverse impact on the water balance and on biodiversity. They are more unstable than multi-storied forests in the face of storms. Moreover, formed trees do not have a market value that would make them of much commercial interest.

The ageing of the forest means a decline in timber quality, *greater blow-down vulnerability*, and ultimately economic losses. The increased intensity and frequency of storms and of climatic extremes such as drought or high temperatures are

indicators of climate change. The 1984 and 1990 storms caused timber losses estimated at 165 000 m^3 and 1 500 000 m^3, respectively. The huge Lothar storm of 26 December 1999 sparked thinking about a more sustainable and less vulnerable approach to forestry. The ageing of the forest also increases the risk of *infestation by insects* and other parasites. Insect attacks have affected 8 800 m^3 of beech stands in Oesling and 3 750 m^3 in Gutland, adding to the damage caused by overabundant populations of game, whose browsing has affected 5% of mature trees and 66% of replanting.

Forests play a *significant economic and ecological role* in capturing *atmospheric* CO_2. Unfortunately, Luxembourg's forests cannot fix appreciable quantities of CO_2 because of their age and their slow growth, associated with frequently neglectful management. The national forest inventory, conducted in 2000, found that the equivalent of only 14% of the country's annual CO_2 emissions (1 250 000 t. CO_2) was being absorbed in the forest ecosystem.

3. The Policy Framework for Nature Conservation and Biodiversity

3.1 Institutional framework

The *Water and Forests Administration* has been in charge of nature conservation since 1965. It is also responsible for the management of publicly-owned forests (belonging to the central government, communes and public institutions), for assistance to and surveillance of private forests, and for the regulation of hunting. Its *Forests Division*, including the Forestry and Forest Planning Department and the Hunting and Fishing Department, is under the Ministry of Agriculture, Viticulture and Rural Development (MAVDR).[8] 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 Fishing Council. Some communes also have environmental advisory committees. A natural environment observatory was created in 2007. A register of biotopes is now being compiled (Box 4.1).

3.2 Legislative framework

The 1965 Nature Protection Act, the country's first such law, has been amended several times. Since the last OECD review (OECD, 2000), legislative and regulatory activity have testified to Luxembourg's *forward-looking* and ambitious goals in this area (Table 4.3). The Nature Protection Act was amended in 2004 and again in 2007. The 2005 law provides for stepped-up partnership between the central government and the communes in this area.

Table 4.3 **Legal instruments relating to the natural environment**

19 May	1885	Hunting Act and its regulations, wildlife species classified as game, hunting and shooting permits and tests, weapons, hunting means and methods, open season, shooting plan, and big game marking
5 May	1905	Act on the clearing of wooded areas
8 October	1920	Act concerning the development of administered woodlands
30 January	1951	Woodland Protection Act, prohibition on abusive logging in private forests
24 August	1956	Act amending and supplementing legislation on hunting, hunting districts, and the location of hunting grounds, the "Game Fund", restocking, game reserves, compensation for damages caused by big game
29 June	1965	Act approving the Treaty between the Grand Duchy of Luxembourg and the Land of Rhineland Palatinate on creation of a common natural park
29 July	1965	Nature Protection Act
20 March	1974	Regional Planning Act
20 December	1980	Act concerning the quality of water requiring protection or improvement so as to support fish
11 August	1982	Act concerning the conservation of nature and natural resources
8 April	1986	Grand ducal Regulation on the protection of certain wild animal species
11 July	1986	Cabinet Decision concerning revision of general guidelines for the master programme for territorial planning – Chapter E Environment
19 August	1989	Grand ducal Regulation on the protection of certain wild plant species
30 August	1993	Natural Parks Act
10 October	1995	Grand ducal Regulation on grants for forest measures
27 October	1997	Grand ducal Regulation instituting an aid programme to encourage agricultural production methods compatible with environmental protection and maintenance of natural spaces
31 May	1999	Act instituting the Environmental Protection Fund
22 March	2002	Grand ducal Decree instituting a programme of grants for the protection of biological diversity
19 January	2004	Act on the Conservation of Nature and Natural Resources; amending the Act of 12 June 1937 concerning urban planning; supplementing the Act of 31 May 1999 instituting the Environmental Protection Fund
27 June	2005	Grand ducal Decree creating the Upper Sûre Natural Park
9 June	2005	Grand ducal Decree declaring the Our Natural Park
15 June	2005	Grand ducal Decree authorising creation of the syndicate for planning and management of the Our Natural Park
3 August	2005	Act concerning partnership between the communal syndicates and the central government and restructuring of the scientific approach to conservation of nature and natural resources.
11 May	2007	Cabinet Decision concerning the National Plan for Nature Conservation and its first part, entitled National Action Plan for Nature Conservation, 1 August 2007
1 August	2007	Grand ducal Decree modifying Grand ducal Decree of 8 April 1986 concerning comprehensive and partial protection of certain wild animal species
15 October	2007	Grand ducal Decree on the organisation and functioning of the Natural Environment Observatory
21 December	2007	Act amending the Act of 19 January 2004 concerning the conservation of nature and natural resources, repealing the Act of 24 February 1928 on the protection of birds

Source: Ministry of Environment.

Box 4.2 **Environmental awareness and education**

Raising public awareness about the natural environment has been recognised as a key element for achieving the goals of the PNPN. A score of *environmental NGOs* have been playing a leading role in Luxembourg in informing the public about the need to protect the environment. They carry out environmental education actions targeted at various audiences, including children. Their efforts are unevenly distributed, however, among target groups and subjects. A national multimedia campaign on biodiversity was launched in 2008.

Governments at the national and local levels have also set up *installations* where people can enter into direct contact with nature. These include visitor centres near protected zones or sites of ecological interest, where the public can learn about the conservation objectives at stake; nature conservation centres with interactive learning activities for discovering nature and its products; self-guiding nature trails; and miscellaneous information points.

The visitor centres have various staffing arrangements and they have been provided with *funding*, but this is intended more for the construction or renovation of buildings or facilities rather than for running awareness programmes. A better balance could be sought between infrastructure financing and awareness activities. The corps of volunteers is often quite small, and replacements can be hard to find.

The *Attert "river contract"* offers an interesting example of how local communities and citizens can be enlisted in watershed management. In 2001, 23 communities on the Luxembourg and Belgian sides of the border signed a co-operation agreement involving around 100 projects, some designed to restore natural settings and biodiversity. This involvement of citizens in ecosystem restoration is yielding concrete benefits for communities and individuals alike. There are also "river contracts" for the Upper Sûre valley and the Our.

These legislative and regulatory amendments have increased the *possibilities* for protecting nature and natural resources, and transpose into domestic law the 1992 Convention on Biological Diversity and the 2000 European Landscape Convention.

3.3 National Plan for Nature Conservation

These legislative amendments also allowed the government to develop and adopt the National Plan for Nature Conservation (PNPN) covering the period 2007-11, and to implement its first phase. The plan is intended to *i) halt the loss of biodiversity* by 2010, in particular by maintaining and restoring threatened species and habitats of

national or community interest; and *ii) preserve and re-establish ecosystem services and processes* at the landscape and national scales. These two goals are broken down into seven objectives and 41 actions to be achieved or undertaken by 2007-11. The seven objectives are:

1. to reinforce concrete efforts for nature conservation;
2. to integrate nature conservation into other sectors of activity;
3. to designate and manage protected areas of national and community interest;
4. to update legal and regulatory planning instruments;
5. to conduct scientific monitoring of the state of nature and the effectiveness of conservation policy;
6. to promote scientific research in biodiversity and nature conservation;
7. to encourage awareness and education about conservation, and to enhance co-ordination among stakeholders (Box 4.2).

Implementing the PNPN is an *ambitious* undertaking, given the degradation of Luxembourg's natural environment, the pressures on its fauna and flora, and the short time horizon for implementing concrete actions. It will also be difficult to measure results, as many activities have not been given quantifiable elements (Box 4.3). The costs of implementing the PNPN were estimated at EUR 8 million for 2007, rising to EUR 12 million in 2011.

3.4 Funding frameworks

The *Environmental Protection Fund* (financed by annual budget allocations) provides assistance to the communes and to officially recognised conservation organisations for: *i)* planning, studies and land acquisitions for establishing the network of protected areas (up to 75% of costs); and *ii)* planning, studies and land acquisition for ensuring the ecological coherence of the protected areas network through the maintenance and development of landscape elements of importance for wildlife and vegetation.

The MAVDR finances "*agri-environmental contracts*" that *i)* promote farming methods compatible with the requirements of conservation and maintenance of natural spaces (target: 16 000 ha for 2010) and *ii)* protect threatened indigenous animal and plant species of agricultural areas (target: 4 000 ha for 2010). The MAVDR also sponsors programmes to protect forest biodiversity and to improve the natural environment. These programmes now cover some 3 100 ha, a figure well below the established target. The PNPN calls for a gradual increase in lands under biodiversity contract to 5 000 ha by 2011. The scale of financial assistance offered by

Box 4.3 **"Sicona-West": enlisting local authorities in nature conservation**

In the western part of the country, five *inter-communal syndicates* covering 21 communes have joined together to form the "Western Inter-communal Syndicate for Nature Conservation – Sicona-West." The communes were inspired by a variety of motives: protecting their countryside, supporting efforts at the national and European levels to protect species and natural habitats, and contributing to the sustainable development of Luxembourg. Each commune has a voting representative on the inter-communal management committee. Operations are funded by the communes themselves and, for some projects, by state grants.

Through Sicona-West, the *communes are co-operating* in many ways: they are fielding their own teams for nature management and improvement measures on municipal and private lands; they are implementing national programmes at the regional level; they are mounting special programmes for highly endangered species; and they are conducting local awareness and information campaigns. Every syndicate runs a biological monitoring station.

A nine-member *team of biologists, geographers, agronomists, foresters and educators* is responsible for preparing the scientific basis for mapping projects, and for project negotiation, contracting and monitoring. It is also engaged in public awareness activities, in developing biodiversity contracts, in preparing an inventory of hedges and in developing hedge management plans. Annual management plans are negotiated with private landowners.

By way of example, since 1990 the *commune of Bertrange* has: planted 4.13 km of new hedges and 892 trees; improved or restored ponds covering 1.05 ha; created 6.36 km or 4.3 ha of watercourse buffer zones and ecological buffers on farmland; planted 6.25 km per year of hedgerows; placed 179.6 ha of land under biodiversity contracts; restored 3.76 ha of abandoned fields; 84.9 ha of strict forest reserves; and 17.45% of biodiversity surface and 20.45% of ecological farmland.

the MAVDR is becoming less attractive with rising land prices, and other available subsidies have been too low from the outset and have almost never been requested (PNPN, 2007). The assistance provisions are now being updated.

A *Game Fund*, financed primarily from a surcharge on hunting permits, is intended to increase game stocks but has paid out nothing for several years. A *Special Hunting Fund*, also financed through a surcharge on hunting permits, is intended to compensate for harvests damaged by game. Its annual outlays are around EUR 300 000. A *Fishing Fund*, financed by a tax on fishing permits, is devoted to restocking and upgrading fish habitat.

Compensation programmes for biotopes destroyed by public works (such as road construction) exist but are rarely used. When they were introduced in 2004, they were intended to discourage certain practices by imposing a tax, the proceeds of which would be earmarked for projects for natural habitat conservation and restoration.

The major *Community financial instruments* (such as the European Fund for Regional Development [EFRD], the European Agricultural Fund for Rural Development [EAFRD], and the LIFE+ programme) are available, and are supporting several projects.

In each year between 1990 and 2006, the state acquired on average 32 ha of lands of conservation significance, for an average annual outlay of EUR 342 000. These *land purchases* have been supported by the "Help for Nature" (*Hëllef fird'Natur*) Foundation and by certain communes.

4. Protected Areas and Species

4.1 Protected areas

Protected areas cover a relatively high proportion (around 17%) *of the country's territory* (Table 4.4). However, these areas fall primarily into the lower-ranked categories of biodiversity protection (IUCN categories III to VI). The advantage of affording high biodiversity protection is that it preserves core areas with significant concentrations of species from which individuals can migrate to colonise neighbouring habitats, thus facilitating the reestablishment of rare or threatened species and helping to maintain biodiversity (Figure 4.2). This migration is facilitated by the presence of ecological liaison corridors.

Protected natural areas

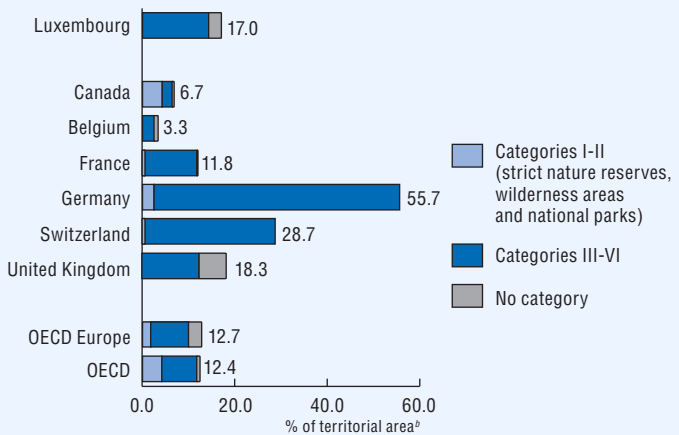
Conservation areas include nature reserves, protected landscapes, and strict forest reserves. They enjoy the highest level of protection in Luxembourg. A grand ducal regulation prohibits or restricts most human activities (hunting, fishing, plant collecting, digging, construction, extraction, use of pesticides, vehicle traffic) within their boundaries. Initially, the 1982 Act provided for listing 140 nature reserves (identified in the 1981 General Declaration of Intent, DIG), covering 22 800 ha (or nearly 10% of the territory). More than 25 years later, 37 of these sites have been classified as conservation areas, covering 3 734 ha or *1.4% of the territory*. Management plans have been developed and implemented for only a third of these areas. Since 2000, 12 new zones have been created, covering 1 127 ha. The five strict forest areas were established during this time. The objective of classifying 5% of the

Table 4.4 **Principal protected areas,**[a] 2008

	Number	Area (ha)	Percent of national territory
Conservation areas	37	3 734	*1.4*
Natura 2000			
ZPS (Birds Directive)	12	13 903	*5.4*
ZSC (Habitats Directive)	47	38 324	*14.8*
Natural parks	2	51 087	*19.8*[b]
Ramsar sites	2	17 213	*6.7*

a) Since many areas have multiple designations, it is not possible to put a figure on the total area protected (data as of 18 November 2008).
b) Upper Sûre and Our natural parks.
Source: Ministry of the Environment.

Figure 4.2 **Protected areas,**[a] 2007



a) Designated terrestrial and marine areas. IUCN management categories I-VI and protected areas without IUCN category assignment. National classifications may differ.
b) Surface area, inland waters and territorial waters out to 12 nautical miles.
Source: UICN/UNEP-WCMC (December 2007), World Database on Protected Areas; Global Maritime Boundaries Database (August 2007).

territory as conservation areas by 2010 is unlikely to be reached, given the scant progress made in recent years (1.4% in 2008).

Natura 2000

Luxembourg's Natura 2000 Network was delimited in 2008, covering 45 260 ha or *17.5% of the national territory*. The Natura 2000 zones do not necessarily entail formal prohibitions, but human activities must be kept compatible with the conservation objectives for designated sites. Some 20 management plans are now being prepared for the 47 zones in the Natura 2000 Network. They will be implemented on a voluntary basis through contracts with owners or local authorities.

The impact of the Natura 2000 Network on biodiversity conservation will depend on the soundness of the management plans and on the works undertaken to restore habitat (including wetlands) and thereby enhance their potential to support diverse wildlife and plant species and restore the capacity of these ecosystems to provide ecological services. The Network represents an interesting potential, but the pace at which management plans are being developed and implemented leaves some doubt as to whether they will help Luxembourg meet the European commitment to *halt biodiversity decline by 2010*.

Natural parks

The natural parks are generally intended to promote sustainable development by associating nature conservation and economic development. There are *two* such parks, the Upper Sûre Natural Park and the Our Natural Park, and they were established only recently. The first was created in 1999 and the second in 2005. The two parks are managed by mixed syndicates under the aegis of the Ministry of the Interior and Territorial Planning. The Upper Sûre park embraces seven communes located in the region of the Upper Sûre lake (5 700 residents, 184 km^2). The main objective of the park is to ensure sustainable management and water protection for the lake and the streams flowing into it. This effort involves close collaboration with the adjacent Upper Sûre-Anlier Forest Natural Park in Belgium. The procedure for renewing the park's mandate is underway. The Our Natural Park is part of the transboundary natural park straddling the German-Luxembourg frontier and is operated in close association with the *Naturpark Südeifel*.

Two other natural parks are *planned*: one in the Mullerthal region (in the east of the country) and the other, the *Trois Frontières* ("Three Borders") park, will be the Luxembourg segment of a transboundary natural park that extends into Germany and France, in the upper Moselle Valley.[9] The natural parks are established on the basis of contracts that are renewable every 10 years.

Ramsar wetlands

Luxembourg's *two Ramsar sites* are located at Haff Remich and in the Upper Sûre Valley. The second site, which is shared with the Wallonia region, has a total area of 46 000 ha (of which 16 900 lies in Luxembourg). It contains some remarkable wildlife, including the black stork, the otter, the pearl mussel and the river mussel *Unio batavus*. The Luxembourg portion is part of the Upper Sûre Natural Park and the Natura 2000 Network. A management plan is now being prepared.

4.2 Species management

The PNPN (covering 2007-11) calls for the development of "*species*" *action plans* and "habitat" action plans, despite a shortage of data and inventories (Ministry of the Environment, 2007). Additional field inventories are now being conducted to support a reliable assessment. Luxembourg has a high proportion of threatened species. Some non-threatened species are in decline, while others are increasing (Box 4.4).

The damage wrought by big game (red deer, roe deer and wild boar) on vegetation and forest plantations has raised awareness of the *need to revise hunting practices*. The number of hunters (down by 25% since 1970) and hunting ground leases (nine years) are no longer adequate to maintain a balance between game populations and habitats. A bill has been drafted to revise hunting activity so that it can play its proper role in ecosystem management.

5. Conservation outside Protected Areas

The rapid economic development that took place in the Grand Duchy of Luxembourg until 2007 had some *pronounced impacts*, entailing loss of biological diversity, fragmentation of forest habitats, steady urban encroachment into rural areas, degradation of the countryside, and diminution of the quality of life.

5.1 Land use management

Luxembourg has long had strict land-use regulations for areas outside protected zones. On "green belt" lands (not covered by development plans), permission must be obtained to erect public or agricultural buildings. There are also statutory guarantees *against the clearance of forests and the reforestation of farmland*.

Action is being taken in farming areas through *agri-environmental contracts* under Regulation EC/2078/1992; these provide assistance relating to the extensification of livestock and farming activities, support for organic farming,

Box 4.4 **The wildcat**

The European wildcat (*Felis sylvestris*) has been accorded *strict international protection.*[a] Within Europe, Luxembourg constitutes the nucleus for the wildcat population: its range extends from the Ardennes to the German Eifel and the French Jura. Luxembourg has taken steps to ensure permanent protection[b] for the wildcats living in its territory (Mamer and Eisch valleys, Fingig/Kahler/Hivange region, vicinity of La Croix de Gasperich and Dudelange, forest of Bettembourg).

The wildcat is a carnivorous mammal of the family *Felidae*, and lives on average for 14 years. It is shy and solitary, and prefers to live deep in the forest. The size of its territory varies with the availability of prey. The female needs a home range of around 200 ha, while the male patrols a hunting range varying from 200 to 1 270 ha. For example, an area of 10 km^2 may contain four females and one male.

The wildcat faces *threats* from a number of sources. Crossbreeding with domestic cats threatens its continued existence and is altering the genetic pool. Other threats include human encroachment, logging, collisions with vehicles, fragmentation of habitat and isolation of populations. The encroachment of urbanisation, roads and farmland affects the quality of its territory and can reduce its density to 0.1 to 0.5 animals/km^2. In addition, traps and poison bait take their toll, as do hunters (who have trouble telling feral cats from true wildcats).

The *conservation project* seeks to help ensure the long-term survival of the wildcat in Luxembourg by reducing losses from road kill, optimising habitats in forests and open lands, informing the public, protecting old hollow trees more than 20 cm in diameter, implementing the national concept of "natural forests", establishing fringe forests and refuges in public forests. Other protection measures will also be needed, such as a ban on the sale of leg-hold traps and maintaining a dense network of wooded corridors in open areas in order to promote the colonisation of new shrubbery. As a contribution to the "Countdown to 2010" initiative ("Halt the Loss of Biodiversity"), the 20 communes of Sicona-West have introduced 10 priority measures, including an action plan to save the wildcat and telemetric studies to record its movements. The Natural History Museum of Sicona-West is conducting telemetric studies of this kind in co-operation with the Geodata consulting firm to gain a better understanding of wildcat populations and their trends

Even today, the wildcat is wrongly regarded by some as a predator of game. An information campaign (targeted particularly at hunters) about the *ecological role of the wildcat* could enhance its public image.

a) Council of Europe, *Status and Conservation of the Wildcat in Europe*, ISBN 92-871-2498-1. Under Annex II of the Washington Convention and Annex II of the Berne Convention, and under the European Habitats Directive.

b) Grand ducal Decree of 1986 on species conservation: "The wildcat (*Felis sylvestris*) is among the wildlife species fully protected."

maintaining features of the farmed landscape, etc. All this is being pursued in the European context of the Common Agricultural Policy. The Single Payment Scheme, the first pillar of the CAP, includes payments subject to conditionality ("cross compliance", which covers numerous environmental conditions). The Rural Development Programme (which includes the agri-environmental measures) is the second pillar and includes respect for the environment as a priority aspect. It is not clear that Luxembourg is taking full advantage of European assistance in this regard.

A number of projects to *restore wetland habitats* along watercourses have been undertaken,[10] along with the creation of more than 100 ponds for amphibians. These projects often fall under "river contracts" that serve both socio-economic and environmental objectives (Box 4.2).

5.2 Territorial planning

Luxembourg has adopted a *Master Programme for Territorial Planning* (27 March 2003) as the frame of reference for establishing sector and regional master plans and for other development planning tools. This land-use policy is recognised as innovative and ambitious (OECD, 2007). Luxembourg has also ratified the European Landscape Convention (in 2006), which deals among other things with zoning regulations that subordinate development to biodiversity conservation.

The key features of the Master Programme are the following (OECD, 2007):

– The Grand Duchy is divided into six "*Planning Regions*" – North, West, Centre North, East, Centre South and South – with a view to rebalancing the country's territorial organisation. The principal sector plans are now in preparation. The regional plans have not yet been prepared.

– The "*Land Occupancy Plans*", which the communes must adopt for developments beyond a certain size, and the "*General Development Plans*" for the communes, which must be consistent with the principles of the Master Programme.

– The *Sectoral Plans* comprise primary and secondary plans. The primary plans are those that have a direct impact on territorial organisation and land use (covering transportation, housing, landscapes and forests, and economic activity zones); the secondary plans have less of a direct impact on land use (high schools, ground stations for public mobile communication networks, Seveso installations and inert waste landfills).

– The *Landscape Plan* is a sectoral plan intended, among other things, to delimit the interurban green belt, to consolidate barriers to urban sprawl, and to delimit areas of countryside slated for protection. It pursues a strategic objective that combines conservation and development of Luxembourg's countryside.

6. International Co-operation

Luxembourg was prompt to ratify the *international conventions* relating to biodiversity (some of which date back a long time): the Berne 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, the Washington Convention (CITES), the Ramsar Convention, and the Florence (European Landscape) Convention.

In addition, *co-operation within the* "*Grande Région*" has produced several initiatives for biodiversity conservation:

- The network of natural parks: implementation of a sustainable development policy in the natural parks of the "Grande Région" (Luxembourg, Wallonia and Lorraine).
- Ecological restoration of the Parc des deux Ourthes Houffalise (Luxembourg and Wallonia).
- Chiers Valley: protection of biological diversity, restoration and upgrading of habitats, and public awareness campaigns (Luxembourg, Wallonia and Lorraine).
- "River contract" for the border-forming Our River: water quality and natural setting (Germany, Belgium and Luxembourg).
- The Upper Sûre Pact: integrated water management (Luxembourg and Wallonia).
- Transboundary ecology and landscape plan to halt despoilment of the countryside and erosion of biodiversity and to implement the Natura 2000 Network (Wallonia and Luxembourg).
- The "*Les Fenderies*" transboundary park announced in 2007 (France and Luxembourg).

Notes

1. The Natura 2000 Network covers 17.5% of the territory.
2. 912 ha were designated in 2008, out of a forest area of 88 620 ha (around 1%).
3. Development is still devouring 1 000 ha per year.
4. The bed of the Chiers was displaced in the 1970s: the old, meandering river bed was filled and replaced by a channel bed. Diversion works on the Alzette have led to the filling of a portion of the original course. Several other watercourses have suffered similar interventions.
5. Research at the Gabriel Lippman Centre shows that over the last 20 years, winter rains brought by westerly atmospheric flows have more than doubled. These rains are long-lasting and abundant, saturating the soil and causing massive runoff (Lippman, 1999).
6. In particular because of the pattern of transmission through successive generations.
7. The beech stands of Gutland have been overexploited to produce charcoal for the iron industry.
8. Ministry of Agriculture, Viticulture and Rural Development.
9. *www.miat.public.lu/amenagement_territoire/parcs_naturels/index.html*.
10. There are several projects underway along the Alzette, Mamer, Gander, Chiers, Moselle, Syre, Attert and Lauterbornerbaach rivers.

Selected Sources

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5

ECONOMY-ENVIRONMENT INTERFACE*

Features

- Environment and consumption modes
- The crisis and efforts to support the economy
- Promoting ecotechnologies
- Sustainable development
- The taxation of energy and transportation

* This chapter assesses progress over the last 10 years and in particular since the Environmental Performance Review published by the OECD in 2000. It also examines performance against the targets in the 2001 OECD Environmental Strategy. It takes into account the latest OECD Economic Surveys of Luxembourg and the latest IEA Energy Review of Luxembourg.

Recommendations

The following recommendations are part of the overall conclusions and recommendations of the environmental performance review of Luxembourg:

- develop a "*green package*" as part of efforts to sustain economic activity and to emerge from the crisis, with a proactive and *long-term environmental vision*;
- promote *synergies* between the environment and R&D, technology, exports, energy savings and resource productivity in the context of diversifying the national economy;
- adopt and *implement* the National Plan for Sustainable Development; adopt and implement the sectoral master plans;
- identify and eliminate *subsidies* and tax provisions that are potentially damaging to the environment;
- review, revise and increase, when necessary, environmental taxes and charges, in particular on transportation and energy, perhaps in the context of a *broader tax reform*;
- review *subsidies* for energy savings and renewable energy and assess their economic efficiency and environmental effectiveness;
- encourage more sustainable *modes of consumption* through regulatory and economic measures and appropriate demand management (for example, in the areas of solid waste, mobility, public and private buildings, land use);
- reinforce the internalisation of external environmental damage; enforce the "*polluter pays*" *and* "*user pays*" *principles* more effectively (for example in the management of waste, sewage, energy and transport);
- make environmental policies more effective and efficient through the use of *economic instruments* and closer *monitoring of the results* of environmental actions;
- ensure better *co-ordination of central and local government efforts* to implement environmental and land use policies, including European directives (for example, classified facilities, water management, space and species management);
- continue to implement the law on *strategic environmental assessments*.

Conclusions

Integrating environmental concerns into economic decisions

Despite its growing GDP and population, Luxembourg has made progress in *decoupling* environmental pressures from economic growth. Generally speaking, such

decoupling has been relative, except for SO_x and NO_x emissions, where decoupling has been absolute. A 2004 law laid the basis for the National Plan for Sustainable Development, which is to be renewed every four years and linked to sectoral plans. A participatory follow-up process (assessment report and indicators) has also been established. The law created an Interdepartmental Commission on Sustainable Development (CIDD) and a Superior Council for Sustainable Development (CSDD) comprising representatives of civil society. Progress has been made in integrating environmental concerns into certain sectoral policies such as transportation, with priority given to *public transport* and an increase in the Rail Fund, but efforts have been inadequate in other sectors. With regard to the *taxation of transportation and energy*, the annual vehicle tax is now calculated as a function of CO_2 emissions, and a fuel tax (the "Kyoto cent") has been introduced to combat climate change. A National Plan for Energy Efficiency has been introduced, together with economic incentives targeted at the construction industry, and a national body has been created to provide information and advice on energy savings and renewable energy.

However, decoupling problems persist, especially for *CO_2 emissions*. Trends in the transport and energy sectors are of concern, particularly as the "*motorisation rate*" is among the highest in the OECD, and taking account of sales of fuel to non-residents, Luxembourg's economy is the most carbon-intensive in the OECD in per capita terms. The country's wealth also generates pressures from household consumption and other economic activities. The 1999 National Plan for Sustainable Development, mostly implemented by the Ministry of the Environment, is to be replaced by a new plan for which a draft, approved by the government in 2009, has yet to be adopted. The *gasoline price gap* between Luxembourg and neighbouring countries should be reduced to encourage fuel savings and to reduce the emissions caused by fuel exports (transit, cross-border workers, "gas pump tourists"). These exports in fact account for 75% of fuel sales in Luxembourg. Some tax provisions, such as the commuter head tax, are potentially damaging to the environment. A comprehensive "*green tax reform*" as recommended in the previous review, has not been undertaken. Environmental policies lack a *long-term vision*. The environment is still often seen in some political debates as a constraint on economic development. R&D efforts (the environmental component of the CORE Programme), ecotechnologies (the new 2009 Action Plan), energy savings (2008 National Energy Efficiency Plan) and the promotion of public transport are all part of a *new conception of the environment as an economic opportunity*. But as Luxembourg looks ahead post-crisis, it is not certain that environmental action will receive greater priority, beyond the country's European commitments.

Strengthening the implementation and efficiency of environmental policies

Luxembourg has a very comprehensive set of domestic environmental laws, based largely on European legislation. It currently has *a control and inspection unit for classified facilities* and a mobile inspection unit for enforcing regulations relating to nature and forests. In 2003, the Luxembourg government adopted a *Master Programme for Territorial Planning*, as a physical planning tool at the national level. This programme provides a reference framework for the *master plans for primary sectors* (transport, landscapes, housing, and economic activity zones), which are in the process of adoption. Regulation remains an effective tool for implementing environmental policies, although voluntary instruments are now being used in many sectors. Government funds contribute to public environmental expenditure. They are financed by budgetary allocations (Environmental Protection Fund, Water Management Fund) and by partially earmarked taxes, such as fuel and vehicle taxes (Financing Fund for the Kyoto Mechanisms).

Yet Luxembourg is facing a number of environmental challenges in terms of pollution (waste water treatment, air pollution from NO_x) and unsustainable patterns of consumption (transport, energy, recreation, space). Its biodiversity and its landscapes are under threat. To address these challenges, *implementation* of environmental policies will have to be strengthened. The principles of "*polluter pays*" *and* "*user pays*" (especially for waste and water management) should be applied more effectively; greater use should be made of *economic instruments*; and the actual results of environmental policies should be measured more closely. Efforts by the central government and local authorities are not always well co-ordinated. Luxembourg has a plethora of plans and programmes, but the measures contained in those plans are not sufficiently spelled-out in terms of their costs, timing or budgeting. Luxembourg has been slow to implement certain laws (the Sustainable Development Plan, sectoral master plans) and European directives. For example, there are gaps in Luxembourg's *implementation of the Seveso Directive*, which calls for external emergency plans that entail active obligations to notify local residents.

♦ ♦ ♦

1. The Environment and Economic Growth

Luxembourg is the *richest country* of the OECD in terms of GDP per capita. Over the period 1990-2007, its economy grew strongly, with GDP rising by 118% for an average of 4.7% per year. This pace of growth was higher than that of most OECD countries.[1] In 2008 and 2009, however, the international *economic and financial*

crisis had a dampening effect on economic growth. Beginning with the financial sector, this effect has spread to all sectors of domestic demand, and is likely to persist in 2010.

1.1 The years 2000-07: strong growth and decoupling?

Between 2000 and 2007, Luxembourg's economy grew rapidly (+34%), while its population also increased (+9%) (Table 5.1 and Box 5.1). Industrial output (+18%) rose more slowly than GDP, reflecting the *increased weight of services*, particularly financial services, in the economy. Agricultural output contracted (–9%). The growth rates of energy supply and consumption were strong, but below that of GDP (+26% and +24% respectively). Freight and private vehicle traffic grew more slowly than GDP (+27% and +18% respectively). These figures do not include the very significant circulation of non-Luxembourg vehicles (transit, cross-border, and "petrol pump tourism"), which accounts for 75% of fuel consumption in Luxembourg.

Emissions intensity

During the period under review, SO_x and NO_x emissions declined (–12% and –17% respectively) (absolute decoupling), while CO_2 emissions rose (+35%) (no decoupling). SO_x and NO_x emissions (per unit of GDP) are *among the lowest in OECD countries*, while CO_2 emissions are *among the highest*. Taking account of fuel sales to non-residents, the Luxembourg economy is the most carbon-intensive in the OECD, on a per capita basis.

Energy intensity

The country's energy intensity (total primary energy supply per unit of GDP at 2000 prices and purchasing power parities) declined by 5% over the period. It stands at 0.15 toe (tonnes of oil equivalent) per USD 1 000, below that of Belgium and comparable to those of France and Germany (IEA, 2009) (Figure 2.3).

Resource intensity

The intensity of *water use* (as a percentage of available resources) remains well below the OECD Europe average and the overall OECD average (3.3% *versus* 14.0% or 11.5%, respectively). Water abstractions per capita per year are also lower than the OECD Europe or the overall OECD averages (140 m^3 per capita, compared to 530 and 880 respectively). No data are available on pesticide use. *Municipal waste* have grown less quickly than GDP (+16% *versus* +34%). This relative decoupling reflects increasing separate waste collection, growing awareness among businesses

Table 5.1 **Economic trends and environmental pressures,** 1990-2007

(trends in %)

	1990-2007	2000-07
MAIN ECONOMIC TRENDS		
GDP[a]	118	34
Population	24	9
Private final consumption	58	14
Agricultural production[b]	22	–9
Industrial production[c]	48	18
Road freight traffic[d]	250	27
Road passenger traffic[e]	65	18
Stock of vehicles	77	21
Road fuels sales	150	42
of which: exports[f]	181	54
MAIN ENVIRONMENTAL PRESSURES		
Pollution		
CO_2 emissions from energy use[g]	4	35
SO_x[b] emissions	–83	–12
NO_x[b, h] emissions	–38	–17
Energy		
Total primary energy supply	30	26
Total final energy consumption[b]	51	24
Resources		
Municipal waste	48	16

a) At 2000 prices and PPP.
b) To 2006.
c) Includes mining, manufacturing and electricity, gas and water.
d) Expressed as tonnes-kilometres. Domestic and international transport by Luxembourg-registered vehicles.
e) Expressed as passenger-kilometres.
f) Sales to transit traffic and cross-border travellers and "petrol pump tourists".
g) Sectoral approach; excludes international marine and aviation bunkers.
h) Excluding emissions resulting from exports of road fuels.
Source: OECD, Environment Directorate; IEA-OECD.

and the general public, and specific efforts to prevent waste generation. Municipal waste generation per capita is still among the highest in the OECD (Figure 3.1).

Assessment

Over the period 2000-07, Luxembourg pursued the trend toward *decoupling* of economic growth and environmental pressures, in a context of sustained economic growth. The most positive outcomes (absolute decoupling) concern SO_x and NO_x emissions. Progress has been less marked (relative decoupling) with municipal waste

Box 5.1 **Economic context 2000-07: growth and dematerialisation of production**

Luxembourg is a *rich country*. In 2008, GDP stood at EUR 36.7 billion (USD 53.7 billion) at current prices, and USD 30.9 billion at 2000 prices and purchasing power parities. GDP per capita is the highest in the OECD and is more than double that of Germany, Belgium or France. In fact, GDP is shared between residents and cross-border workers. Between 2000 and 2007, its annual growth rate, averaging 4.2%, was higher than in most OECD countries. The public finances were in surplus for more than 10 years, and the public debt to GDP ratio was 7% in 2007.

The structure of Luxembourg's economy *shows strongly established services* (banking and insurance, real estate and services to business), which generate 85% of GDP. Industry (steel and rubber or plastic products) accounts for 9%, construction 5%, and agriculture less than 1%. Growth continued even as a radical shift occurred from an industrial economy based on steel to a service economy based on banking and finance. The financial sector has been the principal engine driving the economy for more than two decades. Luxembourg is the leading European financial centre, and the second in the world in terms of the amount of assets managed by undertakings for collective investment (EUR 2 000 billion in 2007).

Of the 332 500 people working in Luxembourg in 2007, 78% were employed in the services sector, 11% in industry, 11% in construction, and 1.4% in agriculture. C*ross-border workers* represent more than 40% of employment in the country. 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, tire production). After going through a crisis in the 1970s, the steel industry has undertaken a major technological transformation, and its job numbers have fallen considerably. Between 2000 and 2007 employment rose by around 3%, most notably in services; employment in the manufacturing and primary sectors has been stable for a decade or so.

Luxembourg's external economic relations have long been marked by *integration* into 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. The European Union is Luxembourg's chief economic partner, both for imports (91% of total) and for exports (86% of total).

Luxembourg has long enjoyed a structural current-account surplus of more than 10% of GDP, thanks to the strength of its *financial services* sector, the exports from which are more than twice as high as merchandise exports. Exports of goods and services represent 178% of GDP, and imports 144%. Successive governments have pursued active policies to enhance Luxembourg's attractiveness as a site for financial and industrial activity.

generation. The *dematerialisation of domestic production* is having a favourable impact on the environment, but services also generate movements and energy consumption for heating and cooling buildings.

On the other hand, the trend in *CO_2 emissions* remains of serious concern, as do trends in transportation and energy. Consumption is exerting heavy pressure on the environment. The *number of vehicles per capita* is the highest in the OECD after the United States and Iceland. Exports of *road fuels* rose by 54% over seven years. The *consumption of space* continues unabated. *Municipal waste* generation and CO_2 emissions per capita are among the highest in the OECD.

1.2 The period 2008-09: crisis and opportunities?

Luxembourg has started a policy of *economic diversification*, exemplified by the "Logistics" Action Plan of 2006 and the "Health Technologies" Action Plan of 2007. The "Ecotechnologies" Action Plan of January 2009 has both economic and environmental objectives, and is intended to encourage new activities and the use of green technologies in industry (Box 5.2).

Luxembourg has been feeling the impact of the *economic and financial crisis* in 2008 and 2009, with GDP down by 0.9% and 4.0% respectively. The government has adopted two sets of support measures (in December 2008 and March 2009) amounting to 3.4% of GDP. The special parliamentary committee on the economic and financial crisis has recommended that the government promote qualitative, balanced and sustainable growth based at once on economic progress and on respect for ecological constraints and social aspirations.

On the R&D front, the CORE Programme (2009 budget: EUR 28 million) of the National Research Fund seeks to foster domestic research in priority areas. Its environmental component will double in 2009. A new environmental grants programme is being developed. In the context of slowing economic activity, it would be desirable to reinforce the environmental measures of the recovery plan adopted by the Luxembourg government (Box 5.3). The National Energy Efficiency Plan of 2008 could be implemented more quickly, and thereby help reduce the carbon intensity of the Luxembourg economy. Production and consumption could both contribute to a "new green growth" paradigm, where the environment would be seen less as a constraint than as an opportunity, including as an economic opportunity.

Box 5.2 **Promoting green technologies**

In 2007, Luxembourg devoted around *1.6% of its GDP to R&D*. This percentage is below the averages for OECD and OECD Europe (2.3% and 1.8% in 2006).

In January 2009, as part of the economic diversification policy adopted in 2004, Cabinet decided to create an "*Ecotechnologies*" *Action Plan*. This comes in the wake of the "Logistics" Action Plan of 2006 and the "Health Technologies" Action Plan of 2007. It seeks to speed the integration of green technologies into all sectors of the economy, by boosting demand and enhancing the supply of ecotechnologies produced domestically by specialised firms and R&D centres. Specifically, it proposes to: *i)* further develop existing firms; *ii)* promote exports; *iii)* encourage traditional sectors to move into these new processes and markets; *iv)* create new firms; and *v)* attract foreign firms to Luxembourg. The plan was drawn up by a working group of the Ministry for Economic Affairs and Foreign Trade, in collaboration with LuxInnovation (National Agency for Innovation and Research), the University of Luxembourg, the Environmental Technologies Resource Centre (CRTE/CRP Henri Tudor), and the firm RDI Consultant. It is being implemented by the Ministry for Economic Affairs in co-operation with the Ministry of the Environment, within an inter-ministerial monitoring group.

The plan calls for doubling environmental research grants from the *National Research Fund* (CORE Programme), which will amount to EUR 5 million in 2009 (*versus* EUR 2.5 million in 2008). A new environmental grants programme is now being readied. Consistent with European Commission guidelines, it will engage primarily in providing subsidies for technological feasibility studies.

One concrete measure called for in this plan is the creation of an industrial "cluster" (EcoDev) in *ecotechnologies* and *sustainable development*. The Clusters Programme was launched in Luxembourg by the Ministry for Economic Affairs and Foreign Trade in 2002 to consolidate the competitive position of firms by promoting collaboration among different technological sectors and strengthening ties between private and public research activities. In 2008, LuxInnovation completed a study on the potential for creating the new EcoDev Cluster and prepared a map of public and private players with competence in environmental issues (water, waste, air, noise, soils, etc.), energy issues (solar energy, biomass, etc.) and crosscutting issues (ecodesign, sustainable development, etc.). Launched in February 2009, the EcoDev Cluster will encourage networking among businesses and research laboratories, supply information on domestic and European grant funding for environmental and ecoinnovation activities, and launch R&D and demonstration projects.

Box 5.3 **The 2008-09 economic context: crisis and support efforts**

Luxembourg has been feeling the impact of the international economic and financial crisis since 2008, and economic growth is likely to remain sluggish in 2010. Unemployment is forecast to rise from 4.9% in 2008 to 7% in 2010.

In March 2009, the government adopted a plan to counter the effects of the economic and financial crisis and to ready the country for eventual recovery. In concert with labour and management, and after consultation with the Chamber of Deputies, it announced a series of measures. The cost of these measures is estimated at EUR 665 million, or 1.8% of GDP. When added to the initial support measures taken in December 2008, the *total stimulus package represents EUR 1.23 billion or 3.4% of GDP*.

Priority will go to:

- *Bolstering household purchasing power* through tax measures such as direct tax cuts (EUR 342 million) and tax credits (EUR 98 million).
- *Support for business activities*, by lowering the corporate income tax rate (EUR 85 million), eliminating the corporate registration fee (EUR 100 million), making additional public investments (EUR 70 million), offering direct subsidies and loan guarantees (EUR 15-30 million), and simplifying administrative procedures relating to municipal planning, urban development, classified installations and conservation of nature.
- *Employment support*, with extension of the partial unemployment system (the state will take over the employer share of unemployment benefits and will make the reference period more flexible, and it will raise the compensation rate for employees) (EUR 10.7 million per month).
- *Preparation for the post-crisis* era (EUR 134 million), with support for public enterprises in developing telecommunications infrastructure and networks and data storage capacities (LuxConnect, Postes et Télécommunications) and expanding the R&D grants system (LuxInnovation).

Environmental measures focus primarily on:

- Extending the scope of application of the EUR 750 subsidy (EUR 4.5 million) for purchases of low-emission vehicles (<120 g of CO_2/km for corporate purchases, <160 g of CO_2/km for persons who are disabled or who have a disabled person in their care).
- Introduction of a "scrapping premium" (EUR 2 500 for 120 g CO_2/km, EUR 1 500 between 121 and 150 g CO_2/km) to encourage the replacement of older passenger cars by low-emission vehicles (EUR 10 million).
- Subsidies to promote energy-saving home refrigerators (EUR 2 million).
- New grants and an increase in existing subsidies to promote renewable energy in buildings (EUR 44.8 million for 2008-12).

2. Institutionalising Sustainable Development

In 1999, the Luxembourg government adopted a National Plan for Sustainable Development (PNDD1). It identified priority action areas for achieving an efficient and sustainable economy, protecting the environment and natural resources, promoting socio-economic equity and providing a social safety net. It called for the inter-ministerial working group to help implement the plan, to track progress, and to promote joint activities. It also proposed the creation of a national committee for sustainable development, in effect an advisory board, comprising representatives of government, labour and management, and other non-governmental associations (OECD, 2000).

2.1 Institutions

The *Law of 25 June 2004* on co-ordination of the national policy for sustainable development laid the legal foundation for the National Plan for Sustainable Development, which is to be updated every four years and is to specify areas of action, objectives and activities. It established a Superior Council for Sustainable Development (CSDD) and created an Interdepartmental Commission for Sustainable Development (CIDD) comprising ministry representatives responsible for mainstreaming the concept of sustainability into sectoral policies.

The *Superior Council for Sustainable Development*[2] is the senior advisory body for sustainable development. It has 15 members, appointed in *their personal capacity* and drawn from the academic world, NGOs, labour unions, chambers of commerce and business associations. Its secretariat is staffed by the Ministry of the Environment. Since its creation, the Council has sent several opinions to the Minister of the Environment, the government, and the Chamber of Deputies.[3] The CSDD has decided to create a working group on synthetic indicators for sustainable development.

The *Interdepartmental Commission for Sustainable Development* includes representatives of all ministerial departments, and is tasked with drafting the National Plan for Sustainable Development, which is then to be submitted to government for approval. The CIDD is also supposed to report on implementation of sustainable development in individual sector policies.

2.2 From PNDD1 to PNDD2

The 2004 Act calls for a report to be prepared every two years on Luxembourg's status with respect to sustainable development, as a way of identifying both successes

and mistakes. An evaluation of PNDD1 (from 1999) was conducted in 2006, in the form of an *implementation report*. It showed that between 1999 and 2006, 78% of the stipulated measures had been pursued but only 37% had been completed, primarily in the area of environment and natural resource conservation. This reflects the lead role played by the Ministry of the Environment, and the stress placed on the "environment and natural resource conservation" pillar.

The assessment also made use of *indicators*. PNDD1 defined a list of 59 indicators, which drew heavily on the Action 21 Programme of the United Nations. In 2002, a set of 27 indicators was published. An update, initiated in 2006, was interrupted while waiting for PNDD2.

Finally, the 2006 implementation report proposed *priority themes for preparation of the second national plan* (PNDD2), namely: fostering a competitive economy, guaranteeing employment for workers, upgrading human capital, maintaining a sustainable pensions system, assuring fiscal health, giving priority to public transport and non-motorised transportation for individuals, combating climate change, ensuring energy supply, halting the degradation of natural resources, and adopting a more intelligent approach to territorial organisation. The CIDD focused its work in 2007 and 2008 on preparing the PNDD2, through a participatory process of consultation. Eighteen quality objectives have been selected, with their associated measures. A draft of the PNDD2, presented by the Minister of the Environment, was approved by the government in March 2009. It must be submitted to the Chamber of Deputies and the CSDD for review and must be subject to a public consultation before being finalised and adopted.

2.3 Assessment

In summary, during the period under review, the 2004 Act established a *noteworthy legal basis* for the PNDD, including the three pillars (economic, social and environmental) and an update every four years. Luxembourg has also created the necessary institutions (CSDD and CIDD) to strengthen the participatory process with civil society, to encourage greater co-operation among ministerial departments, to prepare a biennial report on implementation of the plans, and to establish indicators for measuring progress.

PNDD2 must replace PNDD1 with a more balanced approach to the three pillars and greater coherence among the various plans and measures (recognising that the vehicle tax reform and introduction of the "Kyoto cent" coincided with an increase in the highways fund). A draft of PNDD2 was submitted to Cabinet in 2009, some five

years after the Act was adopted, and 10 years after PNDD1. It would be well if the proposed measures were accompanied by a financing plan.

3. Sustainable Development in Practice: Market-Based Integration

To date, Luxembourg has made little use of the *tax system* to achieve environmental objectives. Taxation is generally rather low, and is used to generate revenues and to influence certain relative prices in order to produce economic benefits.

As a transit country that receives more than 125 000 cross-border workers every year, Luxembourg imposes low taxes on road fuels, and this encourages "fuel tourism". The revenues from these taxes (as a percentage of GDP and as a share of total tax revenues) are among the highest in the European Union (EC, 2008). The *revenues from environmentally related tax* grew by 28% over the period 2000-08 (Table 5.2). The "green tax reform" recommended in the previous OECD report (OECD, 2000) has not been implemented but some progress has been made.

Table 5.2 **Revenues from "environmentally related taxes"**, 1995-2008

(% of GDP)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Energy[a]	2.8	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.7	2.9	2.8	2.5	2.4	2.5
Transport[b]	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
Total	3.0	2.9	3.0	2.9	2.8	2.8	2.8	2.8	2.8	3.0	3.0	2.6	2.6	2.7

a) Road fuels primarily.
b) Vehicle taxes.
Source: OECD/EEA Database on Economic Instruments for Environment, 2009.

3.1 Energy taxes

The government collects taxes on energy and fuels (Table 5.3). There is no tax on coal and coke. Pure biofuels, such as ethanol and biodiesel, whose blending obligation is 2%, are exempt from taxation. Most energy products are subject to VAT

Table 5.3 **Energy taxes and excise duties,** 2008

(EUR)

	Total	UEBL[a]	Independent[b]		VAT (%)
Petrol (1 000 l)					
Leaded	516.66	245.41	113.08	Excise	*15*
			138.17	Social contrib.	
			20.00	Climate contrib.	
Unleaded > 10 mg/kg sulphur	464.58	245.41	61.00	Excise	*15*
			138.17	Social contrib.	
			20.00	Climate contrib.	
Unleaded ≤ 10 mg/kg sulphur	462.10	245.41	58.51	Other	*15*
			138.17	Social contrib.	
			20.00	Climate contrib.	
Kerosene (1 000 l)					
Fuel	302.00	295.00	7.01		*15*
Industrial/commercial use	21.00	18.60	2.41		*15*
Heating	10.00	0	10.00		*12*
Diesel (1 000 l) *used as a fuel*					
Containing > 10 mg/kg sulphur	305.35	198.31	50.84	Excise	*15*
			31.20	Social contrib.	
			25.00	Climate contrib.	
Containing ≤ 10 mg/kg sulphur	302.00	197.45	47.48	Excise	*15*
			31.20	Social contrib.	
			25.00	Climate contrib.	
Industrial/commercial use	21.00	18.60	2.41		*15*
Heating	10.00	0	10.00		*12*
Agriculture, horticulture and other uses	0	0	0		*15*
Biofuels *pure*	0	0	0		
Used as fuel (1 000 l):					
Petrol containing < 50 mg/kg of sulphur and vol. biofuels ≥ 2.93%	45.61	0	45.61		
Diesel containing < 50 mg/kg of sulphur and vol. biofuels ≥ 2.71%	42.34		42.34		
Heavy fuel oil (1 000 kg)	15.00	13.00	2.00		*15*
LPG/methane (1 000 kg)					
Fuel	101.64	0	101.64		*6*
Industrial/commercial use	37.18	37.18	0		*6*
Heating	10.00	0	10.00		*6*
Coal and coke	0	0	0		*12*

Table 5.3 **Energy taxes and excise duties,** 2008 *(cont.)*

(EUR)

	Total	UEBL[a]	Independent[b]	VAT (%)
Natural gas				
Fuel	0	0	0	*6*
Combustible/MWh *cons/yr ≤ 550 MWh*	1.08	0	1.08	*6*
cons/yr > 550 MWh	0.54	0	0.54	*6*
cons/yr > 4 100 MWh	0.05	0	0.05	*6*
Cogeneration	0	0	0	*6*
Electricity				
Consumption/year in MWh ≤ 25 MWh	1.00	0	1.00	*6*
> 25 MWh	0.50	0	0.50	*6*
Metallurgical/mineralogical processes	0.10	0	0.10	*6*

a) Set by the Belgium-Luxembourg Economic Union.
b) Set by Luxembourg.
Source: Ministry of Finance.

at the 15% rate, but kerosene and heating oil are taxed at a reduced rate of 12%. The VAT rate on electricity and natural gas is 6%. *Energy taxation levels* are among the lowest in OECD Europe for all product and consumer categories (IEA, 2009).

Since January 2007, excise taxes on *road fuels* have been gradually raised to finance measures to offset greenhouse gas emissions. A "*climate contribution*" was instituted in 2007, amounting to EUR 20/1 000 litres for petrol and EUR 12.5/1 000 litres for diesel. The latter was increased to EUR 25 in 2008. This tax contributed EUR 36.4 million to the 2007 budget, and EUR 63 million to the 2008 budget (or 0.55% of budgetary revenues). The amount expected for 2009 is EUR 58 million. The revenues from the climate contribution are paid in to the Kyoto Mechanisms Financing Fund created in 2004 to help finance the Kyoto flexibility mechanisms and domestic measures to reduce greenhouse gas emissions.

3.2 Transport taxes

The average cylinder capacity and power of passenger cars in Luxembourg are higher than the EU average (Statec, 2008). The *annual road tax*, which was calculated on the basis of engine size, has been completely overhauled and is now calculated as a function of CO_2 emissions. The new system applies to vehicles registered after 1 January 2001. Older vehicles are still taxed in light of their engine

power. The amount of the tax depends on the quantity of CO_2 emitted as well as on the type of fuel used. The multiplier is 0.9 for diesel and 0.6 for petrol. The tax is increased by a multiplier, which is set at unity if emissions are 130 g per km and decreases or rises by 0.1 for every 10 g consumed below or above 130 g per km. The lower limit is 0.5, or the equivalent of less than 90 g per km. A discount is allowed for diesel-powered vehicles equipped with a filter.[4] The tax contributed EUR 61.5 million to the 2007 budget, and EUR 74 million to the 2008 budget (or 0.64 of budgetary revenues). The anticipated amount for 2009 is EUR 70 million. Prior to the reform, the annual road tax raised EUR 32 million. Since 2007, 40% of the revenues of this tax have been allocated to the Kyoto Mechanisms Financing Fund.

Concerning *financial assistance for less-polluting vehicles*, the government has offered a special grant of EUR 750 since 2007 to private purchasers of vehicles emitting less than 120 g of CO_2 per km (equivalent to 5 litres of petrol for 100 km or 4.5 litres of diesel for 100 km). For hybrid vehicles or those that run on natural gas the limit is 160 g of CO_2 per km. This grant is now available to corporate buyers as well. These provisions have also included a scrapping bonus since January 2009: set at EUR 1 500 or EUR 2 500 (including the EUR 750) depending on the level of emissions of the vehicle purchased, it applies to vehicles more than 10 years old. The proportion of newly registered vehicles emitting less than 120 g of CO_2 per km rose from 1.7% in 2001 to 10.1% in 2006 and 17.9% in 2008. A grant of EUR 2 500 per vehicle was paid between 2007 and 2009 to businesses for low-emission heavy utility vehicles and buses (Euro V standard).

3.3 Assessment

In summary, the measures recently adopted by the government are moving in the right direction, for they help to *internalise the external costs of road transport*. Yet petrol taxes are still relatively low. Thus, pump prices are lower in Luxembourg than in neighbouring countries, and *75% of fuel sales are to non-residents*, generating excessive vehicle traffic and emissions of various pollutants in Luxembourg. The highest sales volumes in Europe are recorded at two service stations in Luxembourg. In 2008, the government raised excise duties on diesel to EUR 0.302 per litre, bringing them up to the Belgian level but leaving them below the levels in France and Germany (EUR 0.428 and EUR 0.470 respectively). At the same time, the 2008 VAT rate, at 15%, was lower than in neighbouring countries (21%, 19.6% and 19% respectively for Belgium, France and Germany).

Luxembourg would thus do well to reduce the petrol price gap with neighbouring countries in order to *encourage fuel consumption savings and reduce emissions from fuel exports*. Luxembourg has announced that it will work

constructively at the European level to harmonise excise rates as long as countries that have applied lower rates in the past are allowed a sufficient transition period for reaching the new minimum rates.

Generally speaking, Luxembourg should pursue its efforts to *internalise the external costs to the environment*. It should also identify and eliminate subsidies and tax provisions that are potentially damaging to the environment such as the flat-rate commuter tax, which is the same for all modes of travel and does nothing to encourage the use of public transport.

4. Sustainable Development in Practice: Sector Policies

4.1 Energy

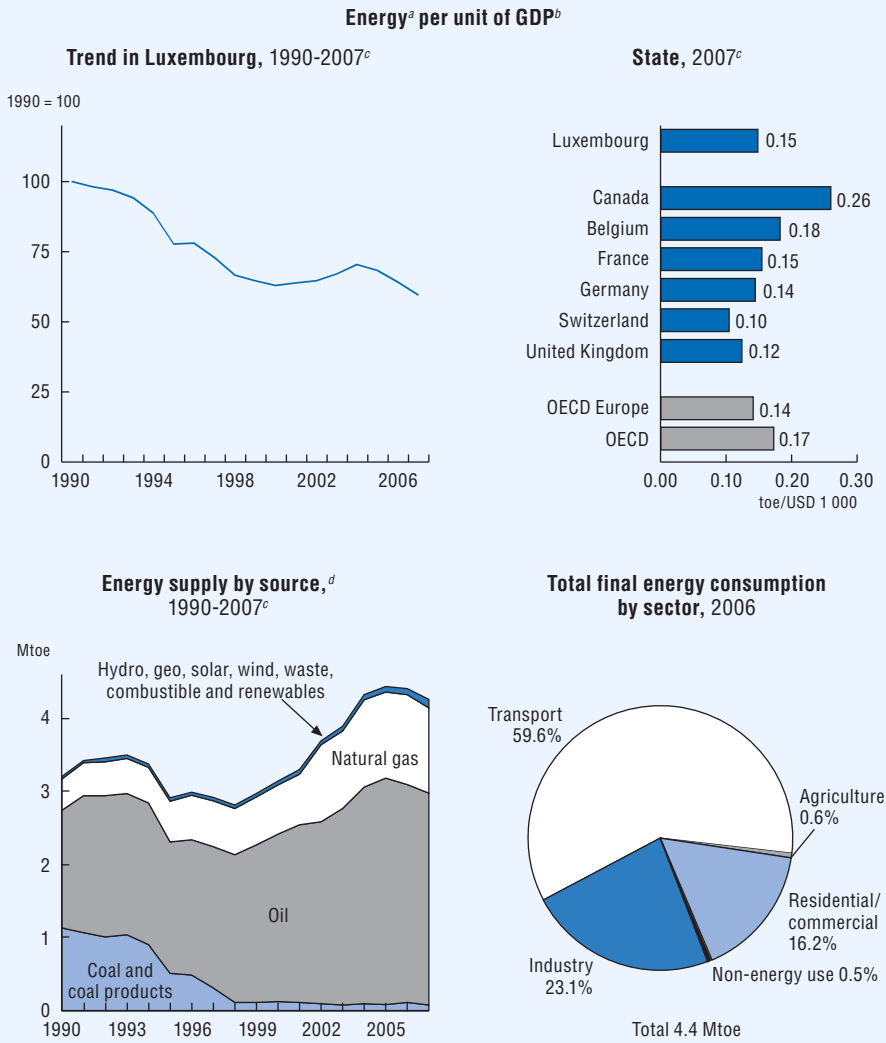
Energy efficiency

Luxembourg's energy efficiency has improved since the last review and is now around the OECD Europe average, at 0.15 toe per USD 1 000 of GDP. *Energy intensity declined* by 5% between 2000 and 2007 as a result of structural changes in the economy as well as progress in energy efficiency (Figure 5.1). Energy consumption in the *industrial, commercial and residential sectors* has been stable since the mid-1990s. Industry has modernised and restructured, while energy is now used more efficiently in buildings. On the other hand, energy consumption in the *transport* sector has risen considerably. That increase is explained largely by fuel sales to drivers of heavy vehicles and to cross-border travellers (whether or not working in Luxembourg). These sales account for around 75% of total final consumption in the transport sector.

In February 2008, Luxembourg adopted a *National Energy Efficiency Plan*, in line with European Directive 2006/32/EC on energy end-use efficiency and energy services. That directive requires member states to set an indicative national energy savings target of 9% for the ninth year of the directive's application. The –9% target for 2016 set by the national plan corresponds to an energy savings of 1 582 GWh compared to the period 2001-2005. The plan in fact goes further and identifies measures that would produce energy savings equivalent to 10.4% of total final consumption. Luxembourg and other member states of the EU have agreed on a *target of –20% for the year 2020*.

More than half of Luxembourg's energy savings to 2016 should come from the *construction* sector. In keeping with the provisions of the European Directive on the energy performance of buildings, a system for calculation, certification and supervision of energy performance was introduced into the building permit process in

Figure 5.1 **Energy structure and intensity**



a) Total primary energy supply.
b) GDP at 2000 prices and purchasing power parities.
c) 2007: estimates.
d) Breakdown excludes electricity trade.
Source: OECD-IEA (2008), *Energy Balances of OECD Countries*; OECD (2008), *OECD Economic Outlook No. 84*.

January 2008. The Building Code has been revised with ceilings on total annual energy consumption in residential buildings and more ambitious provisions for building insulation. The improvement represented by this new regulation over the 1995 insulation standards can be set at 30% in terms of energy performance. Since 1 January 2008, investment subsidies to households for energy efficiency improvements in new and old buildings were revised. In May 2008, the banking industry signed a partnership agreement with the Ministry for Economic Affairs and External Trade to offer reduced interest rates on loans to finance the construction of "passive" or low-energy consuming houses. The government has also earmarked EUR 30 million from 2007 to 2012 for improving the energy performance of existing public buildings.

The *transport* measures in the National Energy Efficiency Plan focus essentially on reducing fuel consumption by raising fuel taxes, introducing a CO_2 tax on vehicles, and promoting less-polluting vehicles. The emphasis that the government is placing on public transport should also help improve energy efficiency. There are plans to invest EUR 2 billion in rail infrastructure over the period 2008-12.

A voluntary agreement on energy savings has been negotiated with the Luxembourg Federation of Industry (FEDIL). That agreement applies to around 90% of total energy consumption in the country's *manufacturing industry*, and is intended to produce a 1% annual improvement in average energy efficiency. Companies that meet the target earn a partial exemption from energy taxes.

A *body that provide advices and information on energy efficiency* and renewable energy was established in 2009. The Economic Interest Grouping formed by the government (Ministry for Economic Affairs, Ministry of the Environment) and the Energy Agency (created in 1991), has nine employees and a budget of EUR 1.3 million for 2009.

Renewable energies

Luxembourg relies essentially on imports for its *primary energy* supply. In 2007, that supply consisted of oil (63.1%), natural gas (25.3%), coal (1.7%), electricity imports (7.4%) and renewable energies (2.5%). Solid biomass and waste account for 47% of renewable energy, biofuels for 30%, biogas for 9%, hydroelectric energy for 9%, wind and solar power for 6%. Since the mid-1990s, the *share of renewable energies* has held steady at around 1.5% of total primary supply. It increased in 2007, as a result of the legal obligation imposed on oil companies to incorporate biofuels into petrol and diesel sold in Luxembourg. Currently, renewable sources account for 9.5% of total electricity production. However, Luxembourg covers more than half of its electricity needs through imports.

The *promotion of renewable energies* in Luxembourg is largely determined by European directives. The indicative target for electricity produced from renewable energy sources as a share of gross electricity consumption is 5.7% for 2010. The target for the minimum share of biofuels in total transportation fuels is 5.75% for 2010. The mandatory targets for 2020 in the European "Energy-Climate" Package, adopted in 2008, are: *i)* an 11% share of renewable energies in final energy consumption, and *ii)* a 10% share of biofuels in total motor fuel consumption. Luxembourg will face a real challenge in meeting these targets. A 2007 study found that the maximum share of energy consumption that could be produced in Luxembourg from renewable sources was 4.5%.

The measures adopted by the Luxembourg government to date for promoting the use of renewable energies focus essentially on feed-in tariffs for electricity, subsidies to invest in renewable energy technologies, tax exemptions, and legal requirements for biofuels used in the transport sector. *Price guarantees and subsidies* have sparked a notable increase in *photovoltaic solar* energy production capacity (from 54 kW in 1999 to 23 500 kW in 2005). Thus, over the period 2001-08, investment in photovoltaic solar power received EUR 70 million in subsidies.

Compared to other renewable energy options (wind, cogeneration, other solar), the photovoltaic option seems particularly costly. It would be useful to reconsider the various systems in place for promoting renewable energy and to assess and review them from the viewpoints of *economic efficiency and environmental effectiveness*. Opportunity costs of the funds allocated to promoting renewable energy and those devoted to energy savings should be assessed.

Energy prices

Wholesale and *retail prices for electricity* in Luxembourg have tended to rise since 2005, as fossil fuels have become more expensive and as the European Union's Emissions Trading System has come into effect. Luxembourg's electricity prices before tax are the highest in the OECD, particularly for small companies and households. This can be explained by the small size of the market and the cost of burying power distribution cables. To offset this high cost, Luxembourg charges very low power taxes to households (averaging 10.4% of the total price in 2007). As a result, the price of electricity paid by households is slightly lower than the OECD Europe average (Table 5.4).

Gas prices charged to households have historically been below the average of OECD Europe countries, reflecting both lower pre-tax prices and relatively low VAT rates. The price to industry is today higher than the average for OECD Europe.

Road fuel (petrol and diesel) *costs* less in Luxembourg than in neighbouring countries, because taxes are relatively low (Figure 5.2).

Table 5.4 **Household energy prices,** 2007

	Electricity (USD[b]/kWh)	Oil[a] (USD[b]/1 000 l)	Natural gas (USD[b]/107kcal)
Luxembourg	0.178	569.9	470.0[c]
Canada	0.078[c]	701.3	433.6
Belgium	..	652.8	..
France	0.127	710.0	629.9
Germany	0.224	687.1	..
Switzerland	0.099	485.9	626.8
United Kingdom	0.169	619.4	582.8
OECD Europe	0.179	765.6	..
OECD	0.137	748.6	634.6
Lux./OECD Europe price (%)	*99*	*74*	..
Lux./OECD price (%)	*130*	*76*	*75*[c]

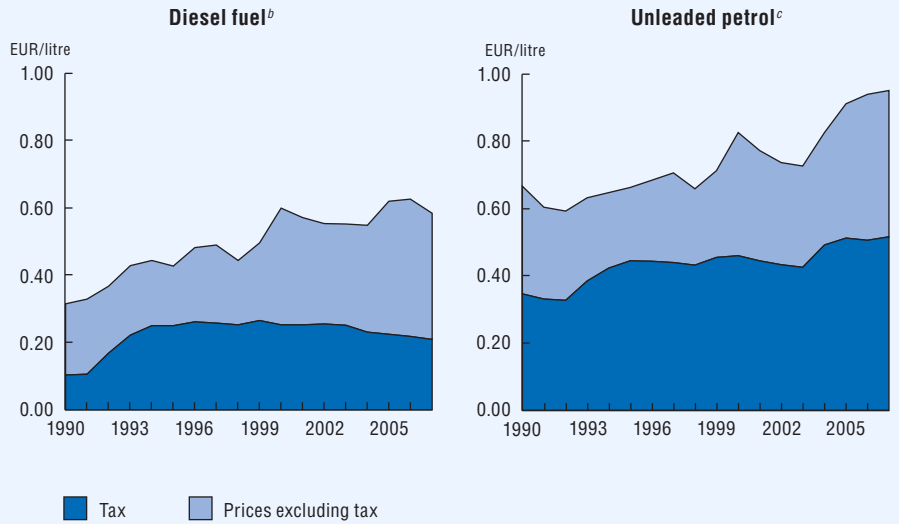
.. not available; x not applicable.
a) Light fuel oil.
b) At current purchasing power parities.
c) 2006.
Source: IEA/OECD, *Energy Prices and Taxes*, 2009.

4.2 Transportation

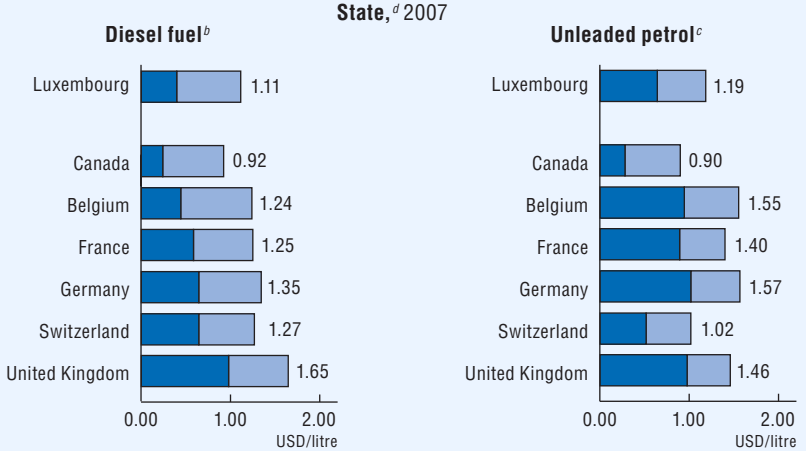
In 2002, the Luxembourg government adopted a mobility strategy ("*mobilitéit-lu*") in which it came out strongly in favour of public transport, setting for 2020 a *modal share* target of 25% for public transport *versus* 75% for private vehicles. The "*Integrated Transport and Territorial Development Concept*" (IVL, published in 2004), sets the pattern for the future development of transportation in the context of sustainable development and territorial planning. Through an integrated interdisciplinary approach, it seeks to co-ordinate the preparation of sector plans and to maintain a balance between the interests of transportation, the environment, and territorial development. The concept of integrated mobility, "Mobil 2020" (2007), retains the modal share target and specifies the means for promoting public transport and non-motorised travel. The objective is an *ambitious* one, for the current share of public transport (trips made by public transport as a share of all motorised trips during a working day) is only 14%. Moreover, under the dual impact of growth in the resident and working population and the encouragement of public transport, the public system will have to cope with demand that will be three times as high in 2020 as it was in 1997.

Figure 5.2 **Road fuel prices and taxes**

Trends in Luxembourg, [a] 1990-2007



State, [d] 2007



a) At constant 2000 prices.
b) Automotive diesel for commercial use.
c) Unleaded premium (RON 95).
d) Diesel fuel: at current prices and exchange rates; unleaded petrol: in USD at current prices and purchasing power parities.

Source: OECD-IEA (2009), Database of End-use Prices.

The *Transport Sector Plan* (PST), presented in draft form in 2008, will give concrete shape to the guidelines in the IVL and the principles of the "Mobil 2020" concept. The plan proposes 49 rail and road infrastructure projects, to be carried out in three phases, the first of which includes 15 rail and 12 road projects. The plan also provides for ongoing monitoring of its implementation. The measures involve: *i)* linking the country to the major European rail networks, *ii)* projects to upgrade regional cross-border public transportation, and *iii)* projects to promote public transport nationally. To promote intermodal transport, transfer stations are planned around the periphery of the capital where passengers can switch between train, tramway and bus. In order to serve the development and employment centres that have the greatest impact on the southern part of the country, the rail network will be expanded in the south and around the capital. International, cross-border and domestic infrastructure projects will be financed by the Rail Fund, estimated at EUR 2 billion over the period 2009-13.

Rail and road infrastructure spending represented about 1% of GDP in 2008. The 2004-08 multiyear programme shows rising revenues and outlays of the Rail Fund, exceeding those of the Road Fund.[5] A successful modal shift will depend on the construction of infrastructure as well as on *management of road traffic*. A recent study shows that despite improvements to the public transport network, there has been no modal switch from automobiles to public transport over the last few years (CEPS/INSTEAD, 2009). Road tolls, parking charges at the workplace, enforcement of speed limits, encouragement for carpooling, and higher fuel taxes should influence the behaviour of motorists, and of cross-border commuters in particular.

5. Environmental Policy Implementation

5.1 Objectives

The government's policy priorities for the period 2004-09 were: *i)* the principle of sustainable development; *ii)* nature conservation; *iii)* sustainable management of waste; *iv)* combating air pollution, the greenhouse effect and noise; and *v)* promoting new and renewable energies. The National Plan for Sustainable Development (1999) and the General Waste Management Plan (2000) have now been joined by the Action Plan for CO_2 Emissions Reduction (2006) and the National Plan for Nature Conservation (2007). These are linked to a number of other economic, sectoral and territorial development plans and programmes (Table 5.5).

Table 5.5 **Environmental plans and programmes**

Title	Year adopted	Period covered
ENVIRONMENT		
National Plan for Sustainable Development	1999 and 2009 (draft)	1999-2009 and 2009-14
National Plan for Nature Conservation	2007	2007-11
General Waste Management Plan	2000 (undergoing revision)	2000-05
Action Plan for CO_2 Emissions Reduction	2006	2006-12
National Plan for the Allocation of Greenhouse Gas Emissions Quotas	2004 and 2006	2005-07 and 2008-12
National Programme for Progressive Reduction of Air Polluting Emissions (SO_2, NO_x, COV, NH_3)	2003 (revised in 2008)	2003-10
National Plan for Implementation of the Stockholm Convention on Persistent Organic Pollutants	2008	Variable
National Forestry Programme	2005	Since 2005
Water District Management Plan	2008 (project)	2009-15
ECONOMY-ENVIRONMENT INTEGRATION		
National Plan for Innovation and Full Employment/ National Reform Programme – Lisbon Strategy	2005	2005-10
Action Plan for SMEs	2008	2006-10
Action Plan for Ecotechnologies	2009	As of 2009
SECTORAL INTEGRATION		
Energy Efficiency Action Plan	2008	Variable
Integrated Mobility Plan – Mobil 2020	2007	Horizon 2020
Action Plan for Non-motorised Mobility	2008	Horizon 2020
National Strategic Plan for Rural Development	2006	2007-13
Rural Development Programme	2000 and 2007	2000-06 and 2007-13
Action Plan for Organic Farming	2009	2009-12
TERRITORIAL PLANNING		
Master Programme for Territorial Planning	2003	Variable
Integrated Transport and Territorial Development Concept for Luxembourg (IVL)	2004	Horizon 2020
Landscape Sector Master Plan	2008 (draft)	Horizon 2020
Transport Sector Master Plan	2008 (draft)	Horizon 2020
Sectoral Master Plan for Economic Activity Zones	2009 (draft)	Horizon 2020
Housing Sector Master Plan	2009 (draft)	Horizon 2020
Sector Master Plan for Inert Waste Disposal	2006	Since 2006

Source: Ministry of the Environment.

5.2 Institutions

While the environmental ministry function has existed since 1971, the creation of an independent Ministry of the Environment with general environmental responsibilities dates from 1984. Following the national elections of 2004,[6] the

Ministry of the Environment was given the mandates of implementing the government's environmental programme, co-ordinating activities under the National Plan for Sustainable Development (PNDD), and taking any measures necessary to protect the natural and human environment. The Ministry of the Environment (with a staff of 27) has the following responsibilities:

- supervision of the Environment Administration;
- supervision of certain activities of the Water and Forests Administration;
- inter-ministerial co-ordination on environmental problems;
- co-ordination of statutory and regulatory provisions concerning the environment;
- management of environmental protection funds;
- combating air pollution, climate change and noise;
- waste prevention and management;
- natural resource conservation and sustainable forest management;
- promotion of energy savings and of new and renewable energies;
- inter-regional and international co-ordination and co-operation on the environment and sustainable development.

The *Environment Administration* (75 persons) has both "preventive" and "curative" mandates to protect the environment so as to enhance the quality of human life in its setting. This includes the prevention of pollution and nuisances, combating air pollution and noise, and managing waste disposal. The Administration consists of the director's office; three divisions (air and noise, waste, and classified installations); and five service units (legal, administrative, IT, chemical products and hazardous substances, environmental permits and management). The *Water and Forests Administration*[7] (138 officials, 257 forestry workers), which is responsible for implementing nature conservation laws, comes under the authority of the Minister of the Environment. It is also responsible at the technical level for hunting and forest management. Forest operations and management are handled in a decentralised manner under the Ministry of Agriculture, Viticulture and Rural Development.

The responsibilities of the *Ministry of the Interior and of Territorial Planning*[8] include supervising municipal syndicates, general territorial planning policy, environmental impact assessment of road projects, abandoned industrial lands, and nature parks. Since 1999, this Ministry has also been responsible for co-ordinating overall water policy (management and protection of water as a resource, cleanup of waters and watercourses, management of sewage sludge, drinking water supply, water pricing, fishing, and floods). In 2004 the *Water Management Administration* was created (by merging the competent agencies) to ensure integrated and sustainable

management and effective protection of water resources and the aquatic environment. It comprises the director's office and four divisions: hydrology, water protection, groundwater and drinking water, and laboratory.

The *municipal (commune) authorities* have *wide-ranging environmental responsibilities,* covering drinking water, sewage and household waste treatment, municipal roads and green spaces, land use planning and urban development (PAG: general land use plan), and road traffic management. Local governments often delegate these responsibilities to municipal syndicates. They play an important role in raising public awareness about sustainable development.

5.3 Legislation

Luxembourg has a complete set of *legislative and regulatory provisions* governing the environment, which have been compiled in a *noteworthy* "*Environmental Code*" (Table 5.6). Since the last OECD review (in 2000), this Code has been expanded with new texts and now includes the new European Community provisions. The transposition of European directives today follows the rule of "the whole directive and nothing but the directive".

The *Environmental Protection Fund Act* (1999) created a special Fund for the Protection of the Environment, identified activities eligible for public assistance, and established the levels of such assistance. Under the supervision of the Minister of the Environment, the Fund covers central government expenses for preventing and combating air pollution, noise and climate change, waste prevention and management, nature and natural resource conservation, and cleanup and rehabilitation of landfills and contaminated sites. A Water Management Fund was created in the same year under the Minister of the Interior. The *Act on Co-ordination of the National Policy for Sustainable Development* (2004) establishes the framework, bodies and instruments for implementing that policy.

Other laws give expression to European Community law. The 1982 *Conservation of Nature and Natural Resources Act* is intended "to safeguard the character, diversity and integrity of the natural environment". It was amended in 2004 to transpose the European Habitats and Birds Directives. The 2005 *Act Governing the Partnership between the Municipal Syndicates and the Government and Restructuring the Scientific Approach to the Conservation of Nature and Natural Resources* associates the municipal syndicates with implementing the 2004 Act and creates the Natural Environment Observatory. The 2004 *Act Establishing a Greenhouse Gas Emissions Quota Trading System* transposes European Directive 2008/87/EC and establishes a national plan for allocating greenhouse gas emission quotas for industrial

Table 5.6 **Principal laws relating to the environment**

1929	Watercourse Protection and Improvement Act[a]
1937	Urban Development Act[a]
1951	Woodland Protection Act
1965	Nature Protection Act[a]
1974	Territorial Planning Act[a]
1976	Clean Air Act
1976	Noise Abatement Act
1982	Conservation of Nature and Natural Resources Act[a]
1990	Hazardous Installations Act[a]
1992	Freedom of Access to Environmental Information Act[a]
1993	Water Protection and Management Act[a]
1993	Energy Efficiency Act
1993	Natural Parks Act
1994	Waste Prevention and Management Act
1995	Act on the Classification, Packaging and Labelling of Hazardous Preparations[a]
1997	Act on the Use and Dissemination of Genetically Modified Organisms
1999	Classified Installations Act
1999	Territorial Development Act
1999	Act Instituting an Environmental Protection Fund
2002	Biocide Products Act
2004	Conservation of Nature and Natural Resources Act
2004	Water Management Administration Act
2004	Act Instituting an Assistance Programme for Protection of the Environment, Rational Use of Energy, and Production of Energy from Renewable Sources
2004	Act on Co-ordination of the National Policy for Sustainable Development
2004	Act Establishing a Greenhouse Gas Emissions Quota Trading System and Creating a Fund to Finance the Kyoto Mechanisms
2004	Municipal Planning and Urban Development Act
2005	Act Governing Partnership between the Municipal Syndicates and the Government and Restructuring the Scientific Approach to the Conservation of Nature and Natural Resources
2005	Act on Public Access to Environmental Information
2005	Act on the Classification, Packaging and Labelling of Hazardous Preparations
2006	Act Promoting the Maintenance of Employment and Defining Special Social Security and Environmental Policy Measures
2006	Kyoto Protocol Project Mechanisms Act
2007	Act on Assessing the Impact of Road, Rail and Airport Infrastructure Projects on the Natural and Human Environment
2007	Act Amending and Supplementing the Amended Act of 10 June 1999 on Classified Installations
2008	Mining Waste Management Act
2008	Act Governing Batteries and Battery Wastes
2008	Act on Evaluating the Environmental Impact of Certain Plans and Programmes
2008	Water Act
2009	Act on Environmental Liability with Regard to the Prevention and Remedying of Environmental Damage
2009	Act Creating a National Pollutant Release and Transfer Register

a) Repealed by a more recent act.
Source: Central Legislation Office of the Luxembourg government.

establishments. It defines the conditions for obtaining greenhouse gas emissions permit as well as the emissions surveillance measures to be observed by the establishments concerned. It also creates the fund for financing the Kyoto Mechanisms which, following adoption of the 2006 *Act Promoting the Maintenance of Employment and Defining Special Social Security and Environmental Policy Measures* is also fed by a portion of the road vehicle tax and an excise surcharge on fuels. The 2004 *Act Instituting an Assistance Programme for Protection of the Environment, Rational Use of Energy, and Production of Energy from Renewable Sources* adapts the national business assistance system to the community framework. The 2005 *Act on Public Access to Environmental Information* guarantees the right of access to environmental information in the hands of the public authorities and governs the dissemination of such information.

Certain aspects of European Community law have been transposed only with some delay. The *Water Act* of 2008 consolidates and updates legislation governing water management and transposes into domestic law the Water Framework Directive (2000/60/EC) and the Flood Risk Management Directive (2007/60/EC). It seeks in particular to restore waters to good condition by 2015 and to apply the cost recovery principle to services related to water use by 2010. The 2008 *Act on Evaluating the Environmental Impact of Certain Plans and Programmes* institutes a system of environmental assessments at the planning stage and transposes European Directive 2001/42/EC, which was supposed to be reflected in member states' legislation before July 2004. It supplements other legal provisions in this area such as the 2003 Grand Ducal Regulation on assessing the environmental impact of certain public and private projects, the 2007 *Act on Assessing the Impact of Road, Rail and Airport Infrastructure Projects on the Natural and Human Environment* and the Grand Ducal Regulation of 2007 determining the contents, conditions and methods of conducting the impact study required for the consolidation of rural properties. The 2009 *Act on Environmental Liability with Regard to the Prevention and Remedying of Environmental Damage* establishes an environmental liability framework based on the polluter pays principle in order to prevent and repair environmental damage, and transposes European Directive 2004/35/EC into domestic law.

5.4 Regulatory instruments

Permits and environmental impact assessments

The *Classified Installations Act* of 1999 is intended to integrate pollution prevention and control (IPPC) and transposes the related European directive. It requires a permit for any activity that would present a danger or a nuisance affecting the safety, health or convenience of workers or the public, or for the human and

natural environment. The permits spell out the installation and operating conditions deemed necessary for the protection of humans and of the built and natural environment, taking into account the best available techniques. A public hearing must be held before a permit is granted for certain kinds of installations.[9]

Classified installations are divided into four classes, using a terminology defined by the amended Grand Ducal Regulation of 16 July 1999. *Permit-granting powers* are distributed, depending on the classification, between the Minister of Labour and Employment (workplace safety and hygiene, health, ergonomics), the Minister of the Environment (protection of air, water, soils, fauna and flora, combating noise, and waste management) or the local mayor (Table 5.7). In 2008, there were 32 IPPC installations in Luxembourg (21 of them related to the steel industry), for which 42 permits had been issued.

Table 5.7 **Permit applications for classified installations,** 2000-08

(number of cases)[a]

Class	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average/ year
1	548	573	625	647	575	621	601	812	567	619
3	523	187	274	288	378	393	467	484	294	365
3B	16	39	29	30	31	28	32	12	37	28
Total	1 087	799	928	965	984	1 042	1 100	1 308	898	1 012

a) Applications handled by the Environment Administration leading to a ministerial order to grant or refuse a permit. On average, 64 applications are handled annually by Environment Administration officials. Class 4 applications, which are declarations, are not included in the table.

Source: Annual Report of the Ministry of the Environment, 2008.

Environmental impact assessment (EIA) identifies, describes and evaluates the direct and indirect effects of a project on humans, fauna and flora, the soil, water, air, climate, landscape, properties, cultural heritage, and interaction among these factors. It is part of the permit application procedure and is required for installations listed in the amended Grand Ducal Regulation of 7 March 2003 concerning assessment of the impact of certain public and private projects on the environment. The assessment procedure involves three stages: *i)* determination of a project's need for an EIA;

ii) identification of the points that the impact statement must address; and *iii)* verification of the statement's conformity with information requirements. Before issuing its decision to grant or refuse a permit, the Environment Administration consults other potentially interested authorities (local administrations, conservation authorities, the Water Management Administration). If necessary, the competent authorities of neighbouring countries are involved. The assessment is made public as part of the public hearing process called for in the Classified Installations Act. In 2008, twelve assessments were conducted by the Environment Administration (covering industrial zones, inert waste management facilities, an incineration plant and a waste water treatment plant).

A *strategic environmental assessment* is required for plans and programmes (in agriculture, forestry, fishing, energy, industry, transport, waste management, water management, telecommunications, tourism, urban and rural development or land use planning) that define the implementation framework of the projects covered by the environmental impact assessment regulations, or that may have an impact on sites (amended Conservation of Nature and Natural Resources Act of 2004).

"Seveso" installations

In Luxembourg, there are 23 installations (14 lower-tier and 9 upper-tier) that are subject to the European Seveso Directive, which was transposed into domestic law by the amended Grand Ducal Regulation of 17 July 2000 regarding the *control of major-accident hazards involving dangerous substances*. Depending on the quantity of dangerous substances stored at the installation site, the operators must provide the competent authorities (Minister of the Environment and Minister of Labour and Employment) with a notification and a statement of their major accidents prevention policy (for lower-tier installations), or a notification, a safety report, and an internal emergency plan (for upper-tier installations). This internal plan will be used as the basis for the authorities to draw up an external emergency plan.

In 2008, 12 of the 14 lower-tier installations had submitted the required documents but external emergency plans for seven of the nine upper-tier installations had yet to be prepared, mainly because the operators had not respected the deadlines. This failure leaves *local residents unprotected* and deprives them of the necessary information on safety measures to be taken in case of a major accident. The European Court of Justice condemned Luxembourg on these grounds in 2009.

The *High Commission for National Protection*, which is responsible for crisis management and is chaired by the Prime Minister, is examining the concept of "*critical infrastructure protection*", which would be built into external emergency plans and activated in case of major incident or accident.

Environmental inspections

The inspection authorities are the Environment and Water Management Administrations. The Customs and Excise Administration is also involved, particularly for transboundary movements of waste. In 2005, a *Control and Inspection Unit* was established within the division responsible for classified installations. The sole officer in charge is responsible, along with other units of the division, for: *i)* recording and tracking recently issued permits; *ii)* responding to requests from the local prosecution offices; *iii)* carrying out an inspection programme as recommended by EU bodies; and *iv)* handling nuisance and pollution complaints from individuals.

Inspections are conducted within the framework of *inspection programmes*, or in response to a complaint from an individual or another administration. These programmes are not always followed. In principle, the inspection of an installation begins with a documentary review (by the Environment Administration), and is followed with an on-site visit by a licensed agency or by the Environment Administration. A six-member mobile unit of the Water and Forests Administration conducts field inspections relating to nature conservation, forest management and hunting.

The economic stimulus measures announced in March 2009 include steps to *simplify administrative aspects* of the Classified Installations Act: these *i)* limit the requirements for obtaining a permit and conducting compliance inspections after they are issued; and *ii)* reduce the number of class 1 installations (which are subject to an EIA and a public hearing) and increase the number in class 4 (subject to a simple declaration). These measures are intended to shorten the time needed to obtain a permit. It will be important to ensure that the IPPC principle is respected.

5.5 Economic instruments

The polluter pays principle

Waste water treatment investments are eligible for significant subsidies, but these are virtually non-existent for drinking water. Water rates are set by the communes and they vary between EUR 2.5 and 2.9 per m^3 (drinking water and waste water). Estimates suggest that the cost recovery rate is around 50% for waste water and 80% for drinking water. The *principle of cost recovery* for services (enshrined in the Water Act of 2008) will entail an average nationwide water cost of around EUR 4.5/m^3 (2.2 EUR/m^3 for drinking water and 2.3 EUR/m^3 for waste water). The price of water billed to the consumer would thus be multiplied by a factor of 2.5 to 9, depending on the commune in question (Chapter 2).

Although it has made some progress, Luxembourg is some way from applying the polluter pays principle fully in the area of *municipal waste*. The use of economic instruments for achieving the reduction-at-source and recovery objectives is limited essentially to specific flows (packaging waste, WEEE, scrapped vehicles). Municipal taxes for household and similar waste management fulfil their incentive role only partially. The harmonised and differentiated taxation model has not yet been extended nationwide because of municipal autonomy in this area. Only a third of residents are paying waste management charges proportionate to the actual volume of waste generated and the cost of facilities. Most communes continue to set their taxes without regard to real costs, and the level of taxes still varies between communes (Chapter 3).

Financial assistance

Since 2001, grand ducal decrees have instituted a system of *assistance to households* to encourage more rational use of energy and increased resort to renewable energy sources. At the beginning of 2008, EUR 133 million had been allocated under this system (primarily for photovoltaic installations and condensing boilers). Through the Environment Protection Fund, the government also provides *financial assistance to communes, intercommunal syndicates, and public establishments* for installing photovoltaic cells, chip-fired heating, heating networks based on cogeneration plants, and low-energy buildings.

Assistance for businesses is handled largely by the Ministry for Economic Affairs and Foreign Trade on the bases of Community rules. For example, the Law of 22 February 2004 instituted a system of business subsidies for protecting the environment, making rational use of energy, and producing energy from renewable sources. The maximum assistance amounts to 30% for environmental protection investments and 40% for investments in rational energy use and electricity generation from renewable sources. Small- and medium-sized enterprises (SMEs, with fewer than 250 employees) are eligible for a 10% bonus. In 2007, investment subsidies under this law totalled EUR 13 million.

5.6 Voluntary instruments

A *voluntary agreement* was concluded in 1996 between FEDIL and the government to improve the energy efficiency of industry by 20% over the period 1990-2020. This agreement was renewed in April 2002. In 2007, it covered 80 firms, accounting for 90% of total energy consumption in Luxembourg's manufacturing industry. The target has in fact been exceeded, and energy efficiency has improved by 28% *vis-à-vis* 1990.

When it comes to *waste*, the Ministry of the Environment has concluded voluntary agreements with the producers and sellers of packaged goods and licensed agencies. Since 2004 several agreements have been concluded with Valorlux for large-scale use of reusable shopping bags in the retail sector. The target (a use rate of 38% in 2006) has been surpassed, and a new agreement calls for maintaining the rate achieved in 2007 (51%) and extending the project to other sectors.

In the tourism sector, an *eco-labelling system* has been introduced for hotels, campsites, self-catering cottages, etc., with 21 participating establishments. Electricity consumers in Luxembourg now have the choice of opting for *Nova Naturstroum* (electricity produced from renewable energy sources) at a price slightly higher than "normal" electric power. An online buyer's guide for ecologically-friendly products has been created by the Environment Ministry and the Mouvement Écologique.

In 2006, one Luxembourg firm in three (primarily in manufacturing) had assessed its environmental impact and had been *certified* for the *SuperDrecksKëscht*® waste management label or for compliance with ISO 14001 or EMAS (environmental management) standards. The two forestry certification schemes (FSC and PEFC) are now being applied in Luxembourg, as a way of certifying timber origin and sustainable forest management: around 20% of the country's forest land (most of it publicly owned) is now certified.

A number of seminars and conferences have been organised by business associations, the CRTE and the Office for Increasing Productivity for raising *awareness about environmental protection*. The "Environment Prize" awarded by FEDIL recognises the most innovative initiatives. To help businesses keep abreast of resource conservation and environmental protection technologies, *support structures* have been made available, for example to assist SMEs in applying the Classified Installations Act.[10]

5.7 Territorial planning

The government adopted a *Master Programme for Territorial Planning* in 2003. As the principle tool for territorial planning at the national level, this programme provides guidance for initiatives and decisions of the central government and local authorities with respect to sustainable development of their territory. It makes provision for sectoral master plans, land-use plans, and greater inter-ministerial co-ordination through the *Integrated Transport and Territorial Development Concept*. Published in 2004, the IVL is a strategic tool for co-ordinating national, regional and municipal plans. It gives concrete shape to the objectives of the Master Programme by setting a scenario for territorial development and transport organisation to the

year 2020. It incorporates economic and demographic trends into a territorial organisation model for making more rational use of land, reducing motorised travel (with a modal distribution of 25% for public transport) and medium- and long-term protection of landscapes. It allows for the design and integration of sectoral master plans.

The *sectoral master plans* (defined by the 1999 Territorial Development Act) are mandatory instruments (with the status of grand ducal regulations) for integrating sectors that have a territorial impact into the national territorial development policy. They are initiated at the request of the Territorial Planning Minister or the sector minister concerned, and are prepared by an inter-ministerial working group following a specific consultation and approval procedure. Four primary sectoral plans (with a direct impact on land-use) are now in the process of adoption: *i)* the Transport Sector Plan; *ii)* the Landscape Sector Plan; *iii)* the Housing Sector Plan; and *iv)* the Economic Activities Zones Plan. Drafts of the transport and landscape plans have been submitted to Cabinet on two occasions (July and October 2008). Drafts for the economic activity zones and housing plans were submitted to the Chamber of Deputies and to the public in March and May 2009, respectively.

The *secondary sectoral master plans* (those with a less direct impact) relate to specific installations, which have to be organised and regulated in light of the objectives in the Master Programme. Plans were adopted in 2005 and 2006 relating to high schools, inert waste disposal, and ground stations for public mobile communication networks. A Seveso Installations Plan is now in the works.

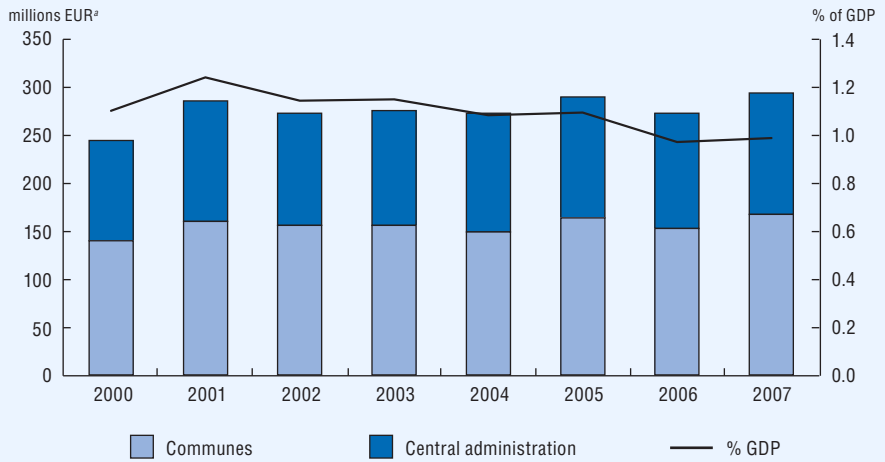
The communes are consulted during preparation of the sectoral plans, which, in practice, could reduce municipal autonomy (in preparing their general development plan). The sectoral plans were prepared at a time of strong economic growth. With the current economic crisis, *pressures on land-use* are likely to intensify (as a result of public infrastructure projects and demands for lots to promote the development of economic activities), to the detriment of the environment.

5.8 Expenditure on environmental protection

Public expenditure on environmental protection (including investment and current expenditure on pollution abatement and control and nature protection) are estimated at around EUR 360 million for 2007, or 1% of GDP (Figure 5.3). A significant portion consists of expenditure on waste water and household waste management, for which responsibility falls to the local authorities. There is no information available on private expenditure (by businesses or households).

Beyond the regular budget, some environmental outlays are financed through special *funds of the central government*. Some of these funds come under the

Figure 5.3 **Public expenditure on the environment,** 2000-07



a) At constant 2000 prices.
Source: Eurostat.

Ministry of the Environment (Environmental Protection Fund, Kyoto Mechanisms Fund, Game Fund and Special Hunting Fund). Others fall under the Ministry of the Interior and Territorial Planning, through the Water Management Administration (Water Management Fund, Special Fishing Fund, Special Transboundary Waters Fund).

In 2008, 68% of outlays from the *Environmental Protection Fund* went to waste prevention and management, 25% to combating air pollution, noise and climate change and promoting rational energy use and new and renewable energies, and 8% to the conservation of nature and natural resources. Total spending by the Fund amounted to EUR 13 million in 2008. The Fund's resources come exclusively from the regular budget, topped up in some years by supplementary appropriations. Spending by the *Water Management Fund* for water conservation and treatment amounted to EUR 65 million in 2008. In addition to budgetary allocations, this Fund will begin in 2010 to receive the proceeds of water abstraction and pollution taxes and charges (Water Conservation and Management Act, 2008). The Kyoto Fund (EUR 6 million in 2008) is financed primarily by an excise duty on road fuels (the "Kyoto cent") and by a portion of the annual road tax.

Notes

1. Only Ireland and Korea had higher growth rates over the period 1990-2007.
2. The mandate of the Council is: *i)* to serve as a discussion forum on all sustainable development problems; *ii)* to propose research and studies on all subjects related to sustainable development; *iii)* to establish relations with similar committees in member countries of the European Union; *iv)* to encourage the broadest possible participation by public and private organisations as well as individual citizens; and *v)* to express its opinion on any measure concerning sustainable development taken or planned by the government, and in particular the National Plan for Sustainable Development and fulfilment of Luxembourg's international commitments.
3. Opinion on fiscal aggregates for the period subsequent to 2009 from the viewpoint of sustainable development criteria, opinion on opportunities and challenges relating to the growing use of biomass.
4. For example, for a vehicle emitting 145 g of CO_2/km the tax is: diesel engine, 145*0.9*1.1 = EUR 143; petrol engine, 145*0.6*1.1 = EUR 95. If the diesel engine has a particulate filter, the tax will be EUR 93.
5. Thus, Road Fund revenues increased from EUR 70 million to EUR 112 million between 2000 and 2008, and outlays from EUR 108 million to EUR 83 million. Rail Fund revenues increased from EUR 104 million to EUR 306 million between 2004 and 2008, while outlays rose from EUR 120 million to EUR 275 million.
6. Since the June 2009 elections, the new Ministry of Sustainable Development and Infrastructures has been assigned responsibilities for transport, territorial planning and public works, in addition to its responsibilities related to the environment.
7. Renamed the Nature and Forests Administration by the Law of 5 June 2009.
8. Since the June 2009 elections, this ministry has kept its responsibilities concerning communal affairs and water management.
9. This act was amended and supplemented in 2007 to allow NGOs to take legal action. The definition of “best available techniques” has been expanded to “best available environmental techniques” (following the European Directive on IPPC) and to “best available techniques for the protection of humans”.
10. The Environment Administration, in co-operation with the business chambers, has prepared standard application forms adapted to the nature and scale of classified installations to help operators complete the formalities of applying for permits.

Selected Sources

The government documents, OECD documents and other documents used as sources for this chapter included the following. Also see list of websites at the end of this report.

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6

SOCIAL-ENVIRONMENTAL INTERFACE*

Features

- Health and the environment
- Environmental information
- Environmental awareness and education
- Local initiatives

* This chapter assesses progress over the last 10 years and in particular since the Environmental Performance Review published by the OECD in 2000. It also examines performance against the targets in the 2001 OECD Environmental Strategy.

Recommendations

The following recommendations are part of the overall conclusions and recommendations of the environmental performance review of Luxembourg:

- design and implement a national plan for better *integration of environmental and health policies*;
- improve the production and dissemination of *environmental information* for timely compliance with national obligations and international commitments; seek synergies among the different players;
- analyse the *interactions of environmental policy with the economy* (for example, expenditure data); develop environmental accounting and material flow accounts;
- pursue local initiatives for implementing the *Action 21* Programme;
- develop environmental *education*, particularly in secondary and higher education, as part of the new National Plan for Sustainable Development.

Conclusions

During the period under review, a number of *health indicators* have improved: life expectancy is up, while the child mortality rate is down by half and is now half the OECD average; the dioxin content of maternal milk is lower. Health risk factors, and environmental ones in particular, are regularly checked and the results are often published. Luxembourg has adopted electromagnetic field exposure limits that are stricter than those in the European recommendation. With regard to *environmental democracy*, Luxembourg ratified the Aarhus Convention in 2005, and its Protocol on Pollutant Release and Transfer Registers in 2006. The recent trend in legislation and case law has facilitated *access to justice* for environmental protection associations. A public mediator has been appointed. The state provides financial assistance to NGOs dedicated to environmental protection and to local and regional initiatives for implementing the *Action 21* Programme, and they have multiplied with this support. New legislative provisions have strengthened the *role of the communes*, inter-communal co-operation, and *partnership with the central government* in nature conservation. The Ministry of the Environment conducts regular environmental awareness campaigns. The University of Luxembourg has a programme for research on environmental technologies and is helping prepare a national strategy for *sustainable development education*.

Although Luxembourg has a high standard of living, some of its health indicators are worrying: for example, the death rate from respiratory diseases is higher than the OECD average. Children are more exposed to *health hazards relating to air pollution*, noise and road accidents than in other EU countries. A "noise map" has been prepared, but no measures have been taken to *combat noise*. There has been little strategic thinking about the links between health and environmental conditions. Greater attention should be paid to the potential economic benefits that would flow from better environmental conditions and a healthier lifestyle. With respect to *environmental information*, there has been little progress in collecting and publishing environmental data, and the country is falling behind in its national and international reporting obligations; people are not always informed about public consultations; inadequate use of environmental indicators hampers environmental governance and planning; the *links between the economy and the environment* have not been studied; there is no regular collection of data on public and private spending on environmental protection nor material flows analysis, part of the OECD Council Recommendation on Resource Productivity.

♦ ♦ ♦

Luxembourg is a rich, densely populated country with relatively low unemployment and income inequality (Box 6.1, Figure 6.1). The first National Plan for Sustainable Development (1999) promoted *socio-economic equality and social protection* through six broad objectives: *i)* strengthening of the social safety net (poverty threshold < 1%, improved delivery of services at the local level); *ii)* equal employment opportunities (unemployment target 1% for 2002, and full employment by 2005); *iii)* access to housing; *iv)* gender equality; *v)* intergenerational equity, with an improved pension system; and *vi)* improvements in health, healthcare and prevention.

1. Environment and Health

1.1 Policy objectives and institutions

The overarching goal of Luxembourg's health policy is to ensure a good-quality healthcare system, increasingly focused on prevention activities. All residents and cross-border workers have access to health services, regardless of income (OECD, 2008). *Health spending* has increased faster than GDP over the last 10 years.

Box 6.1 **The social context**

The country is very *densely populated* (184 inhabitants/km^2) in comparison to the OECD Europe average (107 residents/ km^2), with substantial variations between North and South (Figure 6.1). The population is largely concentrated in the capital city, Luxembourg (85 000 inhabitants), and its immediate vicinity (136 600 inhabitants), and in the industrial communes of the South.

Since 2000, Luxembourg's *resident population* has grown at an annual average of 1.3%, and stood at 483 800 people in 2008, 57% of whom were Luxembourg nationals and 43% foreigners. Net immigration accounts for around 80% of population growth. Every day, more than 130 000 non-residents come from France, Belgium and Germany to work in Luxembourg. With three official languages, the country is indeed multilingual. 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.

Luxembourg is a *rich country* in terms of GDP per capita produced by resident and cross-border workers. Income disparities (the Gini index) are relatively low in comparison to the OECD average (0.27 *versus* 0.30) and have changed little since 2000. The relative poverty rate (percentage of individuals with disposable income per unit of consumption below 50% of the median income for the entire population) is lower than that for the OECD (8.1 *versus* 10.6) but has been rising since the mid-1990s (OECD, 2009).

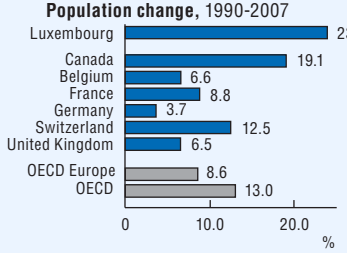
Unemployment has crept up steadily since 2000 and was 4.9% in 2008, still well below the OECD Europe average of 7.9%. With the economic crisis, it is expected to reach 7% in 2010. The proportion of cross-border workers in domestic employment rose to 41% in 2007, of which 51% were French, 26% Belgian and 23% German. Services account for more than 75% of jobs, and financial services alone for 29%.

In relation to GDP, total health-care spending (7.3%) was below the OECD average in 2006 (8.9%) but spending per capita (both in terms of resident and cross-border population) in PPP terms was among the highest in the OECD. Spending on education represented 3.7% of GDP. The proportion of the population with upper secondary or higher education (66% of persons between 25 and 64 years of age) is below the OECD average (68%).

The *Ministry of Health* is responsible for implementing the national health policy and ensuring the integration of health considerations in all government policies. The *Health Directorate* includes several services covering public health and the environment (Ministry of Health, 2008): *i)* the Health Inspection Division enforces regulations for the protection of public health (*e.g.* drinking water quality, environmental hygiene and food inspection); *ii)* the Environmental Medicine Service

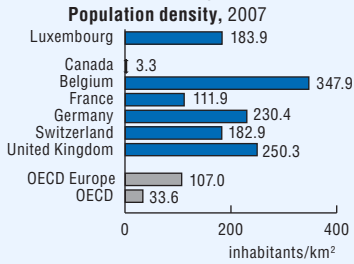
Figure 6.1 **Social indicators**

Population and ageing



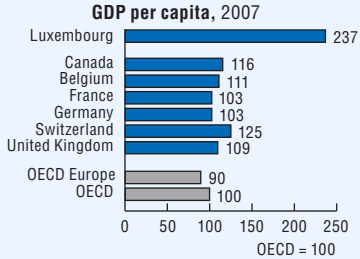
Population change		2000	2007
natural increase	‰	4.3	3.3
net migration	‰	8.2	12.5
		2000	2008
Foreign-born population	%	37.3	42.6
Ageing		2000	2007
over 64/under 15	ratios	0.74	0.77

Settlement and mobility



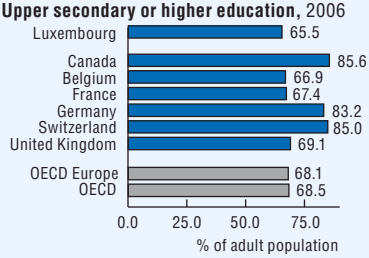
Mobility		2000	2008
car ownership	veh./100 inh.	60	66
rail traffic	billion pass.-km	0.3	0.3

Income and employment



Labour force participation[a] (% pop. 15-64)		2000	2007
total rate	%	92.0	106.6
female rate	%	69.4	96.2
Unemployment (standardised rate)		2000	2008
total rate	%	2.2	4.9
female rate	%	2.9	6.0

Health and education



Educational attainment			2000	2006
upper secondary		%	..	65.5
Life expectancy				
at birth:	total	years	78.0	79.4
	female	years	81.3	81.9
at age 65:	male	years	15.5	17.0
	female	years	20.1	20.3

a) Domestic employment compared to national population. This explains why the participation rate may be higher than 100.
Source: OECD Environment Directorate.

is responsible for detecting physical, chemical or mycological sources in buildings that could be detrimental to health; *iii)* the Food Chain Quality and Safety Agency and *iv)* the Occupational Health Division, which covers all aspects of health risk in the workplace. These services undertake regular inspections and tests to monitor health risks. The National Health Laboratory carries out laboratory analyses of foodstuffs and chemical substances in dwellings and workplaces.

In 2004, the government announced its intention to tie environmental protection more closely into its preventive approach to public health. However, *environment-related health issues are not explicitly spelled out in Luxembourg's health policy*. There are no institutional mechanisms to ensure co-ordination between the Ministry of the Environment and the Ministry of Health. Luxembourg has not prepared a National Environment and Health Action Plan (NEHAP), or a specific Children's Environment and Health Action Plan (CEHAP), and thus has no comprehensive framework to address the environment and health interface.[1] In the period 2006-09, four National Health Conferences were held to underpin the preparation of a National Health Programme, but limited consideration was given to the inter-linkages between health, well-being and environmental conditions. Greater attention should be given to the potential economic benefits accruing from improved environmental conditions and a healthier lifestyle.

1.2 Health status and trends

Like most OECD countries, Luxembourg enjoyed further gains in *life expectancy* and reductions in *infant mortality* over the review period. Life expectancy at birth was 79.4 years in 2006, higher than the OECD average (78.9). The infant mortality rate fell from 5.1 deaths per 1 000 live births in 2001 to 2.6 in 2006, below the OECD average (5.2). Health status is perceived as good by 74% of the population. However, several indicators are of concern. The number of fatalities due to *road accidents* (9.9 deaths per 100 000 population) is higher than the OECD average (8.9), and is partly related to the density of automobile traffic. Cardiovascular disease and cancer are the primary causes of death in Luxembourg, and the mortality rate from respiratory diseases is above the OECD average. This is linked to a less-than-satisfactory performance of the health-care system (OECD, 2008), as well as to lifestyle and environmental factors.

Concerning lifestyle, *consumption of alcohol* is the highest in the OECD (15.5 litres per capita), although part of it may be related to cross-border trade induced by lower excise taxes. The incidences of overweight (53.3%) and *obesity* (18.6%) have increased and are among the highest in OECD Europe. This prompted the Ministry of Health to launch the National Programme for the Promotion of

Healthy Diets and Physical Activity in 2006. On the positive side, the population of Luxembourg enjoys relatively easy access to urban green spaces, and the wider countryside and forests are reasonably accessible for hiking and other healthful activities. The proportion of *daily smokers* among adults further decreased (21%) and is slightly lower than the OECD average (24%).

1.3 Environment-related health risk factors

Luxembourg has a relatively high *DALYs due to environmental factors* compared to other OECD Europe and EU15 countries (18 DALYs/1 000 inhabitants);[2] 15% of total morbidity is attributed to environmental factors and could be prevented through a healthier environment (WHO, 2007).

During the review period, *ambient air quality* generally improved. Nonetheless, heavy traffic is the major cause of repeated exceedances of standards for NO_x and tropospheric ozone in the capital city of Luxembourg (Chapter 2). Around 3.5% of the national population under 15 years lives in proximity to a major road, the highest proportion (together with Belgium) in the EU15. These children are at high risk from air pollution, noise and traffic accidents (Dalbokova *et al.*, 2007). Data on ambient air concentrations of all major pollutants (including particulate matter and ozone) are collected on a daily basis through the Air Monitoring Network, and an interactive air quality map is accessible to the general public at the website of the Ministry of the Environment. Concentrations of heavy metals and persistent organic pollutants are tracked regularly through a bio-monitoring network and, with the notable exception of lead, are generally below the limit values for the protection of health (Chapters 2 and 7). In 2006-07 Luxembourg participated for the second time in the WHO survey on persistent organic pollutants in maternal milk (WHO, 2009). The results showed a decline in the dioxin content of maternal milk since 2002. Some estimates indicate that health damage costs associated with air pollution vary between EUR 310 and 580 million/year (*i.e.* between 1.2% and 2.3% of Luxembourg's average annual GDP); in per capita terms, health damage costs range between EUR 712 and 1 327 per year, among the highest in Europe (AEA Technology Environment, 2005).[3]

Concerning *water quality and sanitation*, virtually all residents are connected to a waste water treatment plant. Nonetheless, a significant portion of surface water is of relatively poor biological quality (Chapter 2). While drinking water is of generally good quality, some 20 of the 300 spring tapping show bacterial contamination from time to time. Municipalities regularly monitor drinking water quality and provide this information to the public; complementary controls of all water sources destined for human consumption are carried out by the Water Management Administration.

Relatively high levels of pesticides and nitrates have been found in groundwater, and this also raises concerns about polluting substances penetrating the food chain: some 20% of fruits and vegetable analysed in 2007 were not compliant with the legal limits for nitrates, compared to barely 5% in 2000.

Concerning *indoor pollution*, the Health Directorate regularly monitors the level of radon in residential and school buildings located near natural sources of radon precursors (in the North of the country). According to Luxembourg law, the annual average radon gas concentration in dwellings should not exceed 150 becquerel (Bq)/m^3, a stricter limit than that recommended by the EU.[4] Private dwellings are also checked for dampness and chemicals. A new "passive smoking" law was introduced in 2006, forbidding the advertising of tobacco products and banning smoking in public places.

In 2006 Luxembourg transposed the EU directive on *Environmental Noise* (2002/49/EC); the national law sets noise limit values[5] above WHO recommendations.[6] As required by the Directive, noise maps were developed for the areas surrounding the Luxembourg airport, major roads and major railways. The related noise action plans are being prepared and draft plans were presented in early 2009.

Luxembourg has implemented the 1999 EU Recommendation on the Limitation of Public Exposure to *Electromagnetic Fields* (*e.g.* from mobile telecommunications and domestic appliances). The exposure limits are generally in line with those of the Recommendation but are stricter for electric fields; minimum distances apply between high voltage power lines and residential areas. Luxembourg performs spot measurements to assess exposure to electromagnetic fields (Commission of the European Communities, 2008). According to polls, a majority of Luxembourg's population is "very concerned" about the health risks of electromagnetic fields, but is also "not satisfied" with the information provided and the actions taken by the authorities to protect people from these health risks (TNS Opinion and Social, 2007). The European Parliament has asked the European Commission to review the electromagnetic field exposure thresholds (2009).

2. Environmental Democracy

In 2005, Luxembourg ratified the Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters (Aarhus, 1998). It was the first state to ratify the Protocol on Pollutant Release and Transfer Registers (Kiev, 2003).

2.1 Access to environmental information

The 2005 *Act on Public Access to Environmental Information* guarantees the right of access to environmental information held by public authorities and provides for the dissemination of such information. It translates into domestic law the first aspect of the Aarhus Convention and the related European Directive (2003/4/EC), and repeals the previous Act of 1992.

Any environmental information held by the public authorities or for their account must be disclosed upon request, and the applicant does not have to provide any specific justification. Disclosure must be made within one month after receipt of the request, or two months if the information is especially complex. The 2005 Act provides some exceptions (requests deemed frivolous or too general; damage to international relations, public security, privacy or confidentiality, etc.). Applicants must be notified of the grounds for refusal.

In 2008, 94 requests for information were submitted to the Classified Installations Division of the Environment Administration. The main obstacles reported by the Ministry arise in complying with the deadlines for providing environmental information (CEENU, 2008). However, NGOs have cited cases where they had to turn to the administrative tribunal to obtain certain information (*e.g.* the list of "Seveso" installations, quantities and origin of electricity imports for the steel mills).

2.2 Production and dissemination of environmental information

Luxembourg does *not publish any regular report on the state of the environment*. One report was published in 1993 and there were two publications containing environmental indicators in 1998 and 2003 (with an update planned for 2009). The 2004 Act concerning co-ordination of the national policy for sustainable development calls for a biennial evaluation containing social, economic and ecological indicators. An initial set of indicators produced in 2002 was updated in the 2006 report (Government of Luxembourg, 2006).

The annual report of the Environment Ministry contains data from the Environment and the Water and Forest Administrations. *Partial data* are published at its website and that of STATEC. Information on certain key areas is produced only occasionally or not at all: there are no annual inventories of national emissions, except for a recent inventory of greenhouse gases; there is no information on the national trend in freshwater abstractions; and the last study on environmental protection expenditure dates from 1997. Material flow accounts and environmental accounting have to be developed. A single officer in the Environment Ministry is responsible for producing and disseminating environmental data. Consideration

should be given to reinforcing co-operation with STATEC on environmental accounting and material flow analysis. The Water Management Administration also suffers from a shortage of resources: there is no national consolidation of available municipal data.

On the other hand, legislation in general, and environmental legislation in particular, is readily accessible at the *government's Internet portal*. The preamble to bills, reports of parliamentary committees, and the minutes of parliamentary debates are publicly accessible and help keep the public informed.

2.3 Access to justice in environmental matters

There is no specific arrangement, beyond the generally applicable procedure, for challenging decisions by public authorities on the environment (Milieu Ltd., 2007). The Classified Installations Act was amended in 2007 to allow legal challenges by *environmental protection associations* of national importance (officially recognised by the Minister of the Environment). In criminal matters, these associations can exercise rights as civil parties for infractions of environmental laws. In administrative matters, they can apply to the administrative tribunal, and they can appeal its decisions to the administrative court. The criterion for admissibility of any action is to have a legal interest in bringing proceedings. Application of that criterion has been rendered less strict for associations – their interest is recognised as being sufficient – as the result of a recent case law regarding the Aarhus Convention (*Mouvement écologique vs*. Ministry of the Environment with regard to classified installations, 2008). The obstacles cited by NGOs in gaining access to justice have to do with the cost of proceedings and the need to be officially recognised by the Environment Ministry.

The *Ombudsman* was instituted in 2003 to promote friendly settlement of disputes between citizens and government authorities. The most common complaints have to do with financial assistance granted by the Environment Ministry, the procedure for approving general and specific development plans, development permits in "green belt" areas, and the establishment of farming operations.

2.4 Public participation

Industry representatives, trade unions and business associations are regularly *consulted* during preparatory work on legislation and grand-ducal decrees. The CES[7] issues an annual opinion on government policy, including its environmental policy: recent opinions have dealt with the simplification of administrative procedures relating to classified installations, nature conservation, and links between the economy and the environment.

Environmental NGOs are formally consulted on projects of environmental significance. They are also involved in environmental education and awareness activities, in buying and managing protected sites, and in generating data relating to nature conservation. An umbrella organisation, NATURA, covers around 40 associations. The main ones are the *Ligue pour la protection de la nature et des oiseaux* ("League for the Conservation of Nature and Birds", 13 000 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 NGOs activities was established in 2000.

While public participation is encouraged in principle, it appears to suffer from a lack of proactive information on the part of government, and enthusiasm for getting involved is relatively weak. A recent poll found that only 19% of the population was aware of the public consultation process on management plans under the Water Framework Directive. Half of the people interviewed expressed an intention to participate (European Commission, 2009). NGOs admit to difficulties in rallying Luxembourgers to commit themselves to environmental conservation projects and, more generally, to take part in *voluntary activities*. It would be useful to examine ways of developing a volunteer culture in Luxembourg.

3. Local Initiatives

The Environment Ministry covers up to 50% of the actual costs of local and regional efforts under the *Action 21* Programme. Between 2002 and 2008 it allocated EUR 1.2 million to sustainable development projects. Carried out by the communes and the municipal syndicates, these projects focus on energy savings and the use of renewable energy, nature conservation, and environmental awareness.

When it comes to *nature conservation*, the role of the communes has been strengthened since 2004: *i)* the state now pays up to 75% of capital costs for the purchase of nature conservation lands (with reform of the Environmental Protection Fund); *ii)* protected areas of municipal importance are being created (under the Conservation of Nature and Natural Resources Act); and *iii)* contracts are being signed between the state and the municipal syndicates to encourage inter-communal co-operation and promote strategic planning (under the Act on Partnership between the Municipal Syndicates and the Government). Thirty-five cities and communes, representing more than half the national population, have joined the "Climate Alliance", a Europe-wide association of municipalities and NGOs dedicated to reducing greenhouse gas emissions, and to promote solidarity with the Third World (Box 6.2).

Box 6.2 **Local initiatives for sustainable development: the Beckerich example**

The Commune of Beckerich (2 200 inhabitants) is located in the western part of the Grand Duchy of Luxembourg in the Canton of Redange, on the Belgian border. Since 1990, the local authorities have been pursuing a sustainable development policy that fosters local job creation and the development of renewable energies, and relies on active public involvement. In 1995, Beckerich joined the Climate Alliance, a Europe-wide association of municipalities and NGOs dedicated to *reducing CO_2 emissions by 50% between 1990 and 2010*, and to promote solidarity with the Third World.

The commune operates its own water source, and sells 100 million bottles from it every year. This activity has created 65 jobs. With its ownership of the resource and its 15% shareholding interest in the enterprise, the commune earns an annual income from the operation. A regional-scale shopping centre has sprung up next to the Belgian border. The municipality derives some *revenues* from petrol sales and other commercial taxes.

Beckerich is striving for *energy independence* by 2020. Today, 90% of its electricity and 40% of its heating comes from renewable sources. In 2008, the commune was awarded the *European Solar Prize* by the European Association for Renewable Energy for this performance. The commune has carried out many projects. Two biogas facilities are now supplying power to more than 700 households, and heating to 120 households (via a 24 km municipal heating pipe network). Around 100 residents also draw heat from a wood shavings boiler. The heating network and the boiler required an investment of EUR 9.5 million (of which 2.9 million was financed by the state). *Photovoltaic solar energy* provides 5% of household power consumption. The roofs of municipal buildings are available free of charge to groups of citizens who want to install solar panels; they can then use the revenues from the electricity generated in this way to reduce their power bills. A project is now underway to set up four wind turbines of 1.8 MW each. When they come on line, Beckerich will have reached its target of reducing CO_2 emissions by 50% by 2010. An association has been formed to raise public awareness about energy savings and to promote renewable energies. The commune subsidises the cost of home thermal insulation up to EUR 6 500.

With respect to social issues, the commune of Beckerich relies on active public participation in nearly a dozen advisory commissions. The municipal Council earmarks 0.7% of its annual revenues for development assistance.

Source: www.beckerich.lu.

In 2001, a "*river contract*" was signed with Belgian partners for sustainable and concerted management of the transboundary Attert River basin (75% in Luxembourg, 25% in Belgium). It aims to reduce the impact of flooding, to improve water quality, to promote forms of agriculture that are respectful of the aquatic environment, to restore the natural environment and heritage, and to educate people and raise their awareness about the environment. The *Maison de l'eau*, which manages this river contract, enlists volunteers to man such operations as cleaning up watercourses. People on the Luxembourg side have shown themselves less eager to participate than the Belgians.

4. Environmental Education and Awareness

An *opinion survey* showed that 32% of Luxembourgers consider the environment "extremely important", 46% "very important", 20% "important", and 2% "of little or no importance". The main topics of interest are climate change, waste reduction and air pollution. Respondents say they are ready to change their habits by saving energy and buying more environmentally-friendly products. A majority (72%) say they are willing to pay more for water, and a minority (43%) would do the same for petrol or for road use. When asked about what the government should do to make citizens behave more responsibly, the majority are in favour of stiffer penalties for environmental offences (85%) and better information (81%), while a minority want petrol to be more expensive (26%, while 60% are calling for a "green tax reform") (Ministry of the Environment, 2007).

The Ministry of the Environment conducts regular *awareness and information campaigns* on environmental issues (waste, climate change, energy savings, etc.). Mass mailings are used to send flyers to all households and businesses.

Raising public awareness is one of the objectives in the National Plan for *Nature Conservation*, and is explicitly mentioned in the respective Act. Environmental NGOs have long been active in this area, and their education efforts are now being augmented by the schools and other public and private organisations. There are currently more than 20 institutions involved in environmental education in various settings (school and extracurricular instruction, adult education, leisure activities and public information services). The communes, the Water and Forests Administration and local chambers of commerce have set up conservation centres, outreach institutions, self-guiding nature trails and information points (around 100 nationwide). At the national level, educational facilities of various kinds have been established (Natural History Museum in the capital city, the SNJ Hollenfels Environmental Education Centre, and the Burfelt Forestry Centre near the Haute-Sûre

Lake), but all of the facilities are not always adequately funded and equipped to operate effectively. The education effort varies greatly among different target groups, its impact (especially on the general public) is not well understood, and co-ordination among the players is often insufficient.

In 2008 the government established an inter-ministerial committee to prepare a *sustainable development education strategy*. The University of Luxembourg, which is supporting the consultation process, hosted a seminar in 2009 and launched a project to analyse the situation in the Luxembourg education system. Its results will provide input for the new National Plan for Sustainable Development. The University has been offering a Master's Degree in sustainable development (energy-environment studies) since 2003.

5. Employment and the Environment

The unemployment rate in Luxembourg, at 4.9% in 2008, is well below the rates of neighbouring countries and the OECD Europe average (7.9%). It has been creeping up steadily since 2000, however, and is likely to reach 7% in 2010. During the review period, domestic employment rose by 3% annually, thanks largely to the *employment of cross-border workers* whose numbers have been growing by more than 6% a year. The great majority of jobs are concentrated in services, especially financial services.

According to existing estimates, *pollution management* (covering air, waste water and waste) was directly responsible for about 1.3% of jobs in 2004 – up by more than 20% over 1999 – a performance comparable to that of neighbouring countries (Ernst and Young, 2006). "Eco-business" turnover was estimated at around 1.2% of GDP. Waste management accounted for 26% of that total, waste water treatment 28%, and water supply 20%. The Luxembourg Trades Chamber recently estimated the *market for renewable energy sources and energy efficiency* at some EUR 200 million a year (or 6% of the construction market), accounting for around 2 300 jobs (0.7% of domestic employment). Luxembourg's economic diversification effort could benefit from an analysis of the employment impact of its environmental policy.

Notes

1. European countries committed themselves to develop NEHAPs (Helsinki, 1994) and to develop by 2007 action plans to protect children's health against environmental hazards (Budapest, 2004).
2. The disability-adjusted life-year (DALY) is a summary measure that combines the impact of illness, disability and mortality on population health. The environmental factors considered are unsafe water, sanitation and hygiene, indoor air pollution from solid fuels and outdoor air pollution.
3. These estimates are based on the VOLY (Value of Life Year) approach, applied to changes in life expectancy due to air pollution from particulate matters and ozone.
4. Limits of 400 Bq/m^3 for existing buildings and 200 Bq/m^3 for new constructions.
5. A noise action plan should be developed if noise levels exceed 70 dB(A) in daytime (measured in Lden) and 60 dB(A) (measured in Lnight) during the night. Mitigation measures should be implemented if noise levels exceed 65 dB(A) in daytime and 55 dB(A) during the night.
6. WHO guidelines suggest serious annoyance at 55 dB(A) LAeq in daytime and evening and adverse health effects above 40 dB(A) (measured in Lnight) during the night.
7. A permanent advisory body to the government, comprising management and labour representatives and senior economic officials.

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7

INTERNATIONAL CO-OPERATION*

Features

- Development assistance
- Trade and the environment
- Climate change
- Regional co-operation

* This chapter assesses progress over the last 10 years and in particular since the Environmental Performance Review published by the OECD in 2000. It also examines performance against the targets in the 2001 OECD Environmental Strategy.

Recommendations

The following recommendations are part of the overall conclusions and recommendations of the environmental performance review of Luxembourg:

- continue to strengthen the environmental dimension of *official development assistance* (environmental projects, environmental impact assessments of other projects, climate change adaptation);
- speed up and reinforce implementation of the measures adopted for achieving the Kyoto target; prepare for *post-Kyoto* by integrating climate change objectives into energy, construction and transport policies (for example, energy efficiency, energy charges and taxes, transport charges and taxes);
- expand co-operation mechanisms through the international commissions on transboundary waters (for example, mutual evaluation of management plans and action programmes);
- fulfil obligations and reinforce co-operation regarding *air pollution* in Europe (European directives, Gothenburg and Aarhus protocols); promote and contribute to the implementation of a *regional plan for ground-level ozone;*
- implement the National Plan for the *Stockholm Convention*, including for substances recently added;
- promote international environmental co-operation and step up *environmental diplomacy* efforts in Europe and around the world.

Conclusions

Among OECD DAC members, Luxembourg is one of the most generous donors. In 2008 it devoted 0.92% of GNI to *official development assistance,* exceeding the United Nations target of 0.7% and approaching its own objective of 1%. Around 8% of total bilateral aid goes to environmental protection, water supply and sanitation. The government is committed to enlisting public support for efforts to adapt to climate change. *Regional co-operation* with neighbouring countries on nature and water conservation has been boosted within the context of the "Grande Région" and the International Commissions for the Protection of the Moselle and the Sarre. Despite some delays, Luxembourg transposed the main European environmental directives into its domestic legislation during the period under review. Luxembourg's presidency of the European Union, in the first half of 2005, helped win adoption of

the guideline to "Encourage the sustainable use of resources and strengthen the synergies between environmental protection and growth" of the Lisbon Strategy. In 2008 Luxembourg adopted a national plan for implementing the Stockholm Convention, detailing measures taken and progress achieved in reducing or eliminating *persistent organic pollutants* (POPs). Real progress has been made concerning trade in hazardous substances (hazardous waste, chemical products, POPs, ozone-depleting substances) and environmentally responsible business conduct (for example implementation of the OECD Guidelines for Multinational Enterprises).

In 2007, GHG emissions were at their 1990 level, and Luxembourg's action plan will not be enough to achieve the *ambitious target* (–28% below 1990 levels) set under the *Kyoto Protocol* and the EU Burden-sharing Agreement. CO_2 emissions per capita are the highest in the OECD (although a significant portion comes from international road transport). The sector shares of GHG emissions have changed radically since 1990: *i)* emissions from the steel industry have sharply declined with replacement of blast furnaces by electric arc furnaces; *ii) transport emissions* have risen with the growing number of cross-border travellers and higher export sales of diesel and gasoline, reflecting lower prices in Luxembourg *vis-à-vis* neighbouring countries. Luxembourg will need to rely heavily on *flexible mechanisms* (estimated at about EUR 360 million) to achieve its GHG targets. The country is unlikely to meet its NO_x *emission* reduction goals (52% below 1990 by 2010) set under the Gothenburg Protocol to the Convention on Long-range Transboundary Air Pollution. Compliance with international commitments is lagging, particularly with respect to the *EU environmental directives*. Luxembourg has been cited on several occasions for infractions of European environmental legislation (urban waste water, nitrates, integrated prevention and reduction of pollution). These lags could be overcome by devoting more resources to meeting international commitments and by giving greater economic and diplomatic priority to the environment.

♦ ♦ ♦

Luxembourg's economy is an integral part of the *regional, European and world economies*. More than 130 000 people cross the border to work in the country every day, and most of the scrap metal used in the steel industry comes from neighbouring countries. A founding member of the European Union, Luxembourg has a very open economy and one that is thoroughly integrated into the European economy, and especially with Germany, Belgium and France. The financial and steel sectors operate on a world scale. Luxembourg's *geographic location*, in the midst of highly populated and heavily industrialised regions, subjects the country to high levels of

transboundary pollution. On the political side, Luxembourg has also become a *European capital*, hosting several EU institutions.

Luxembourg has *successfully helped deepen co-operation* at the regional, European and global levels on environmental matters and on sustainable development (Box 7.1). It is one of the most generous countries when it comes to official development assistance. Naturally enough, Luxembourg also encourages joint action to reduce pollution, and follows the same line as its neighbours on environmental issues.

Box 7.1 **Follow-up to the World Summit on Sustainable Development (Johannesburg, 2002)**

At *the national level*, the 25 June 2004 Act on Co-ordination of the National Policy for Sustainable Development: *i)* provided a legal basis for the National Plan for Sustainable Development; *ii)* instituted national reporting on the implementation of sustainable development; *iii)* established a Superior Council for Sustainable Development; and *iv)* created an Interdepartmental Commission for Sustainable Development, comprising key ministries. In 2006, the implementation report for the first plan (from 1999) found that most of the stipulated measures were being addressed (already implemented or in preparation). It is noteworthy that the environmental pillar has been emphasised to the detriment of the economic and social pillars, suggesting that ministries other than the Environment Ministry were not sufficiently involved in drawing up the plan. A new National Plan for Sustainable Development for the period 2009-13 is now in preparation (Chapter 5).

At the *local authority level*, the Environment Ministry covers up to 50% of the actual costs of municipal and regional efforts to implement the Agenda 21 Programme; 35 of Luxembourg's communes are now members of the Climate Alliance, an association of municipalities and NGOs that seeks to reduce greenhouse gas emissions and support the Third World (Chapter 6).

It was under Luxembourg's presidency of the *European Union* that the Lisbon Strategy's Guidelines on Sustainable Development were adopted in 2005, laying the basis for the Renewed Sustainable Development Strategy adopted by the Council of the European Union in June 2006.

Within Europe, Luxembourg endeavours to *implement EU directives on time*, and the directives have substantially shaped its environmental legislation. Nevertheless, the country has recently been brought before the European Court of Justice on a number of environmental issues, where it has been condemned, for

example, regarding reparations for environmental damages, external emergency plans under the Seveso Directive, emission ceilings, nitrate pollution, best available techniques, monitoring of greenhouse gas emissions, access to justice, and urban waste water. Some of these judgments have sparked prompt responses to remedy the situation, while others are still awaiting action after more than 10 years. In many instances, implementation of European directives is going to require determination and money: this is the case, for example, with urban waste water, integrated pollution prevention and control, and habitats. These delays in transposition, and more importantly in implementation, can be blamed in part on a lack of means, but they also reflect the inadequate priority accorded to the environment in the Luxembourg economy.

1. Official Development Assistance (ODA)

1.1 Luxembourg sets the example

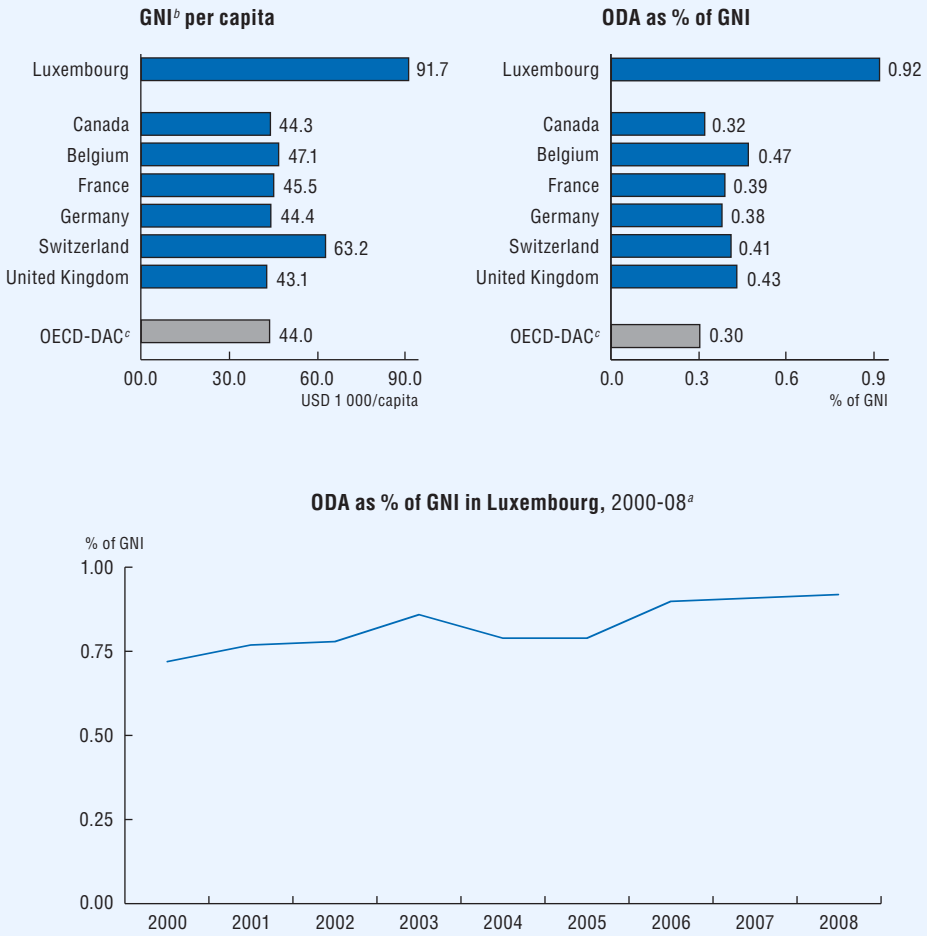
During its presidency of the European Union in the first half of 2005, Luxembourg helped *move forward the European and international agenda* for development co-operation: in June 2005, the European Council committed member states of the European Union and the Commission to make progressive increases in their ODA, individually and collectively, in order to achieve the target of 0.7% of GNI by 2015. Luxembourg had already set an example by reaching this objective in 2000.

In 2008, Luxembourg's ODA was among the *most generous in the DAC* on a per capita basis (EUR 575). Luxembourg's ODA rose steadily over the review period, increasing by 6.7% a year by volume, demonstrating the Grand Duchy's determination to achieve the UN target of 0.7% of GNI, and its own goal of 1%.[1] After a 16% jump in 2007, Luxembourg's development co-operation budget edged up by 2% in volume to EUR 278 million in 2008, or 0.92% of GNI (Figure 7.1).

The *Ministry of Foreign Affairs* managed 85% of the development co-operation budget in 2007. The remaining 15% represented contributions from the Ministry of Finance and Luxembourg's share in the European Union budget for development co-operation. Luxembourg provides its ODA exclusively in the form of grants, and the aid is completely untied. Of the total, 69% went to bilateral co-operation in 2008, and 31% to multilateral and non-governmental organisations. The share of aid channelled through NGOs in 2008 represented 12% of the total.

More than half of the country's bilateral aid goes to the least developed countries. The Grand Duchy's core partners (Mali, Cape Verde, Senegal, Viet Nam, Burkina Faso, Nicaragua, Laos, Niger, El Salvador and Namibia) have seen an

Figure 7.1 **Official development assistance,** 2008[a]



a) 2008: Provisional data.
b) Gross national income in USD at current exchange rates.
c) Member countries of the OECD Development Assistance Committee.
Source: OECD-DAC.

increase in their shares, reflecting a strict policy of *geographic concentration of aid*. A large portion – 47% in 2007 – of bilateral assistance goes to *infrastructure and social services*: health (15%), education (11%), population policy (7%), governance and civil society (6%). The DAC average in this area has been 41%. Luxembourg's

multilateral aid goes primarily to United Nations agencies, the European Commission, and the multilateral development banks.

1.2 ODA and environment

The 1996 Development Co-operation Act called for environmental co-operation to promote sustainable economic and social development. The Luxembourg Co-operation Strategy (2006) stresses sustainable development in its social, economic and environmental aspects, and also emphasises the Millennium Development Goals.

Around 8% of the country's total bilateral aid goes to environmental protection, water and sanitation, a share comparable to that at the beginning of the decade. The "cross-cutting" themes of co-operation include gender equality, capacity building and good governance, and *environmental issues*. These are taken into account in the various projects financed by the Ministry of Foreign Affairs, but they are not highlighted in the strategic policy papers and are not well reported in ODA statistics. In Burkina Faso, for example, Luxembourg is financing a natural resource management project (2006 to 2011) for nearly EUR 6 million.

As a signatory to the Hyogo Framework for Action (adopted at the 2005 United Nations World Conference on Disaster Reduction), Luxembourg is committed to helping protect people from future disasters and to analyzing and reducing risk factors, especially in developing countries. Since 2006, Luxembourg has invested at least 5% of its humanitarian budget in *disaster prevention*. In 2008, the Minister for Co-operation and Humanitarian Action announced an increase in Luxembourg's support for efforts in coming years to adapt to climate change, and declared that each new project would be vetted in advance for its climate impact. That approach is consistent with the 2006 OECD Declaration and the principles approved in 2009 (OECD, 2009).

2. Trade and Environment

2.1 Multinational business guidelines

Luxembourg has signed the OECD Guidelines for Multinational Enterprises, which set out voluntary standards and principles for *responsible business conduct* relating in particular to the environment. It has a tripartite contact point responsible for overseeing the guidelines: this falls under the Ministry for Economic Affairs and involves the Ministry of Finance, the Ministry of Labour and Employment, three business federations and two trade union federations. In 2006, one Luxembourg firm in three (primarily in manufacturing) had conducted an environmental impact

assessment and had been awarded environmental certification (Ceps/Instead, 2008). Socially responsible investment (SRI) surged in 2007 and 2008, and in 2008 there were around 200 SRI funds in the country (Etika, 2009).

As a member of the OECD Working Party on Export Credits and Credit Guarantees (ECG), Luxembourg follows the revised Recommendation on Common Approaches on the Environment and Officially Supported *Export Credits*. The environmental guidelines were introduced in Luxembourg in 2002. The *Office du Ducroire* is the official export credit guarantee agency. It assesses the potential environmental impact of projects proposed for export credits with a repayment term of two years or more. Projects with an impact deemed considerable and irreversible (category A) require an environmental impact assessment if their amount exceeds EUR 10 million, or if they are located in a sensitive area. The list of environmentally sensitive projects is published at the agency's website. A transaction involving delivery of blast furnace equipment in Korea was accepted in 2008. A project to expand a steel mill in India is now under examination.

2.2 Trade in hazardous substances

Hazardous waste

Luxembourg has had a procedure in place for monitoring waste transfers since 1982. Consistent with European legislation,[2] it enforces the Basel Convention on the *Control of Transboundary Movements of Hazardous Waste* (to which it has been a party since 1994) and its 1995 amendment, as well as OECD Council Decision [C(2001)107/Final] concerning control of transboundary movements of waste destined for recovery operations. In 2007, a Luxembourg regulation established a prior notification system for waste transfers within the country, identical to the European system (Chapter 3).

In 2006, *hazardous waste* generated in Luxembourg came primarily from the construction industry (44%), steelmaking (22%), and the services sector (20%). Given the confines of its territory, Luxembourg co-operates with its neighbours in managing waste. Germany is the primary destination (81%) for *waste exports subject to notification* (329 000 tonnes in 2008), most of which is for recovery (59%). Contaminated earth from a rail-twinning project on the Luxembourg-Pétange line produced a recent jump in exports. The Environment Administration works with the Customs and Excise Administration to detect illegal waste transfers. Up to a dozen roadside inspections are conducted annually along the borders of Luxembourg, on motorways or in the interior (often in co-operation with Germany, France and the

Walloon region). In 2008, written warnings were issued to 24 firms found to be non-compliant during these inspections.

Chemicals

Luxembourg participates in the work of the European Chemicals Agency concerning the registration, evaluation, authorisation and restriction of chemicals (*REACH*). Regulation EC/1907/2006, in force since 2007, makes industry responsible for managing the risks that chemicals may pose for health and the environment. All manufacturers and importers are required to identify and manage the risks associated with the substances they produce and place on the market. Any firm that makes or imports more than one tonne per year must prove that it has respected these provisions by submitting a registration to the Agency.

The government has designated the Minister of the Environment as the co-ordinator and the Environment Administration as the competent national authority. A Chemicals Unit was created within the Environment Administration in 2008. The Environmental Technologies Resource Centre has set up a REACH Helpdesk and a website, and has advised companies on how to comply with the pre-registrations required by the regulation. As of December 2008, more than 65 000 enterprises in Europe had submitted some 2.75 million pre-registrations to the European Chemicals Agency, concerning around 150 000 substances. In Luxembourg, 121 legal entities were registered and had deposited 4 430 pre-registrations. Some major chemical firms based in Luxembourg are aware of the comparative advantage associated with these environmental advances in the context of world trade.

Persistent organic pollutants (POPs)

In 2000, the Grand Duchy ratified the 1998 *Aarhus Protocol* to the Convention on Long-Range Transboundary Air Pollution and in 2003, it ratified the 2001 *Stockholm Convention* on Persistent Organic Pollutants. The Stockholm Convention seeks to minimise and eliminate the production, use and release of 21 chemicals.[3] It distinguishes between "intentional" products (pesticides and PCBs) and "unintentional" products (dioxins, furans, PCBs and HCBs). There is no intentional production of POPs in Luxembourg. National and European regulations (EC/850/2004) prohibit the production, marketing and use of substances covered by the Convention.

With respect to *unintentional products*, now that the sintering plant has been shut down and updated smokestack scrubbing devices installed at the waste incinerator, the principal sources of emissions are the three electric-arc steel mills. These facilities are subject to regular inspection under the Classified Installations Act and to

supplemental measurements by the Environment Administration. Since 2001, the limit values for emissions of dioxins, furans and PAHs have been exceeded several times. A bio-monitoring network has been in place around major industrial sites since 1995. For dioxins, furans and PCBs: *i)* the sanitary action threshold applicable to washed vegetables for human consumption (beyond which consumption is not recommended) has not been exceeded since 2003, while *ii)* the sanitary prevention threshold has been exceeded each year at Schifflange and on several occasions at Esch/Alzette. The maximum content for plant products destined for animal feed is also regularly exceeded at Schifflange. Areas close to the three steel mills are exposed to lead emissions as well.

Luxembourg has prepared a *National Plan for Implementing the Stockholm Convention*, which was approved by Cabinet in July 2008. The measures outlined relate to unintentional releases and include: *i)* monitoring of trends and use of best available techniques, analysis of pollution levels as a prerequisite for any new industrial installation; *ii)* regular POPs emissions inspections at electric-arc steel mills, examination of impacts and diffuse emission reductions, more regular quality controls over scrap metal and secondary fuels; *iii)* preparation of regulations governing soil protection and emissions from wood combustion; *iv)* reassessment of the bio-monitoring network near the steel mills; *v)* evaluation and management of public health risks; and *vi)* establishment of a national co-ordinating committee with representatives of the national environment and health authorities, local authorities, industry and ecological associations.

In 2002, Luxembourg ratified the 1998 Rotterdam Convention making the *export of certain chemicals* (including eight POPs covered by the Stockholm Convention) subject to the prior informed consent of the importing country. Luxembourg carries out the Convention requirements, in accordance with national and European regulations (Regulations EC/304/2003 and EC/689/2008).

Protection of the ozone layer

Luxembourg has ratified all the amendments to the 1987 Montreal Protocol. European Regulation EC/2037/2000 imposes a schedule for eliminating all ozone-depleting substances (ODS) that is in fact stricter than the Protocol itself. The Environment Administration and *SuperDrecksKëscht*® have taken steps to *recover substances* still present in Luxembourg and *dispose of them in an environmentally responsible manner*. CFCs in the insulating foam of discarded refrigerators have been recovered since 1991 (17 000 fridges were collected in 2008 *versus* 7 000 in 1991). Fire protection systems and fire extinguishers containing halons were to be decommissioned before the end of 2003. Inspections are conducted since then to monitor strict enforcement of the regulation. Sizeable quantities in old systems

(containing tonnes of halons) were still held in stock in 2007. The Grand Ducal Regulation of 18 April 2004 concerning CFC, HCFC and HFC emissions implements the European regulation on control of leakage from refrigeration and air-conditioning equipment. When it comes to *monitoring illegal trade in ODS*, the Environment Administration conducts joint inspections with the Customs and Excise Administration at Luxembourg Airport. No suspect substances have been detected.

2.3 Trade in endangered species

Luxembourg is a party to the *Washington Convention* on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The fines imposed for breaches of this Convention would be more effective if they were reinforced and increased. More generally, Luxembourg has a positive record in meeting its international commitments (often of longstanding) for the conservation of nature and biodiversity (Chapter 4).

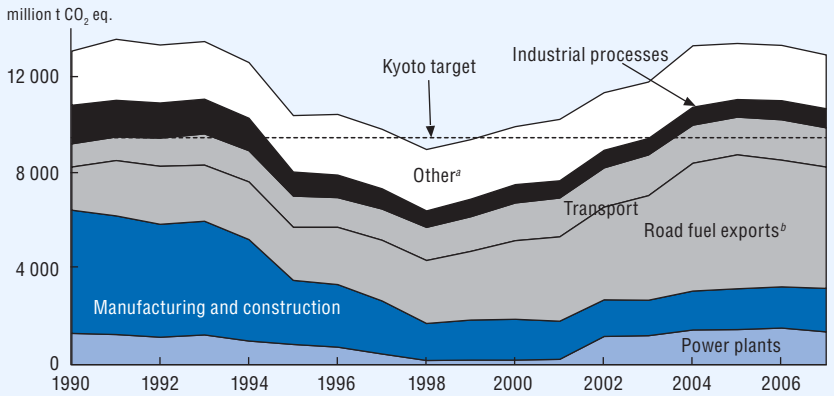
3. Climate Change

3.1 Objectives and trends

Luxembourg ratified the United Nations Framework Convention on Climate Change in 1994, and the Kyoto Protocol in 2002. Pursuant to that Protocol and the terms of the European agreement distributing the burden among the 15 member states of the European Union, Luxembourg undertook to *reduce its greenhouse gas emissions by 28% below their 1990 levels* over the period 2008-12. This is the deepest cut of any agreed by the 15 member states. When the Act approving the Kyoto Protocol was adopted in Luxembourg (2001), its GHG emissions were down by more than 30% between 1990 and 1998. In 2004, the government made a commitment that the bulk of its emission reductions under the Kyoto agreement would be achieved in Luxembourg itself, with limited resort to the Protocol's "Flexible Mechanisms".

In 2007, Luxembourg's total *GHG emissions* amounted to 13 million tonnes of CO_2 equivalent, barely below the 1990 level. CO_2 constituted the bulk of these missions (92%), followed by N_2O (4%), CH_4 (4%) and fluorinated gases (1%). Transportation was the principal source of emissions (52%), followed by combustion and industrial processes (19%), power plants (11%), residential (11%), and agriculture (6%). Since 1990, emissions have followed two successive trends: a decline of 31% between 1990 and 1998, followed by an increase of 43% to 2007 (Figure 7.2). This pattern can be explained by: *i)* the steel industry's switch from blast furnaces to electric-arc furnaces between 1993 and 1998, *ii)* a substantial increase in

Figure 7.2 **Greenhouse gas emissions by sector,** 1990-2007



a) Emissions from households, commerce, public services and agriculture.
b) Emissions from vehicles not registered in Luxembourg (transit, cross-border workers, fuel tourism).
Source: National submission to the CCNUCC, May 2009.

road transport emissions (up 144% between 1990 and 2007), including in particular from exports of motor fuels,[4] and *iii)* the commissioning in 2002 of a combined-cycle (gas-steam) power plant that emits about a million tonnes of CO_2 equivalent per year.

In 2006, per capita CO_2 emissions from fuel combustion in Luxembourg were more than twice the OECD average (23.8 tonnes *versus* 11.0 tonnes per capita). Half of these emissions came from road vehicles not registered in Luxembourg.

3.2 The National Strategy

In 2000, a *National Strategy for Reducing Greenhouse Gas Emissions*, adopted by the Environment Ministry, identified six areas for action: renewable energies, energy production efficiency, energy savings, "green taxation", transportation, and co-operation with developing countries and countries in transition. This was followed by regulations instituting subsidies for the rational use of energy and the promotion of renewable energies, but there has been no noticeable impact on national emissions.

In 2005, the Environment Ministry commissioned a study[5] on the potential for reducing emissions (FIFO, Cologne University, 2006/2007) to identify the measures needed to respect the Kyoto Protocol commitments. That analysis showed that a progressive increase in fuel excise taxes was essential for halting the growth in fuel

exports (the source of 75% of GHG emissions from transport). It estimated the potential reductions at between 3 and 16 million tonnes equivalent of CO_2 over the period 2008-12, through action on transportation (from 0.350 to 13 million t. eq. CO_2),[6] use of biofuels (1.185 million t. eq. CO_2), industry (except electricity production, 1.125 million t. eq. CO_2) and buildings (0.419 million t. eq. CO_2). In 2006, these measures were incorporated into the *first Action Plan for Reducing CO_2 Emissions*, which was adopted by the government. This plan identified two major goals: *i)* limiting dependence on fossil fuels, especially by accelerating their replacement through renewable energies (in particular, for thermal energy generation), and *ii)* seeking energy savings by enhancing the energy efficiency of transportation, industry and buildings. It called for regulatory measures and also voluntary economic instruments, public awareness campaigns, training and counselling, as well as the use of the Flexible Mechanisms[7] (Table 7.1). In 2007, a working group headed by the Environment Ministry and including the ministries concerned (Agriculture, Economic Affairs and Foreign Trade, Finance, Interior, Transport, Public Works and Housing) met to evaluate and refine these measures.

In the wake of an initial National Allocation Plan for GHG emission allowances (NAP) covering the period 2005-07, a *second NAP* was adopted for the period 2008-12, pursuant to Directive 2003/87/EC, and was notified to the European Commission in 2006. It proposed allocating 3.95 million tonnes equivalent of CO_2 per year to the sectors covered by the Emissions Trading Scheme (manufacturing and energy generation), but the Commission accepted a revised version of the plan in which the annual allocation for Luxembourg was set at 2.49 million tonnes (or 23% less than in the 2005-07 period); allowances are allocated free of charge; and operators' use of credits resulting from projects (clean development mechanism and joint implementation) is limited to 10% of the allocated ceiling. In 2007, emissions from installations in the trading system accounted for 19% of the total GHG emissions. Their verified emissions were 21% below the allowances.

National projections suggest that, with the measures now in place, total GHG emissions in 2010 will be 2.5% higher than in 1990, the base year (or 1.4% higher if planned measures are included). Luxembourg will not be able to meet its Kyoto target (–28%) without substantial resort to the Flexible Mechanisms (for perhaps 30% of projected 2010 emissions). The government estimates total spending of EUR 360 million to finance these Flexible Mechanisms (Emissions Trading, Clean Development Mechanism [CDM] and Joint Implementation [JI]) for the period 2008-12. These amounts will come from the Kyoto Mechanisms Fund.

The Kyoto Mechanisms Fund (Act of 23 December 2004) contributes to financing the Kyoto flexibility mechanisms and national measures to reduce GHG

Table 7.1 **Principal measures concerning climate change**

Sector	Type	Measures
Energy	Stricter legislation on the energy performance of residential buildings	– GDR[a] of 30/11/2007 concerning the energy performance of residential buildings (thermal insulation)
	Subsidy scheme for energy savings and use of renewable energies in dwellings	– PRIMe house: GDR[a] of 21/12/2007 instituting subsidies for home-owners to promote rational energy use and renewable energies (grants up to EUR 15 000 for a low-energy consumption house, EUR 40 000 for a "passive" house); supplements GDRs[a] of 17/07/2001 and 03/08/2005
	Information and awareness campaigns on energy savings, promotion of energy-saving products, training and advice on energy issues	– 2007 Campaign "Think Climate, Act Clever" – Online buyer's guide for ecological products *oekotopten.lu* (2007) – PRIMe cool: subsidy (EUR 150 if > = 175 l and EUR 100 if < 175 l) for purchases of low-energy refrigerators (A++, 2008) – Energy advisory network (2007) – "My Energy GIE" Economic Interest Grouping formed by the government and the Energy Agency (2008), budget 2009: EUR 1.3 million
	Promotion of "green" electricity	– GDR[a] of 03/08/2005 instituting a subsidy for electricity produced from wind, water, biomass or biogas energy; supplements GDR[a] of 28/12/2001 – GDR[a] of 08/02/2008 on electricity generation from renewable energy sources
	VAT reduction for energy-saving products	– VAT reduced for heat supplied by heating networks and wood-fired heating (01/01/2009)
Transport	Priority to public transport	– Transport Sector Master Plan to achieve a modal distribution of 25/75 (public transport/individual transport) by 2020 – Estimated expenditure: Rail Fund: EUR 2 billion, Road Fund: EUR 800 million over period 2009-13
	Taxes on private automobile use	– Kyoto Cents: 01/01/2007: 2 cents/litre for petrol and 1.25/litre for diesel; 1/1/2008: 2.5/litre for diesel – Vehicle tax (01/01/2007): preference for vehicles with lower emissions of CO_2
	Financial incentives for fuel-efficient vehicles	– Prime CAR-e: EUR 750/car for individuals (01/06/2007) and businesses (01/06/2008) (cars emitting less than 120 g CO_2/km, 160 g CO_2/km if car > = 6 seats or natural gas/hybrid vehicles) – CAR-e plus (scrapping premium for cars > 10 years): EUR 1 500 or 2 500 (incl. CAR-e EUR 750) if replacement emits < 150 g CO_2/km or < 120 g CO_2/km (01/01/2008 and 01/01/2009) – Subsidy to businesses: EUR 2 500/low-emission vehicle (01/01/07-30/06/09), utility vehicles and buses (Euro V Standard)
Industry	Second National Allocation Plan for GHG emissions allowances	– EC GHG Emissions Trading System (2003/87/CE): 2.49 million tonnes CO_2 allocated annually 2008-12 to 15 installations (power, steel, cement, glass factories)
Inter-sectoral	Use of Flexible Mechanisms under the Kyoto Protocol	– See Table 7.2

a) GDR: Grand Ducal Regulation.
Source: Government of Luxembourg.

emissions. It buys and sells carbon credits and finances or co-finances programmes and projects. In 2008, 61% of its resources came from an additional excise duty on motor vehicle fuels (the "Kyoto cent"), 29% came from a 40% share of vehicle tax revenues, and the remainder was covered from the government budget. The government has signed Emissions Reduction Purchase Agreements (ERPA) for CDM projects in El Salvador, in Mexico and in China. It contributes to the Multilateral Carbon Credit Fund of the European Bank for Reconstruction and Development (EUR 10 million), to the Carbon Fund for Europe sponsored by the World Bank and the European Investment Bank (EUR 10 million), to the Asia Pacific Carbon Fund of the Asian Development Bank (USD 15 million), to the Community Development Carbon Fund (USD 10 million) and to the BioCarbon Fund (USD 5 million) of the World Bank (Table 7.2).

Table 7.2 **Actual and projected revenues and expenditure of the Kyoto Mechanisms Fund,** 2008-12

(EUR 1 000)

	2008 Actual	2009 Budget	2010 Projected	2011 Forecast	2012 Forecast
I. Receipts, disbursements and cash position					
Holdings on 1 January	101 725	199 129	241 374	212 546	170 105
Budgetary allocations	10 500	11 000	11 000	11 000	11 000
Fuel tax ("climate contribution")	63 335	58 375	58 000	58 000	58 000
Vehicle tax	29 491	28 000	27 200	26 400	26 000
Grants	5	–	–	–	–
Total outlays	5 927	55 130	125 028	137 841	140 026
Holdings on 31 December	199 129	241 374	212 546	170 105	125 079
II. Spending programme					
Emission rights purchases[a]	–	2 000	25 000	25 000	25 000
CDM[b] projects	2 011	24 885	46 278	58 041	56 566
JI[c] Projects	–	–	15 000	20 000	20 000
Multilateral funds	2 044	7 821	8 300	8 100	6 860
National measures	1 521	18 545	28 750	25 000	30 000
Miscellaneous	351	1 879	1 700	1 700	1 600
Total outlays	5 927	55 130	125 028	137 841	140 026

a) 50% international, 50% European.
b) CDM = Clean Development Mechanism.
c) JI = Joint Implementation.
Source: Draft 2010 budget.

3.3 Post-Kyoto

The "Energy-Climate" Package adopted by the European Union in 2008 is intended to contribute to a common energy policy and to combat climate change after 2012. It calls for Luxembourg to: improve energy efficiency by 9% between 2001-05 and 2016;[8] reduce GHG emissions by 20% below their 2005 levels; achieve an 11% share of renewable energy in total energy consumption by 2020; and achieve a 10% share of biofuels in total transport by 2020.

The goal of the 2008 *National Action Plan for Energy Efficiency* is to improve energy efficiency by 9% (1 582 GWh) by 2016, with an interim target of 3% in 2010. More than half of the energy savings required would come from measures in the building sector (enforcement of insulation standards, subsidies for enhancing the energy performance of new construction and existing buildings). Measures affecting industry and energy generation[9] should contribute around 22% and transport 12% to these savings. Implementation of the measures identified would make it possible to surpass the planned objective and improve energy efficiency by 10.4% by 2016.

Since 2000, the *share of renewable energy* sources (mainly waste and solid biomass) in total primary energy supply has remained stable at around 1.5%. It reached 2.5% in 2007, in the wake of new legislation imposing a minimum market share of 2% for biofuels. The economically feasible potential for renewable energy development in Luxembourg is limited by the country's size and population density. One study quantified the maximum potential for renewable energy at 4.5% of total energy consumption in 2020 (in contrast to the 11% undertaking). Moreover, the country's efforts to produce electricity from renewable energy sources do not help in terms of its GHG emissions performance. Luxembourg depends on imports for more than half of its electricity supply. Electricity-linked emissions are imputed to the producing country, and consequently production in the country replaces power imports that did not affect domestic emission levels.

As of 2013, the *revised European Union Greenhouse Gas Emission Trading System* (EU-ETS) will apply to Luxembourg. Its target is a 21% reduction in GHG emissions in the EU's energy and industrial sectors by 2020, compared to 2005. The number of permits issued each year in the EU will decrease along a linear trend line and the portion of allowances auctioned will be higher than in the system's previous periods. According to the "effort sharing decision", Luxembourg is committed to a 20% reduction by 2020 in GHG emissions from *sectors outside* the EU-ETS (road transport, buildings, services, agriculture, and small industrial plants). Access to credits resulting from project activities will be limited to 4% of its 2005 emissions. To reach this objective, Luxembourg will have to *reduce road transport emissions*. Estimates for 2008 point to a slight drop in emissions from this sector, and this is

likely to continue under the impact of the economic crisis. Over time, implementation of the Transport Sector Plan and its public transport target, as well as fuel tax harmonisation with neighbouring countries, will have a great influence on GHG emission trends.

4. Regional Co-operation

4.1 Frameworks for co-operation

Luxembourg co-operates with *its neighbours* and its European partners on numerous aspects of regional development, territorial planning and the environment (water, nature and biodiversity, risks) all within a series of institutional frameworks:

- bilateral;
- tripartite (water and explosives with France and Belgium, intergovernmental co-operation with France and Germany);
- the "Grande Région" and the "Sarre-Lorraine-Luxembourg-Trier/Western Palatinate" Regional Commission (enlarged in 2005 to include the Walloon Region and the French- and German-speaking communities of Belgium);
- the Benelux co-operation framework ("Market and Sustainable Development" Division).

Cross-border co-operation at the *local government level* is based on the 1980 Madrid Convention. Co-operation procedures for Luxembourg municipalities were worked out with the Benelux partners in the 1986 Convention, and with France, Germany and Switzerland in the 1996 Karlsruhe Agreement.

"Grande Région"

Within the framework of the "*Grande Région*" (11 million inhabitants), "Chief Executive Summits" have been held since 1995, bringing together the highest-ranking representatives of Luxembourg and its other regional partners (Sarre, Lorraine, Rhineland-Palatinate, Wallonia and the French- and German-speaking communities of Belgium). The meetings are devoted to specific economic and social problems (*e.g.* issues such as territorial planning, employment, transport, culture, tourism and education). Environment ministers and senior environment officials of the "Grande Région" have met several times since 1996. In that year, they adopted the Bastogne Declaration, which laid the foundations for co-operation with a particular focus on nature parks, forests, renewable energy resources and abandoned industrial sites. The 1998 Summit Meeting in Trier dealt with environmentally sustainable development in the "Grande Région". Luxembourg is chairing the 11th summit of the

"Grande Région" (2008-09) and has selected "space" as the main theme, *i.e.* territorial development and planning. It is promoting, in particular, nature parks as drivers of regional development of rural areas.

The partners in the "Grande Région" have launched a *number of specific projects* for cross-border and inter-regional co-operation within the *framework of the European* "*Interreg*" *Initiatives* financed by the Structural Funds. Between 2000 and 2006, Luxembourg operators participated in more than 90 projects for a total value of over EUR 20 million, with the European Regional Development Fund (ERDF) covering up to half the costs. These projects were, in particular, concerned with nature conservation, water and waste management (especially for energy recovery) (Table 7.3). A common programme for the "Grande Région" has been established for the period 2007-13. With a total budget of EUR 212 million (including EUR 106 million in EU assistance through the ERDF), the "INTERREG IV A" Operations Programme has four priorities: *i)* the economy (support for innovation, expansion of economic infrastructure, tourism and the labour market); *ii)* physical space (traffic, environment and energy); *iii)* human resources (education, training, health, culture); and *iv)* technical assistance. These four priorities represent 44%, 25%, 25% and 6%, respectively, of the total investment.

Benelux

Benelux is a long-standing and primarily economic-oriented co-operation framework involving Belgium, Luxembourg and the Netherlands. The three partners signed a new treaty on 17 June 2008 in The Hague with a view to pursuing Benelux co-operation and extending cross-border co-operation in the areas of economics, sustainability, justice and the interior. The sustainable development chapter of the Benelux Plan for 2009 calls for concerted action for territorial development, the climate (harmonising measures to promote renewable energies) and nature (Natura 2000). In 2006, a memorandum was signed on co-operation in managing crises (of natural, technical or human origin) likely to have transboundary consequences. During Luxembourg's presidency in 2008, the Benelux Parliament adopted a recommendation to reinforce co-operation on energy, environment and biodiversity.

4.2 Transboundary waters

Most of Luxembourg (98%) lies in the Rhine basin, via the Moselle and tributaries such as the Sûre and Alzette; 2% is in the Meuse basin via the Chiers. On water issues it co-operates with its neighbours through the International Commission for the Protection of the Rhine (ICPR), the International Commissions for the

Table 7.3 **Interreg[a] Projects involving Luxembourg,** 2000-06

(EUR 1 000)

Fields/Projects	Partner countries	Partners' total budget	(%) of total	Luxembourg partners' budget	(%) of total	*of which:* ERDF
Land use planning		28 851	*24*	1 822	*8*	911
Infrastructure and transportation		7 920	*6*	2 767	*12*	842
Water supply and disposal	BE, FR, LU,	1 179		435		174
WWTP Lasauvage	FR, LU	1 810		1 810		407
Training and research		3 894	*3*	664	*3*	348
Economy		24 866	*20*	5 163	*22*	2 115
Labour market		2 004	*2*	524	*2*	272
Tourism		4 217	*3*	1 884	*8*	942
Culture		1 564	*1*	648	*3*	290
Nature and environment		12 264	*10*	2 580	*11*	1 370
Beech forest rescue strategies	DE, LU	1 018		202		101
Nat'Our: continuity of the Our and its tributaries	DE, LU	1 775		551		380
Ecoliri: producing local ecotypes of trees for planting on river banks	BE, FR, LU	793		130		65
Management of natural settings and countryside: multifunctional agricultural projects	BE, FR, LU	952		205		100
Ecology- and landscape-based transboundary plan (PEBT)	BE, LU	825		357		178
Forest renewal	BE, FR, LU	523		60		30
Ardennes ecological network	BE, LU	865		428		206
Sludge recovery	BE, FR, LU	387		137		55
ProBois: sustainable forest management	BE, DE, FR, LU	5 127		511		255
Water and energy		25 109	*21*	4 371	*19*	1 936
Rubin: biomass use	DE, LU	930		132		66
Agricultural methane	BE, FR, LU	996		13		6
Haute-Sûre River Contract	BE, LU	564		273		136
Haute-Sûre Forêt d'Anlier water conservation	BE, LU	1 118		74		37
Flood prevention I + II: Chiers, Messancy and Ton River basins	BEL, LU	2 204		733		307
Rhinenet	BE, DE, FR, LU, NL	3 584		400		200
TIMIS: transboundary geographic information system for flood protection	DE, FR, LU	6 857		1 712		856
Warela: territorial planning measures for flood prevention	CH, DE, LU	6 609		381		..
Aquafil: network of water resource centres	LU, FR, PR, HU, RO, BG	2 249		654		327

Table 7.3 **Interreg[a] Projects involving Luxembourg,** 2000-06 *(cont.)*

(EUR 1 000)

Fields/Projects	Partner countries	Partners' total budget	(%) of total	Luxembourg partners' budget	(%) of total	*of which:* ERDF
Health and social affairs		10 892	*9*	2 250	*10*	1 098
Networking: 8th Executive Summit of the "Grande Région"	BE, FR, LU	779	*1*	297	*1*	149
Total		122 360	*100*	22 971	*100*	10 273

a) European Interreg Projects under the IIIA, IIB, IIIC and INTERACT programmes.
Source: Ministry of the Interior and Land Use Planning.

Protection of the Moselle and Sarre (CIPMS) and the International Commission for the Protection of the Meuse (CIPM). These commissions are co-ordinating implementation of the European Water Framework Directive (WFD, 2000/60/EC), which seeks to restore aquatic resources to "good water status" by 2015 (Chapter 2).

With France, Belgium (Walloon region) and Germany (Rhineland-Palatinate, Saarland and North Rhine-Westphalia), Luxembourg is following the steps determined by the WFD for the Moselle-Sarre sector within the CIPMS. A situation report has been published (CIPMS, 2005). The basin of the Moselle and its principal tributary, the Sarre, covers 28 000 km^2 (with around 600 surface water bodies and 71 groundwater bodies). The main pressures on the basin stem from the development of the Moselle as a deep-draft navigable waterway over 75% of its length (with the attendant changes to habitats and alteration of water quality), nitrogen and phosphorus pollution from waste water treatment plants discharges, and agricultural runoff. Toxic substances (heavy metals, PAHs, PCBs, pesticides) have been found throughout the sector. In Luxembourg, *control of point releases remains a priority*. Population growth is placing ever-growing demands on treatment plants, and demographic concentration along the Franco-Luxembourg border is causing problems on the Alzette. Expenditure on the sewerage and sewage treatment programme has doubled as a percentage of GDP since 2000, reaching EUR 65 million in 2008 (0.2% of GDP). Several treatment plants still fall short of the operating requirements of European directives. The entire territory is designated as "sensitive" under the Urban Wastewater Directive, and as "vulnerable" under the Nitrates Directive. The parties to the CIPMS are supposed to have water district management plans in place in 2009,[10] that include, among other things: *i)* supervision

for the sector (CIPMS, 2007), *ii)* objectives, and *iii)* measurement programmes. A provisional document was presented in 2008 (CIPMS, 2008). The national management plans will provide details by country. Luxembourg's plan was put to public consultation until July 2009. An international water district management plan must also be established for the Meuse.

In the wake of the 1993 and 1995 floods, the commissions undertook an *Action Plan on Floods*. For the Moselle-Sarre basin, the plan is claimed to have reduced the potential for flood damage by at least 10% *vis-à-vis* 1998. It has also improved the flood forecasting and warning system and has enhanced water retention in the basin (Box 7.2).

Box 7.2 **Action plans on floods**

Following the floods of 1993 and 1995, the Environment ministers of the countries concerned tasked the Watershed Management Commissions for the Rhine, the Moselle/Sarre and the Meuse with drawing up an action plan on flood defence for each catchment basin that would take a global and co-ordinated approach to the problem of flooding. The purpose of these action plans is to *protect people and their property* from flooding and at the same time to improve the *ecological state* of the rivers and their alluvial zones.

Cross-border co-operation in this area dates back to 1985, when an International Working Group on Flood Control was established. In 1987 an intergovernmental agreement was signed relating to flood warnings in the Moselle basin. *The Action Plan on Floods of the International Commissions for the Protection of the Moselle and Sarre* (CIPMS), presented in 1998, is based on the results of those efforts. It had three objectives: *i)* to reduce the risk of damage (with, as goals, no increase in 2000, a 10% reduction in 2005, and a 25% reduction by 2020); *ii)* to improve flood warning and forecasting systems (extending advance warning times for the lower Moselle to 12 hours in 2000 and to 24 hours in 2005), and *iii)* to increase water retention. Upon completion of the Plan's second phase at the end of 2005, the countries had spent more than EUR 220 million. The Moselle-Sarre basin was again hit by heavy flooding in 2003 and 2006. The protection measures by then in place avoided major damage.

The European Union has been providing funds to encourage *better flood prevention*. The "Interreg TIMIS Flood" Project (Luxembourg, France and Germany) is one example. This is a *transnational flood information system* covering the Moselle and the Nahe basins and a portion of the Rhine watershed (about 55 000 km^2). It establishes a forecasting and early warning system for floods, flood risk maps indicating flood zones, water depths and speed of flow, and designated flood-prone areas (for around 100 watercourses with a total length of 3 200 km) and an Internet-accessible transnational geographic information system (GIS). The project was completed in 2008 at a total cost of EUR 6.86 million (50% financed by the EU). The transnational project "Management of Floods and Low Waters in the River Basin of the Moselle and the Sarre" (FLOW MS), launched in 2009, follows up on the TIMIS Flood.

The action plans of the International Commission for the Protection of the Rhine (ICPR) and the CIPMS in fact served as models for the *European Floods Directive* adopted in 2007 (2007/60/EC) (CIPMS, 2006).

Luxembourg is participating in the project for the *re-introduction of highly migratory fish stocks in the Rhine river system* (the "Salmon 2000" and "Salmon 2020" programmes of the ICPR). Measures concerning silver eels have also been in place since 2004 (in the Sûre basin). Captured upstream from the Rosport hydroelectric plant at peak flow times, they are transported directly to the Rhine in order to avoid descending through the power dams on the Mosel. Some two tonnes of eels have been detoured around the turbines in this way since 2004.

4.3 Air pollution

In 1982, Luxembourg ratified the 1979 Geneva Convention on Long-Range Transboundary Air Pollution (CLRTAP) and is a party to its *eight protocols*, including the 1999 Gothenburg Protocol, which it ratified in 2001. In 2006, Luxembourg surpassed the targets set in that agreement, having cut emissions of SO_2 by 83 % and of NH_3 by 12 % below their 1990 levels. The Environment Administration foresees a further reduction in 2010, thanks to caps on the sulphur content of diesel fuel and heating oil imposed by European legislation, and the decline in cattle herds (Econotec, 2008). NMVOC emissions were cut by 40% between 1990 and 2006. Over the review period, this trend can be explained essentially by the introduction of cars equipped with catalytic converters and the installation of activated carbon filters in petrol tanks. According to estimates, NMVOC emissions should reach a level just below the ceiling set for 2010 (Chapter 2).

On the other hand, when it comes to NO_x emissions, which fell by 38% between 1990 and 2006 and by 17% between 2000 and 2006, Luxembourg is unlikely to achieve the 52% reduction target of the Gothenburg Protocol (which is the same as the ceiling set by Directive 2001/81/EC): projections indicate that emission levels are likely to *exceed the target by 15% in 2010* (Table 7.4).

Existing partial data and estimates suggest that the Aarhus objectives for cutting emissions of heavy metals and persistent organic pollutants to below 1990 levels have been achieved, except for hexachlorobenzene (HCB). The sharp increase in HCB emissions between 1990 and 2003 coincided with commissioning of the three electric steel mills, which accounted for nearly 80% of emissions in 2003. Transport emissions have also jumped with the growing number of diesel vehicles.

The parties to the CLRTAP Convention and its protocols are supposed to compile and update their emissions inventories. According to Directive 2001/81/EC setting ceilings on national emissions of certain air pollutants, inventories of SO_2, NO_x, VOC and NH_3 emissions are to be submitted annually. Luxembourg has not

been compiling regular inventories of its emissions. In 2008, the European Court of Justice condemned Luxembourg for missing the deadlines for communicating its programmes, inventories and annual projections for the year 2010 concerning the progressive reduction of emissions. This information was however communicated at the end of 2008.

Table 7.4 **International air pollution reduction targets**

	Protocol		Commitments		Results	
			Target period	Target reduction (%)	Observation period	Variance (%)
CLRTAP						
Sulphur dioxide (SO_2)	Gothenburg	1999	1990-2010	*–73*	1990-2006	*–83*
Nitrogen oxides (NO_x)	Gothenburg	1999	1990-2010	*–52*	1990-2006	*–38*
Non-methane volatile organic compounds						
NMVOC	Gothenburg	1999	1990-2010	*–55*	1990-2006	*–40*
Ammonia (NH_3)	Gothenburg	1999	1990-2010	*0*	1990-2006	*–12*
Heavy metals	Aarhus	1998				
Cadmium (Cd)			1990 level	*n.a.*	1990-2002	*–92*[a]
Lead (Pb)			1990 level	*n.a.*	1990-2002	*–98*[a]
Mercury (Hg)			1990 level	*n.a.*	1990-2002	*–4*[a]
Persistent organic pollutants (POPs)	Aarhus	1998				
Polycyclic aromatic hydrocarbons (PAHs)			1990 level	*n.a.*	1990-2003	..
Dioxins and furans			1990 level	*n.a.*	1990-2003	*–97*[b]
Hexachlorobenzene (HCB)			1990 level	*n.a.*	1990-2003	*+277*[c]

n.a.: Not applicable.
a) 2010 emission ceilings for these pollutants are those set by Directive 2001/81/EC.
b) EMEP estimates.
c) The sintering plant (for coalescing metal powders), source of more than 60% of emissions in 1990, has been shut down.
d) The three electric steel mills, the principal sources of emissions, did not exist in 1990.
Source: Environment Administration.

Notes

1. Luxembourg was expecting to achieve 1% in 2009 (OECD, 2008), but this target date was postponed.
2. Regulation EC/1013/2006 of the European Parliament and of the Council on shipments of waste.
3. Aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, PCBs, PCDD/PCDF (dioxins and furans) and toxaphene (original list), plus alpha-hexachlorocyclohexane, beta-hexachlorocyclohexane, hexabromodiphenyl ether and heptabromodiphenyl ether, tetrabromodiphenyl ether and pentabromodiphenyl ether, chlordecone, hexabromobiphenyl, lindane, pentachlorobenzene, perfluorooctane sulfonate (added to the list in May 2009).
4. Emissions from vehicles not registered in Luxembourg (transit and cross-border commuter traffic, "petrol tourism").
5. An initial study was conducted in 2003 (Glauser/Greenpeace Luxembourg).
6. Assuming increases of one cent/litre and 10 cents/litre in road fuel excise taxes, respectively.
7. Emissions Trading, the Clean Development Mechanism, and Joint Implementation.
8. Reduction in total final energy consumption by sectors outside the EU-ETS.
9. Outside EU-ETS.
10. The Moselle-Sarre Management Plan is part of the International Water District Management Plan for the Rhine (overarching).

Selected Sources

The government documents, OECD documents and other documents used as sources for this chapter included the following. Also see list of websites at the end of this report.

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REFERENCES

I.A Selected environmental data

I.B Selected economic data

I.C Selected social data

II.A Selected multilateral agreements (worldwide)

II.B Selected multilateral agreements (regional)

III. Abbreviations

IV. Physical context

V. Selected environmental websites

I.A: SELECTED ENVIRONMENTAL DATA (1)

		CAN	MEX	USA	JPN	KOR	AUS	NZL	AUT	BEL	CZE	DNK	FIN
LAND													
Total area (1000 km2)		9985	1964	9632	378	99	7741	268	84	31	79	43	338
Major protected areas (% of territorial area)	*2*	6.7	8.6	19.5	8.0	3.8	13.0	19.5	28.0	3.3	15.8	2.0	8.2
Nitrogenous fertiliser use (t/km2 of agricultural land)		2.5	1.1	2.6	9.2	18.8	0.2	1.8	3.2	10.6	6.8	7.4	7.0
Pesticide use (t/km2 of agricultural land)		0.06	0.04	0.07	1.16	1.27	-	0.03	0.10	0.50	0.11	0.12	0.07
Livestock densities (head of sheep eq./km2 of agr. land)		174	217	168	706	1324	62	573	489	1635	267	869	334
FOREST													
Forest area (% of land area)		34.1	33.0	33.1	68.2	63.5	21.3	31.0	46.8	22.1	34.3	11.8	73.9
Use of forest resources (harvest/growth)		0.4	0.2	0.6	0.4	0.1	0.6	..	0.7	0.9	0.7	0.7	0.7
Tropical wood imports (USD/cap.)	*3*	1.6	0.2	2.1	10.7	6.1	4.0	3.4	0.4	24.2	0.3	3.8	1.4
THREATENED SPECIES													
Mammals (% of species known)		20.3	31.8	16.8	23.3	11.4	23.8	18.0	22.0	35.9	20.0	22.0	10.8
Birds (% of species known)		9.8	16.2	11.7	13.1	6.3	13.0	21.0	27.7	24.9	50.0	16.3	13.3
Fish (% of species known)		29.6	27.6	31.7	36.0	8.9	1.0	10.0	50.6	23.4	41.5	15.8	11.8
WATER													
Water withdrawal (% of gross annual availability)		1.5	16.7	19.2	20.2	40.3	4.8	1.2	4.5	31.9	10.7	5.0	2.1
Public waste water treatment (% of population served)		72	39	71	72	87	..	80	92	55	75	88	81
Fish catches (% of world catches)		1.2	1.4	5.2	4.5	1.8	0.2	0.6	-	-	-	1.0	0.1
AIR													
Emissions of sulphur oxides (kg/cap.)		61.6	25.9	40.7	6.6	9.2	43.7	19.4	3.4	10.6	20.6	4.6	16.0
(kg/1000 USD GDP)	*4*	2.0	2.6	1.1	0.2	0.4	1.5	0.8	0.1	0.4	1.1	0.1	0.5
% change (1990-2006)		-36	-3	-42	-17	-46	-43	50	-62	-65	-89	-86	-66
Emissions of nitrogen oxides (kg/cap.)		70.8	14.0	53.3	15.2	27.1	82.0	39.8	27.2	21.8	27.5	34.1	36.6
(kg/1000 USD GDP)	*4*	2.3	1.4	1.4	0.5	1.3	2.8	1.7	0.9	0.7	1.4	1.1	1.2
% change (1990-2006)		-3	14	-30	-5	50	36	56	17	-48	-62	-32	-35
Emissions of carbon dioxide (t./cap.)	*5*	16.5	4.0	19.1	9.5	9.9	19.1	8.8	8.8	11.1	11.8	10.2	12.7
(t./1000 USD GDP)	*4*	0.53	0.37	0.50	0.34	0.47	0.64	0.38	0.28	0.37	0.61	0.32	0.42
% change (1990-2006)		25	42	17	13	108	52	72	29	6	-22	10	23
WASTE GENERATED													
Industrial waste (kg/1000 USD GDP)	*4, 6*	..	..	..	40	40	20	10	..	50	30	10	110
Municipal waste (kg/cap.)	*7*	400	350	770	410	380	690	400	590	490	290	800	510
Nuclear waste (t./Mtoe of TPES)	*8*	6.2	0.1	1.0	1.5	3.2	-	-	-	2.0	1.7	-	1.9

.. not available. - nil or negligible.

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) IUCN management categories I-VI and protected areas without IUCN category assignment; national classifications may differ

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

4) GDP at 2000 prices and purchasing power parities.

Source: OECD Environmental Data Compendium.

OECD EPR / SECOND CYCLE

FRA	DEU	GRC	HUN	ISL	IRL	ITA	**LUX**	NLD	NOR	POL	PRT	SLO	ESP	SWE	CHE	TUR	UKD*	OECD*
552	357	132	93	103	70	301	**3**	42	324	313	92	49	505	450	41	784	244	35096
11.8	55.7	2.8	8.9	5.6	0.5	12.5	**17.0**	15.6	4.6	28.1	4.9	25.2	7.7	9.2	28.7	3.9	18.3	12.4
7.5	10.5	2.7	5.8	0.6	8.1	4.2	**-**	13.4	10.0	6.3	2.3	4.6	3.3	5.1	3.6	3.3	5.9	2.2
0.24	0.19	0.12	0.17	-	0.07	0.55	**-**	0.55	0.07	0.10	0.44	0.15	0.14	0.07	0.09	0.04	*0.15*	*0.07*
485	635	227	169	54	1165	388	**948**	1859	862	342	413	241	312	378	772	233	*599*	188
28.3	31.8	29.1	22.1	0.5	9.7	33.9	**33.9**	10.8	30.8	30.0	41.3	40.1	35.9	67.1	30.5	13.2	11.8	31.0
0.6	0.5	0.6	0.5	-	0.7	0.5	**0.5**	0.6	0.5	0.6	0.8	0.5	0.5	0.7	0.8	0.5	0.6	0.6
6.8	1.8	2.7	0.1	2.8	11.2	7.2	**-**	15.6	3.6	0.3	17.6	0.1	6.2	2.2	0.6	0.5	2.7	4.0
19.0	37.9	37.8	37.8	-	1.8	40.7	**51.6**	18.6	13.7	13.5	26.2	21.7	13.3	18.3	32.9	14.3	*15.8*	..
19.2	27.3	1.9	14.5	44.0	5.4	18.4	**23.1**	21.6	16.1	7.8	38.1	14.0	26.9	17.5	36.4	3.7	*16.2*	..
36.1	68.2	26.2	43.2	-	23.1	35.1	**27.9**	22.1	9.4	21.0	62.9	24.1	51.4	10.9	38.9	11.1	*11.1*	..
17.5	18.9	12.1	4.8	0.1	2.3	24.0	**3.3**	10.9	0.6	19.1	12.4	0.9	30.4	1.4	5.0	19.1	*12.9*	*11.3*
80	97	65	60	57	65	94	**95**	99	78	62	69	57	86	86	97	42	*97*	*72*
0.6	0.3	0.1	-	1.7	0.3	0.3	**-**	0.5	2.6	0.2	0.2	-	0.9	0.3	-	0.5	0.7	25.3
7.4	6.8	48.0	11.7	29.9	12.8	6.6	**5.2**	3.9	4.5	32.6	18.0	16.3	26.5	4.3	2.4	23.1	11.2	22.8
0.3	0.2	2.1	0.7	0.9	0.4	0.3	**0.1**	0.1	0.1	2.5	1.0	1.1	1.1	0.1	0.1	2.1	0.4	0.8
-66	-90	14	-88	20	-70	-78	**-83**	-66	-60	-62	-40	-84	-46	-64	-58	11	-82	-51
22.0	16.9	28.3	20.7	106.7	27.6	18.0	**29.9**	19.0	40.9	23.3	23.5	16.0	33.6	19.2	11.2	14.8	26.3	31.1
0.8	0.6	1.2	1.3	3.1	0.8	0.7	**0.5**	0.6	1.0	1.8	1.3	1.1	1.4	0.6	0.3	1.4	0.9	1.2
-27	-51	13	-13	3	-6	-45	**-38**	-42	-8	-44	2	-60	19	-44	-48	66	-46	-24
6.2	10.0	8.4	5.6	7.2	10.6	7.6	**23.8**	10.9	7.9	8.0	5.3	6.9	7.4	5.3	5.9	3.3	8.9	11.0
0.22	0.36	0.36	0.35	0.21	0.30	0.29	**0.38**	0.35	0.20	0.61	0.30	0.46	0.31	0.17	0.18	0.30	0.30	0.41
7	-13	34	-18	16	47	13	**7**	14	30	-11	43	-34	59	-8	8	89	-3	16
60	20	..	40	10	40	30	**30**	30	20	120	50	120	30	110	-	30	30	50
540	580	450	460	560	780	550	**690**	630	830	260	470	290	580	520	710	410	570	560
4.2	1.2	-	1.7	-	-	-	**-**	0.1	-	-	-	3.0	1.2	4.1	1.9	-	1.0	1.5

UKD: pesticides and threatened species: Great Britain; water withdrawal and public waste water treatment plants: England and Wales.

5) CO2 from energy use only; sectoral approach; international marine and aviation bunkers are excluded

6) Waste from manufacturing industries.

7) CAN, 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.

I.B: SELECTED ECONOMIC DATA (1)

		CAN	MEX	USA	JPN	KOR	AUS	NZL	AUT	BEL	CZE	DNK	FIN
GROSS DOMESTIC PRODUCT													
GDP, 2007 (billion USD aU 2000 prices and PPPs)		1047	1169	11524	3621	1066	639	100	267	324	210	173	165
% change (1990-2007)		59.9	66.5	62.0	26.3	148.9	76.2	69.3	50.5	41.7	40.3	45.3	50.7
per capita, 2007 (1000 USD/cap.)		31.7	11.1	38.2	28.3	22.0	30.4	23.7	32.2	30.5	20.4	31.7	31.1
Exports, 2008 (% of GDP)		35.0	28.4	13.4	18.1	56.3	23.3	31.3	59.9	90.9	77.1	54.6	46.4
INDUSTRY	*2*												
Value added in industry (% of GDP)		32	36	22	31	39	29	25	31	24	39	26	33
Industrial production: % change (1990-2007)		45.6	60.2	59.7	10.7	264.8	36.5	35.3	92.7	30.5	35.4	43.8	106.7
AGRICULTURE													
Value added in agriculture (% of GDP)	*3*	2	3	1	1	3	2	7	2	1	2	1	3
Agricultural production: % change (1990-2006)		28.4	52.1	24.7	-9.2	19.7	12.5	46.3	-1.4	21.2	..	1.4	-8.4
Livestock population, 2006 (million head of sheep eq.)		106	234	696	36	25	275	99	16	23	11	22	8
ENERGY													
Total supply, 2007 (Mtoe)		272	184	2367	522	227	128	18	33	59	46	20	37
% change (1990-2007)		30.0	48.1	22.9	17.7	143.1	46.3	32.1	32.7	18.6	-6.6	13.7	29.5
Energy intensity, 2007 (toe/1000 USD GDP)		0.26	0.16	0.21	0.14	0.21	0.20	0.18	0.12	0.18	0.22	0.12	0.23
% change (1990-2007)		-18.7	-11.1	-24.2	-6.8	-2.3	-17.0	-22.0	-11.9	-16.3	-33.4	-21.8	-14.1
Structure of energy supply, 2007 (%)	*4*												
Solid fuels		10.6	4.7	23.5	21.9	25.4	43.6	8.5	12.4	7.2	44.9	23.3	20.0
Oil		35.5	55.8	39.4	46.0	43.1	31.2	39.8	41.8	39.4	20.6	40.1	28.9
Gas		28.7	28.8	22.9	15.9	13.7	19.2	20.6	22.2	25.5	15.2	19.9	10.3
Nuclear		8.9	1.5	9.2	13.2	16.4	-	-	-	21.6	14.5	-	16.9
Hydro, etc.		16.3	9.3	5.0	3.1	1.4	6.0	31.1	23.6	6.4	4.8	16.8	23.9
ROAD TRANSPORT	*5*												
Road traffic volumes per capita, 2007 (1000 veh.-km/cap.)		10.1	0.7	16.3	6.8	4.7	10.1	13.7	10.3	9.2	4.6	8.2	10.1
Road vehicle stock, 2007 (10 000 vehicles)		1883	2569	24795	7413	1590	1417	273	513	575	483	262	299
% change (1990-2007)		13.8	167.2	31.3	31.2	368.2	45.0	47.8	38.9	35.1	86.4	38.5	33.7
per capita (veh./100 inh.)		57	24	82	58	33	67	65	62	54	47	48	56

.. not available. - nil or negligible.

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

2) Value added: includes mining and quarrying, manufacturing, gas, electricity and water and construction; production: excludes construction.

Source: OECD Environmental Data Compendium.

OECD EPR / SECOND CYCLE

FRA	DEU	GRC	HUN	ISL	IRL	ITA	**LUX**	NLD	NOR	POL	PRT	SLO	ESP	SWE	CHE	TUR	UKD	OECD
1738	2319	270	162	11	160	1570	**31**	534	192	533	188	90	1084	299	259	822	1833	32400
37.7	34.0	69.3	40.0	73.7	191.4	26.2	**118.2**	56.0	70.6	91.2	43.4	64.5	66.7	48.5	26.6	100.3	53.5	53.3
28.2	28.2	24.1	16.1	35.1	36.8	26.5	**65.1**	32.6	40.8	14.0	17.8	16.7	24.2	32.7	34.3	11.7	30.1	27.5
26.7	48.1	22.1	82.6	41.9	81.7	29.4	**177.6**	77.7	46.2	40.1	33.3	85.3	27.0	53.8	57.3	23.2	28.5	28.7
21	30	20	30	24	34	27	**16**	24	43	31	24	35	30	29	28	34	23	26
20.3	31.3	22.7	128.7	..	365.4	13.4	**48.0**	33.1	31.1	161.3	20.3	47.4	33.7	67.1	50.8	98.8	10.8	45.8
2	1	4	4	6	2	2	**0**	2	1	4	3	4	3	2	1	11	1	2
-4.2	-6.3	14.5	-23.0	12.1	7.0	5.3	**22**	-7.2	-7.8	-24.3	-2.6	..	16.3	-15.7	-6.9	24.9	-5.0	..
144	108	19	10	1	49	57	**1**	36	9	54	15	5	90	12	12	96	102	2373
268	335	31	27	4	15	187	**5**	83	26	99	25	18	148	50	27	100	227	5591
17.8	-6.0	38.6	-5.2	104.2	50.1	26.1	**29.8**	24.0	19.8	-1.3	43.1	-15.2	62.4	5.1	9.2	89.2	6.9	23.6
0.15	0.14	0.11	0.17	0.40	0.10	0.12	**0.15**	0.16	0.13	0.19	0.13	0.20	0.14	0.17	0.10	0.12	0.12	0.17
-14.5	-29.9	-18.1	-32.3	17.6	-48.5	-0.1	**-40.5**	-20.5	-29.8	-48.4	-0.2	-48.4	-2.5	-29.2	-13.7	-5.5	-30.3	-19.4
4.9	25.8	27.5	11.4	1.6	15.1	9.1	**1.9**	9.3	2.8	57.9	11.5	24.1	13.6	5.5	0.6	29.5	18.8	20.8
32.3	33.3	55.9	28.7	22.9	54.2	45.6	**68.1**	45.0	29.9	24.3	55.5	19.9	48.0	27.3	43.2	30.6	35.5	39.3
14.1	22.8	11.3	40.3	-	27.9	38.0	**27.3**	40.7	18.5	12.5	14.6	28.2	21.6	1.8	9.7	30.3	36.2	22.6
41.9	10.9	-	14.3	-	-	-	**-**	1.3	-	-	-	22.5	9.7	35.2	26.8	-	7.2	10.6
6.8	7.2	5.3	5.2	75.5	2.9	7.3	**2.7**	3.7	48.8	5.4	18.4	5.4	7.1	30.2	19.8	9.6	2.3	6.7
8.5	7.0	10.1	2.3	9.6	10.1	9.3	**8.8**	8.4	8.2	4.2	8.9	2.9	5.2	8.6	8.3	1.0	8.3	8.7
3665	4922	608	349	24	226	4021	**36**	822	269	1702	573	164	2696	478	430	946	3316	67322
28.8	31.9	141.1	56.3	80.4	138.7	34.4	**76.6**	43.5	38.3	162.1	160.6	58.8	86.7	21.8	32.3	301.0	39.2	43.8
59	60	54	35	78	52	68	**75**	50	57	45	54	30	60	52	57	13	54	57

3) Agriculture, forestry, hunting, fishery, etc.

4) Breakdown excludes electricity trade.

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

I.C: SELECTED SOCIAL DATA (1)

		CAN	MEX	USA	JPN	KOR	AUS	NZL	AUT	BEL	CZE	DNK	FIN
POPULATION													
Total population, 2007 (100 000 inh.)		330	1058	3016	1278	485	210	42	83	106	103	55	53
% change (1990-2007)		19.1	26.0	20.8	3.4	13.0	23.2	25.7	7.7	6.6	-0.4	6.2	6.1
Population density, 2007 (inh./km^2)		3.3	53.9	31.3	338.1	488.2	2.7	15.8	99.1	347.9	130.9	126.7	15.6
Ageing index, 2007 (over 64/under 15)		78.8	18.2	62.2	158.8	55.1	67.7	59.3	110.1	100.9	101.4	83.4	97.1
HEALTH													
Women life expectancy at birth, 2006 (years)		82.7	78.1	80.4	85.8	82.4	83.5	82.2	82.7	82.3	79.9	80.7	83.1
Infant mortality, 2006 (deaths /1 000 live births)		5.4	18.1	6.9	2.6	5.3	4.7	5.0	3.6	3.7	3.3	3.8	2.8
Expenditure, 2006 (% of GDP)		10.0	6.6	15.3	8.1	6.4	8.7	8.0	10.1	10.3	6.8	9.5	8.2
INCOME AND POVERTY													
GDP per capita, 2007 (1000 USD/cap.)		31.7	11.1	38.2	28.3	22.0	30.4	23.7	32.2	30.5	20.4	31.7	31.1
Poverty (% pop. < 50% median income)		12.0	18.4	17.1	14.9	14.6	12.4	10.8	6.6	8.8	5.8	5.3	7.3
Inequality (Gini levels)	*2*	31.7	47.4	38.1	32.1	31.2	30.1	33.5	26.0	26.0	25.0	25.0	26.0
Minimum to median wages, 2003	*3*	41.0	19.0	32.0	31.0	25.0	57.0	46.0	x	47.0	37.0	x	x
EMPLOYMENT													
Unemployment rate, 2007 (% of civilian labour force)	*4*	6.0	3.2	4.6	3.9	3.2	4.4	3.6	4.4	7.5	5.3	3.8	6.9
Labour force participation rate, 2006 (% 15-64 years)		80.0	64.5	75.5	80.3	69.4	77.5	79.8	77.1	68.2	70.5	82.2	75.7
Employment in agriculture, 2006 (%)	*5*	2.6	14.1	1.5	4.3	7.7	3.5	7.1	5.5	1.9	3.8	3.0	4.7
EDUCATION													
Education, 2006 (% 25-64 years)	*6*	85.6	32.4	87.8	84.0	76.7	66.7	69.4	80.3	66.9	90.3	81.6	79.6
Expenditure, 2005 (% of GDP)	*7*	6.2	6.5	7.1	4.9	7.2	5.8	6.7	5.5	6.0	4.6	7.4	6.0
OFFICIAL DEVELOPMENT ASSISTANCE	*8*												
ODA, 2008 (% of GNI)		0.32	..	0.18	0.18	..	0.34	0.30	0.42	0.47	..	0.82	0.43
ODA, 2008 (USD/cap.)		142	..	86	73	..	148	81	201	223	..	510	214

.. not available. - nil or negligible. x not applicable.

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

2) Ranging from 0 (equal) to 100 (inequal) income distribution; figures relate to total disposable income (including all incomes, taxes and benefits) for the entire population.

3) Minimum wage as a percentage of median earnings including overtime pay and bonuses.

Source: OECD.

OECD EPR / SECOND CYCLE

FRA	DEU	GRC	HUN	ISL	IRL	ITA	**LUX**	NLD	NOR	POL	PRT	SLO	ESP	SWE	CHE	TUR	UKD	OECD
617	823	112	101	3	43	593	**5**	164	47	381	106	54	449	91	76	706	610	11799
8.8	3.7	10.9	-3.1	22.2	23.9	4.6	**23.9**	9.6	11.0	0.2	7.4	1.9	15.5	6.9	12.5	25.7	6.5	13.0
111.9	230.4	84.8	108.1	3.0	61.7	196.9	**183.9**	394.5	14.5	121.9	115.1	110.1	88.8	20.3	182.9	90.1	250.3	33.6
89.5	150.5	130.2	106.3	54.8	53.2	139.4	**76.5**	81.1	76.0	85.9	112.2	74.9	114.2	103.2	104.4	26.8	91.2	76.1
84.4	82.4	82.0	77.4	83.0	82.1	83.8	**81.9**	81.9	82.9	79.6	82.3	78.2	84.4	82.9	84.2	74.2	81.1	..
3.8	3.8	3.7	5.7	1.4	3.7	3.9	**2.5**	4.4	3.2	6.0	3.3	6.6	3.8	2.8	4.4	21.7	5.0	..
11.0	10.6	9.1	8.3	9.2	7.5	8.7	**7.3**	9.5	8.7	6.2	10.2	7.4	8.4	9.2	11.3	5.7	8.4	..
28.2	28.2	24.1	16.1	35.1	36.8	26.5	**65.1**	32.6	40.8	14.0	17.8	16.7	24.2	32.7	34.3	11.7	30.1	27.5
7.1	11.0	12.6	7.1	7.1	14.8	11.4	**8.1**	7.7	6.8	14.6	12.9	8.1	14.1	5.3	8.7	17.5	8.3	10.6
26.0	30.0	34.0	26.0	28.0	31.0	32.0	**27.0**	28.0	24.0	32.0	37.0	24.0	31.0	23.0	27.6	43.0	33.0	30.3
61.0	x	49.0	49.0	x	38.0	x	**54.0**	51.0	x	40.0	44.0	45.0	29.0	x	x	44.0	44.0	..
8.3	8.4	8.3	7.4	2.9	4.7	6.2	**4.2**	3.2	2.6	9.6	8.1	11.2	8.3	6.2	3.6	9.7	5.3	5.6
69.2	79.6	71.0	60.7	86.4	74.1	63.2	**67.7**	80.5	80.5	62.4	78.3	68.1	73.1	71.1	85.0	49.1	76.3	72.0
3.4	2.3	12.0	4.9	6.3	5.6	4.3	**1.4**	3.1	3.3	15.8	11.8	4.4	4.8	2.0	3.8	27.3	1.3	5.5
67.4	83.2	58.7	78.1	63.3	66.2	51.3	**65.5**	72.4	78.9	52.7	27.6	86.5	49.8	84.1	85.0	28.3	69.1	68.5
6.0	5.1	4.2	5.6	8.0	4.6	4.7	**3.7**	5.0	5.7	5.9	5.7	4.4	4.6	6.4	6.2	4.1	6.2	5.8
0.39	0.38	0.20	..	..	0.58	0.20	**0.92**	0.80	0.88	..	0.27	..	0.43	0.98	0.41	..	0.43	0.30
176	169	62	..	..	300	75	**845**	425	832	..	58	..	147	513	262	..	186	55

4) Standardised unemployment rates; MEX, ISL, TUR: commonly used definitions.

5) Civil employment in agriculture, forestry and fishing.

6) Upper secondary or higher education; OECD: average of rates.

7) Public and private expenditure on educational institutions; OECD: average of rates.

8) Official Development Assistance by Member countries of the OECD Development Assistance Committee.

II.A: SELECTED MULTILATERAL AGREEMENTS (WORLDWIDE)

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

			CAN	MEX	USA
1946	Washington	Conv. - Regulation of whaling	Y D	R	R
1956	Washington	Protocol	Y D	R	R
1949	Geneva	Conv. - Road traffic	Y R		R
1957	Brussels	Conv. - Limitation of the liability of owners of sea-going ships	Y S		
1979	Brussels	Protocol	Y		
1958	Geneva	Conv. - Fishing and conservation of the living resources of the high seas	Y S	R	R
1959	Washington	Treaty - Antarctic	Y R		R
1991	Madrid	Protocol to the Antarctic treaty (environmental protection)	Y R		R
1960	Geneva	Conv. - Protection of workers against ionising radiations (ILO 115)	Y	R	
1962	Brussels	Conv. - Liability of operators of nuclear ships			
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	Y		
1963	Moscow	Treaty - Banning nuclear weapon tests in the atmosphere, in outer space and under water	Y R	R	R
1964	Copenhagen	Conv. - International council for the exploration of the sea	Y R		R
1970	Copenhagen	Protocol	Y R		R
1969	Brussels	Conv. - Intervention on the high seas in cases of oil pollution casualties (INTERVENTION)	Y	R	R
1973	London	Protocol (pollution by substances other than oil)	Y	R	R
1969	Brussels	Conv. - Civil liability for oil pollution damage (CLC)	Y D	D	S
1976	London	Protocol	Y R	R	
1992	London	Protocol	Y R	R	
1970	Bern	Conv. - Transport of goods by rail (CIM)	Y		
1971	Brussels	Conv. - International fund for compensation for oil pollution damage (FUND)	D	D	S
1976	London	Protocol	Y R	R	
1992	London	Protocol (replaces the 1971 Convention)	Y R	R	
2000	London	Amendment to protocol (limits of compensation)	Y R	R	
2003	London	Protocol (supplementary fund)	Y		
1971	Brussels	Conv. - Civil liability in maritime carriage of nuclear material	Y		
1971	London, Moscow, Washington	Conv. - Prohib. emplacement of nuclear and mass destruct. weapons on sea-bed, ocean floor and subsoil	Y R	R	R
1971	Ramsar	Conv. - Wetlands of international importance especially as waterfowl habitat	Y R	R	R
1982	Paris	Protocol	Y R	R	R
1987	Regina	Regina amendment	Y R	R	
1971	Geneva	Conv. - Protection against hazards of poisoning arising from benzene (ILO 136)	Y		

OECD EPR / SECOND CYCLE

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

JPN	KOR	AUS	NZL	AUT	BEL	CZE	DNK	FIN	FRA	DEU	GRC	HUN	ISL	IRL	ITA	**LUX**	NLD	NOR	POL	PRT	SVK	ESP	SWE	CHE	TUR	UKD	EU
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	**R**	R	R		R	R	R	R	R		R	
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	**R**	R	R		R	R	R	R	R		R	
R	R	R	R	R	R	R	R	R	R		R	R	R	R	R	**R**	R	R	R	R	R	R	R	S	R	R	
D		D			D		D	D	D	D			R		S		D	D	R	R		R	D	R		D	
		R			R			S		S						**R**			R	R		R		R		D	
		R	S		R		R	R	R				S	S			R			R		R		R		R	
R	R	R	R	R	R	R	R	R	R	R	R	R			R		R	R	R		R	R	R	R	R	R	
R	R	R	R	S	R	R	S	R	R	R	R	S			R		R	R	R		S	R	R	S		R	
R					R	R	R	R	R	R	R	R			R		R	R	R	R	R	R	R	R	R	R	
	S				S					S				S			R			R							
						R						R							R		R	S				S	
					S	R	R	R	S	R	R	R			R		R	R	R	S	R	S	R	S	R	S	
						S						S			S				S								
R	R	R	R	R	R	R	R	R		R	R	R	R	R	R	**R**	R	R	R	S	R	R	R	R	R	R	
					R		R	R	R	R			R	R			R	R	R	R		R	R			R	
					R		R	R	R	R			R	R			R	R	R	R		R	R			R	
R	S	R	R		R		R	R	R	R	S		R	R	R		R	R	R	R		R	R	R		R	
		R	S		R		R	R	R	R				R	R		R	R	R	R		R	R	R		R	
D	D	D	D		D		D	D	D	D	D		D	D	D	**D**	D	D	D	D		D	D	D		D	
R	R	R			R		R	R	R	R	R		R	D	R	**R**	R	R	R	R		R	R	R		D	
R	R	R	R		R		R	R	R	R	R	R	R	R	R	**R**	R	R	R	R		R	R	R	R	R	
				R	R	R	R	R	R	R	R	R		R	R	**R**	R	R	R	R	R	R	R	R	R	R	
D	D	D	D		D		D	D	D	D	D		D	D	D		D	D	D	D		D	D	D		D	
R		R			R		R	R	R	R	R		R	D	R		R	R	R	R		R	R			D	
R	R	R	R		R		R	R	R	R	R	R	R	R	R	**R**	R	R	R	R		R	R	R	R	R	
R	R	R	R		R		R	R	R	R	R		R	R	R	**R**	R	R	R	R		R	R	R	R	R	
R					R		R	R	R	R	R	R		R	R		R	R		R		R	R			R	
					R		R	R	R	R					R		R	R		S		R	R			S	
R	R	R	R	R	R	R	R	R		R	R	R	R	R	R	**R**	R	R	R	R	R	R	R	R	R	R	
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	**R**	R	R	R	R	R	R	R	R	R	R	
R	R	R	R	R		R	R	R	R	R	R	R	R	R	R	**R**	R	R	R	R	R	R	R	R	R	R	
R	R	R	R	R			R	R	R	R	R	R	R		R	**R**	R	R	R				R	R	R	R	
						R		R	R	R	R	R			R	**R**					R	R		R			

II.A: SELECTED MULTILATERAL AGREEMENTS (WORLDWIDE)

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

			CAN	MEX	USA
1972	London, Mexico, Moscow.	Conv. - Prevention of marine pollution by dumping of wastes and other matter (LC)	Y R	R	R
1996	London	Protocol to the Conv. - Prevention of marine poll. by dumping of wastes and other matter	Y R	R	S
2006	London	Amendment to Annex I of Prot (storage of CO2)	Y R	R	S
1972	Geneva	Conv. - Protection of new varieties of plants (revised)	Y R	R	R
1978	Geneva	Amendments	Y R	R	R
1991	Geneva	Amendments	Y		R
1972	Geneva	Conv. - Safe container (CSC)	Y R	R	R
1972	London, Moscow, Washington	Conv. - International liability for damage caused by space objects	Y R	R	R
1972	Paris	Conv. - Protection of the world cultural and natural heritage	Y R	R	R
1973	Washington	Conv. - International trade in endangered species of wild fauna and flora (CITES)	Y R	R	R
1974	Geneva	Conv. - Prev. and control of occup. hazards caused by carcinog. subst. and agents (ILO 139)	Y		
1976	London	Conv. - Limitation of liability for maritime claims (LLMC)	Y	R	
1996	London	Amendment to convention	Y S		
1977	Geneva	Conv. - Protection of workers against occupational hazards in the working environment due to air pollution, noise and vibration (ILO 148)	Y		
1978	London	Protocol - Prevention of pollution from ships (MARPOL PROT)	Y R	R	R
1978	London	Annex III	Y R		R
1978	London	Annex IV	Y		
1978	London	Annex V	Y	R	R
1997	London	Annex VI	Y		S
1979	Bonn	Conv. - Conservation of migratory species of wild animals	Y		
1991	London	Agreem. - Conservation of bats in Europe	Y		
1992	New York	Agreem. - Conservation of small cetaceans of the Baltic and the North Seas (ASCOBANS)	Y		
1996	Monaco	Agreem. - Conservation of cetaceans of the Black Sea, Mediterranean Sea and Contiguous	Y		
1996	The Hague	Agreem. - Conservation of African-Eurasian migratory waterbirds	Y		
2001	Canberra	Agreem. - Conservation of albatrosses and petrels (ACAP)	Y		
1982	Montego Bay	Conv. - Law of the sea	Y R	R	
1994	New York	Agreem. - relating to the implementation of part XI of the convention	Y R	R	S
1995	New York	Agreem. - Implementation of the provisions of the convention relating to the conservation and management of straddling fish stocks and highly migratory fish stocks	Y R		R
1983	Geneva	Agreem. - Tropical timber	Y R		R
1994	New York	Revised agreem. - Tropical timber	Y R	R	R
2006	Geneva	Revised agreem. - Tropical timber		S	R

OECD EPR / SECOND CYCLE

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

JPN	KOR	AUS	NZL	AUT	BEL	CZE	DNK	FIN	FRA	DEU	GRC	HUN	ISL	IRL	ITA	**LUX**	NLD	NOR	POL	PRT	SVK	ESP	SWE	CHE	TUR	UKD	EU
R	R	R	R		R		R	R	R	R	R	R	R	R	R	**R**	R	R	R	R		R	R	R		R	
		R	R		R		R		R	R			R	R	R	**R**	S	R				R	R	R		R	
		R	R		R		R		R	R			R	R	R	**R**	S	R				R	R	R		R	
R	R	R	R	R	R	R	R	R	R	R		R	R	R	R		R	R	R	R	R	R	R	R	R	R	R
R	R	R	R	R		R	R	R	R	R		R	R	R	R		R	R	R	R	R	R	R	R	R	R	R
R	R	R		R		R	R	R		R		R	R				R		R			R	R	R	R	R	R
R	R	R	R	R	R	R	R	R	R	R	R	R	R		R	**R**	R	R	R	R	R	R	R	R	S	R	
R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	R	**R**	R	R	R		R	R	R	R	R	R	
R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	**R**	R	R	R	R	R	R	R	R	R	R	
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	**R**	R	R	R	R	R	R	R	R	R	R	
R					R	R	R	R	R	R		R	R	R	R	**R**		R		R	R		R	R			
R		R	R		R		R	R	R	R	R			R		**R**	R	D	R			R	R	R	R	R	
R		R					R	R	R	R						**R**	S	R				R	R			R	
					R	R	R	R	R	R		R			R	**R**		R	R	R	R	R	R			R	
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	**R**	R	R	R	R	R	R	R	R	R	R	
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	**R**	R	R	R	R	R	R	R	R	R	R	
R	R	R		R	R	R	R	R	R	R	R				R	**R**	R	R	R			R	R			R	
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	**R**	R	R	R	R	R	R	R	R	R	R	
R	R	R		R	R	R	R	R	R	R	R				R	**R**	R	R	R			R	R			R	
		R	R	R	R	R	R	R	R	R	R	R		R	R	**R**	R	R	R	R	R	R	R	R		R	R
				R	R	R	R	R	R	R		R		R		**R**	R	R	R	R	R		R			R	
					R		R	R	R	R							R		R				R			R	S
									R		R				R					R		R					
					R	R	R	R	R	R	S	R		R	R	**R**	R			R	R	R	R	R		R	R
		R	R						R									R				R			R	
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	**R**	R	R	R	R	R	R	R	S		R	R
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	**R**	R	R	R	R	R	R	R	S		R	R
S	S	R	R	R	R		R	R	R	R	R		R	R	R	**R**	R	R	R	R		R	R			R	R
R	R	R	R	R	R		R	R	R	R	R			R	R	**R**	R	R		R		R	R	R		R	R
R	R	R	R	R	R		R	R	R	R	R			R	R	**R**	R	R		R		R	R	R		R	R
R											S							S						S			R

II.A: SELECTED MULTILATERAL AGREEMENTS (WORLDWIDE)

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

			CAN	MEX	USA
1985	Vienna	Conv. - Protection of the ozone layer	Y R	R	R
1987	Montreal	Protocol (substances that deplete the ozone layer)	Y R	R	R
1990	London	Amendment to protocol	Y R	R	R
1992	Copenhagen	Amendment to protocol	Y R	R	R
1997	Montreal	Amendment to protocol	Y R	R	R
1999	Beijing	Amendment to protocol	Y R	R	R
1986	Vienna	Conv. - Early notification of a nuclear accident	Y R	R	R
1986	Vienna	Conv. - Assistance in the case of a nuclear accident or radiological emergency	Y R	R	R
1989	Basel	Conv. - Control of transboundary movements of hazardous wastes and their disposal	Y R	R	S
1995	Geneva	Amendment			
1999	Basel	Prot. - Liability and compensation for damage			
1989	London	Conv. - Salvage	Y R	R	R
1990	Geneva	Conv. - Safety in the use of chemicals at work (ILO 170)	Y	R	
1990	London	Conv. - Oil pollution preparedness, response and co-operation (OPRC)	Y R	R	R
2000	London	Protocol - Pollution incidents by hazardous and noxious substances (OPRC-HNS)	Y		
1992	Rio de Janeiro	Conv. - Biological diversity	Y R	R	S
2000	Montreal	Prot. - Biosafety (Cartagena)	Y S	R	
1992	New York	Conv. - Framework convention on climate change	Y R	R	R
1997	Kyoto	Protocol	Y R	R	S
1993	Paris	Conv. - Prohibition of the development, production, stockpiling and use of chemical weapons and their destruction	Y R	R	R
1993	Geneva	Conv. - Prevention of major industrial accidents (ILO 174)	Y		
1993		Agreem. - Promote compliance with international conservation and management measures by fishing vessels on the high seas	Y R	R	R
1994	Vienna	Conv. - Nuclear safety	Y R	R	R
1994	Paris	Conv. - Combat desertification in those countries experiencing serious drought and/or desertification, particularly in Africa	Y R	R	R
1996	London	Conv. - Liability and compensation for damage in connection with the carriage of hazardous and noxious substances by sea (HNS)	S		
1997	Vienna	Conv. - Supplementary compensation for nuclear damage			S
1997	Vienna	Conv. - Joint convention on the safety of spent fuel management and on the safety of radioactive waste management	Y R		R
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)	Y R	R	S
2001	London	Conv. - Civil liability for bunker oil pollution damage			
2001	London	Conv. - Control of harmful anti-fouling systems on ships		R	S
2001	Stockholm	Conv. - Persistent organic pollutants	Y R	R	S

Source: IUCN; OECD.

OECD EPR / SECOND CYCLE

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

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

II.B: SELECTED MULTILATERAL AGREEMENTS (REGIONAL)

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

			CAN	MEX	USA
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		
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 uniform conditions of approval and reciprocal recognition of approval for motor vehicle equipments and parts	Y		
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		
1964	Brussels	Agreem. - Measures for the conservation of Antarctic Fauna and Flora	Y		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		
1972	London	Conv. - Conservation of Antarctic seals	Y	R	R
1979	Bern	Conv. - Conservation of European wildlife and natural habitats	Y		
1979	Geneva	Conv. - Long-range transboundary air pollution (CLRTAP)	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

OECD EPR / SECOND CYCLE

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

JPN	KOR	AUS	NZL	AUT	BEL	CZE	DNK	FIN	FRA	DEU	GRC	HUN	ISL	IRL	ITA	**LUX**	NLD	NOR	POL	PRT	SVK	ESP	SWE	CHE	TUR	UKD	EU
					R				R	R							R							R			
					R				S						R					S		R			R		
					R				R							**R**											
				S	R				S		S		R		R	**R**	R			S		R	R	R	R		
					R				R							**R**											
				R	R	R	R	R	R	R	R	R		R	R	**R**	R	R	R	R	R	R	R	R		R	
				R	R		R	R	R	R		R			R	**R**	R	R	R	R		R	R	R		R	
R	R	R	R	R	R	R	R	R	R	R	R	R			R	**R**	R	R	R	R	R	R	R	R	R	R	R
				S	R		R	R	R	R	R				R	**S**	R	R		R		R	R	S	R	R	
				S	R		R	R	R	R					R	**S**	R	R				R	R	S		R	
				S	R		R	R	R	R	R				R	**S**	R	R		R		R	R	S	R	R	
				S	R		R	R	R	R					R	**S**	R	R				R	R	S		R	
				S	R		R	R	R	R	R				R	**S**	R	R		R		R	R	S	R	R	
				S	R		R	R	R	R					R	**S**	R	R				R	R	S		R	
					S	R	R	R	S	R	R	R			R		R	R	R	S	R	S	R	S	R	S	
									R	R						**R**											
									R	R						**R**											
									R	R						**R**											
									R	R						**R**	R							R			R
									R	R						**R**	R							R			R
									R	R						**R**	R							R			R
									R	R						**R**	R							R			
									R	R						**R**	R							R			
R		R	R		R				R						R			R	R						R	
					R		R		R	R					R	**R**	R					R		R		R	
							R			S						**R**	R					R		S		R	
				R	R	R	R	R	R	R	R		R	R	R	**R**	R	D		R		R	D	R	R	R	
				R	R	R	R	R	R	R	R		R	R	R	**R**	R	D		R		R	D	R	R	R	
				R	R		D		D	R	D		R		R	**R**				D		R	D	D		D	
					R											**R**	R										
R		R	S		R				R	R					R			R	R						R	
				R	R	R	R	R	R	R	R	R	R	R	R	**R**	R	R	R	R	R	R	R	R	R	R	R
				R	R	R	R	R	R	R	R	R	R	R	R	**R**	R	R	R	R	R	R	R	R	R	R	R
				R	R	R	R	R	R	R	R	R		R	R	**R**	R	R	R	R	R	R	R	R	R	R	R
				R	R	R	R	R	R	R		R			R	**R**	R	R			R		R	R			
				R	R	R	R	R	R	R	R			R	R	**R**	R	R	S		R	R	R	R		R	R

II.B: SELECTED MULTILATERAL AGREEMENTS (REGIONAL)

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

			CAN	MEX	USA
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)	Y	R	R
1998	Aarhus	Protocol (persistent organic pollutants)	Y	R	R
1999	Gothenburg	Protocol (abate acidification, eutrophication and ground-level ozone)	Y	S	R
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
1980	Bern	Conv. - International carriage of dangerous goods by train (COTIF)	Y		
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
2001	Sofia	Amendment			
2003	Kiev	Prot.- Strategic environmental assessment			
1992	Helsinki	Conv. - Transboundary effects of industrial accidents	Y	S	S
2003	Kiev	Prot. - Civil liability and compensation for damage caused by the transboundary effects of industrial accidents on transboundary waters			
1992	Helsinki	Conv. - Protection and use of transboundary water courses and international lakes	Y		
1999	London	Prot. - Water and health	Y		
2003	Kiev	Prot. - Civil liability and compensation for damage caused by the transboundary effects of industrial accidents on transboundary waters			
1992	La Valette	European Conv. - Protection of the archaeological heritage (revised)	Y		
1992	Vienna	Agreem. - Forecast, prevention and mitigation of natural and technological disasters			
1993	Lugano	Conv. - Civil liability for damage resulting from activities dangerous to the environment			
1994	Lisbon	Treaty - Energy Charter	Y		
1994	Lisbon	Protocol (energy efficiency and related environmental aspects)	Y		
2005		Agreem. - Transfrontier co-operation with Saarlorlux-Rhineland-Palatinate-Walloon regions - French and German communities of Belgium			
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 env. information and public participation in env. decision-making	Y		
2003	Kiev	Prot. - Pollutant Release and Transfer Registers (PRTR)			
1998	Strasbourg	Conv. - Protection of the environment through criminal law			
1999	Bern	Conv. - Protection of the Rhine	Y		
2000	Florence	Conv. - European landscape convention	Y		
2000	Geneva	Agreem. - International carriage of dangerous goods by inland waterways (AND)			
2002	Gand	Agreem.- Meuse	Y		

Source: IUCN; OECD.

OECD EPR / SECOND CYCLE

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

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

Reference III
ABBREVIATIONS

AGE	Water Management Administration
CFC	Chlorofluorocarbons
CIDD	Interdepartmental Commission on Sustainable Development
CIPM	International Commission for Protection of the Meuse
CIPMS	International Commissions for the Protection of the Moselle and the Sarre
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CRTE	Environmental Technology Resource Centre
CSDD	Superior Council for Sustainable Development
EAFRD	European Agricultural Fund for Rural Development
EAGF	European Agricultural Guarantee Fund
EIA	Environmental impact assessment
ERDF	European Regional Development Fund
FEDIL	Federation of Luxembourg Industries
FGE	Water Management Fund
GHG	Greenhouse gases
GDP	Gross domestic product
HCB	Hexachlorobenzene
HCFC	Hydrochlorofluorocarbons
ICPR	International Commission for the Protection of the Rhine
IUCN	World Conservation Union (International Union for Conservation of Nature)
MAVDR	Ministry of Agriculture, Viticulture and Rural Development
NEHAP	National Action Plan for Environment and Health
NGO	Non-governmental organisation
NH_3	Ammonia
NMVOC	Non-methane volatile organic compounds
NO_x	Nitrogen oxides
ODA	Official development assistance
ODS	Ozone-depleting substances
PCBs	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzodioxins (dioxins)

PCDF	Polychlorinated dibenzofurans (furans)
PDR	Recycling centres
PGD	Waste Prevention and Management Act
PGGD	General Plan for Waste Management
PNDD	National Plan for Sustainable Development
PNPN	National Plan for Nature Conservation
POP	Persistent organic pollutant
PPGD	Waste Prevention and Management Plan
SDK	Action SuperDrecksKëscht®
SO_2	Sulphur dioxide
STATEC	Central Statistics and Economic Studies Office
VOC	Volatile organic compounds
WEEE	Waste electrical and electronic equipment

Reference IV
PHYSICAL CONTEXT

Located in the middle of western Europe, Luxembourg is bordered by Belgium, France and Germany. The country has a *land area* of 2 586 km^2, 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 comprises 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).

In terms of *land use*, Luxembourg has a high proportion of farmland and permanent grazing (50%) and woodlands (34%). The balance (16%) includes built lands (9%) 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).

Reference V
SELECTED ENVIRONMENTAL WEBSITES

Website	Host Institution
www.gouvernement.lu	Government of the Grand Duchy of Luxembourg
www.environnement.public.lu	Environment portal of Luxembourg
www.environnement.public.lu/ functions /apropos_du_site/mev/ index.html	Ministry of the Environment
www.environnement.public.lu/ functions/apropos_du_site/aev/ index.html	Environment Administration
www.environnement.public.lu/ functions/apropos_du_site/aef/ index.html	Water and Forests Administration
www.miat.public.lu	Ministry of the Interior and Territorial Planning
www.eau.public.lu	Water Management Administration
www.legilux.public.lu/leg/textes coordonnes/thema/ENV/index.html	Environment Code
www.statistiques.public.lu	Statistics portal of Luxembourg STATEC
www.ceps.lu	Centre d'études de populations, de pauvreté et de politiques socio-économiques
www.crte.lu	Centre de ressources des technologies pour l'environnement
www.tudor.lu	Centre de recherche public Henri Toudor
www.lippmann.lu	Centre de recherche public – Gabriel Lippmann
wwwfr.uni.lu	Université du Luxembourg
www.iksr.org	International Commission for the Protection of the Rhine

http://213.139.159.34/servlet/is/392	International Commissions for the Protection of the Moselle and the Sarre
www.cipm-icbm.be	International Commission for the Meuse
www.sdk.lu	Action SuperDrecksKëscht®
www.bourse-de-recyclage.lu	Bourse luxembourgeoise de recyclage (Luxembourg Recycling Exchange)

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