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Foreword

This report is the first OECD Environmental Performance Review of Israel. It aims to provide support to the country's environmental progress. Indeed, in parallel with its accession to the OECD, successfully completed in 2010, Israel has moved rapidly to strengthen its environmental policies in line with the standards expected of OECD members. Despite fast economic and population growth, Israel has managed to reduce emissions of major air pollutants, moderate the energy and carbon intensities of its economy, further reduce freshwater abstractions, and extend the number of protected natural areas. However, other pressures on the environment have intensified, including greenhouse gas emissions, waste generation and habitat degradation.

With a relatively small, water-scarce, densely populated, and highly urbanised territory, Israel faces some pressing and unique environmental challenges. Geopolitical concerns about energy, water and food security have implications for the environment and related policies. To meet these challenges, Israel has started to make greater use of environmentally related taxes and other economic incentives. One result has been the emergence of an internationally competitive clean-tech sector, specialised in water and renewable energy technologies. More recently, Israel has introduced policies to support the clean-tech sector as a growth engine, consistent with the 2011 OECD Green Growth Strategy. However, Israel still needs to develop a whole-of-government approach to sustainable development and green growth that more effectively reinforces synergies between environmental, economic and social policies.

This Review presents 41 recommendations, covering water and waste management, biodiversity, climate change, and the integration of economic and environmental policies. Some of the key recommendations include:

- *To continue to expand the use of environmentally related taxes and market-based instruments, and gradually remove tax concessions that are potentially harmful to the environment.*
- *To strengthen the mix of policies to support the commercialisation and diffusion of environment- and climate-related technologies.*
- *To reinforce environmental liability for damage to natural resources.*
- *To gradually increase the agricultural and industrial sectors' share in financing the full costs of water infrastructure.*
- *To set up a system to monitor the implementation of measures to reduce greenhouse gas emissions and provide an annual assessment to the Parliament on progress in achieving targets.*
- *To review current arrangements for the management of waste and consolidate them in a comprehensive and coherent new policy, possibly a new law and an action plan.*

This Review is the result of a co-operative dialogue between Israel and other members and observers of the OECD Working Party on Environmental Performance. We are confident that this effort will help advance the policy debate on how to tackle the shared environmental challenges that OECD members and their partners face.

Angel Gurría
OECD Secretary-General

Preface

The principal aim of the OECD Environmental Performance Review programme is to help member and selected partner countries improve their individual and collective performance in environmental management by:

- helping individual governments to assess progress in achieving their environmental goals;
- promoting continuous policy dialogue and peer learning;
- stimulating greater accountability from governments towards each other and with respect to public opinion.

This report is the first *OECD Environmental Performance Review of Israel*. It examines progress made in the decade since 2000. Progress in achieving domestic objectives and international commitments provides the basis for assessing the country's environmental performance. Such objectives and commitments may be broad aims, qualitative goals or quantitative targets. A distinction is made between intentions, actions and results. The assessment of environmental performance is also placed within the context of Israel's historical environmental record, current state of the environment, physical endowment in natural resources, economic conditions and demographic trends.

The OECD is indebted to the Government of Israel for its co-operation in providing information, for the organisation of the review mission to the country (16-26 October 2010), and for facilitating contacts both inside and outside governmental institutions.

Thanks are also due to all those who helped in the course of this review, to the representatives of member countries participating in the OECD Working Party on Environmental Performance, and especially to the examining countries: Germany, Korea, Norway and the United States.

The team that prepared this review comprised experts from the reviewing countries: Mr. Helmut Schnurer (Germany), Mr. Ik-Jae Kim (Korea), Mr. Gunnar Farestveit (Norway) and Mr. John Epifanio (United States); members of the OECD Secretariat: Mr. Gérard Bonnis, Ms. Ivana Capozza, Mr. Brendan Gillespie, Mr. Eugene Mazur and Mr. Krzysztof Michalak; and Mr. Joseph Curtin, Mr. Andreas Kontoleon and Mr. Bill Long (consultants). Ms. Carla Bertuzzi and Mr. Shayne MacLachlan (OECD Secretariat), and Mr. John Smith (consultant) provided statistical and editorial support during the preparation of the report. Preparation of the report also benefitted from comments provided by Mr. Philip Hemmings, Ms. Gita Kothari and other members of the OECD Secretariat.

The OECD Working Party on Environmental Performance discussed the draft *Environmental Performance Review of Israel* at its meeting on 21 June 2011 in Paris, and approved the assessment and recommendations.

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Signs

The following signs are used in figures and tables:

. . : not available

– : nil or negligible

. : decimal point

Country aggregates

OECD Europe: This zone includes all European member countries of the OECD except Estonia and Slovenia, *i.e.* Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

OECD: This zone includes all member countries of the OECD except Chile and Israel, *i.e.* the countries of OECD Europe plus Australia, Canada, Japan, Korea, Mexico, New Zealand and the United States.

Country aggregates may include Secretariat estimates.

Statistical data

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Currency

Monetary unit: New Israeli Shekel (NIS)

In 2009: USD 1.00 = NIS 3.927

In 2010: USD 1.00 = NIS 3.732

Cut-off date

This report is based on information and data available up to 31 May 2011.

Executive summary

Israel is relatively small, densely populated and water-scarce. The fast pace of its economic and population growth in the 2000s has intensified what were already significant pressures on the environment. Until comparatively recently, environment was not a major policy priority. However, in the last few years the government has promoted a more proactive approach to the development of environmental policy and has sought to develop synergies with economic policies. Since 2003, government ministries have been required to prepare sustainable development strategies. This has helped to raise environmental awareness in line ministries, and to foster analysis of how potentially negative environmental impacts of sectoral policies could be mitigated. However, the quality of ministerial strategies has been mixed and implementation has often been slow. Israel should develop a whole-of-government approach to sustainable development and green growth. It should also enhance the use of economic assessment tools to better integrate economic and environmental decision making.

Strengthening environmental management capacity

Israel has adopted a number of important environmental laws which are expected to improve the coherence of environmental policy and legislation. Nonetheless, the widespread lack of implementing regulations continues to weaken the overall environmental legislative framework. Israel has a highly centralised system of environmental governance, with officials of the Ministry of Environmental Protection having to address many, sometimes minor, environmental issues. This leads to inefficient use of the Ministry's limited human and financial resources. Local authorities have acquired certain permitting and enforcement powers, although smaller municipalities do not currently have the capacity to exercise these powers. Despite recent efforts to introduce integrated environmental permitting, the regulatory focus continues to be on individual media and end-of-pipe pollution control. The scope and effectiveness of environmental inspections have been expanded and enforcement has become more rapid and more proportionate to non-compliance, leading to higher levels of compliance. However, the efficiency of inspections and enforcement actions could be further improved, while the environmental liability system should be strengthened so that regulated entities responsible for pollution bear the costs of environmental remediation.

Enhancing the use of green taxes and economic instruments

In the context of a fiscal policy that has prioritised reduction of the public deficit, Israel has made greater use of environmentally related taxes and other economic instruments. Revenue from environmentally related taxes more than doubled in real terms during the period 2000-09. In 2009, it accounted for 3% of GDP and 10% of total tax receipts, among the highest shares in the OECD. However, a number of support schemes and tax breaks provide environmentally harmful incentives, particularly in the agricultural and transport sectors. The government should examine how the environmentally harmful subsidies that have been identified could be removed. Removing such subsidies and expanding the use of green taxes could contribute further to achieving both the government's fiscal and environmental policy objectives.

Promoting synergies between economic and environmental policies through eco-innovation

The Israeli "clean-tech" sector has grown in recent years, mainly driven by increasing global demand. It is specialised in water and renewable energy technologies. The development of this sector has also been stimulated by environmentally related policy measures, such as increased water prices and renewable energy support, increased public R&D funding, and targeted assistance programmes. Nonetheless, domestic demand for environmental technologies is generally low, partly due to the relatively slow implementation of environmental regulations and standards. The demonstration and commercialisation of new environmental technologies could be better supported. The clean-tech industry is made up of relatively small businesses that have difficulty accessing credit and venture capital.

Water resources management

Israel's limited water resources are under severe pressure due to its geo-climatic location, rapidly expanding population, growing economy, and water pollution loads. The intensity of freshwater use is much higher than the OECD average. The overall quality of the water in Israel's rivers has improved, owing to the extension of wastewater treatment systems and river rehabilitation investment. However, major rivers have become seriously depleted and polluted. Groundwater is being used unsustainably, and a potentially serious pollution problem (including salinity and nitrates) is developing, particularly in the Coastal Aquifer.

Water governance has improved since 2007 with the creation of the Water Authority. River basin management authorities have been established, although their performance remains uneven. Pricing has been a key instrument to reduce demand for scarce water resources. Water prices have significantly increased, and rising block tariffs provide incentives to conserve water resources. However, further steps could be taken to reduce household consumption in line with good international practices. Tariffs now cover the full cost of supplying water services although, as in many countries, agricultural uses of water are still cross-subsidised.

Water pricing has also provided incentives for the development of water-efficient technologies such as drip irrigation and the reuse of treated water. As the water crisis has deepened, more emphasis has been placed on increasing water supply through seawater desalination, with the aim of supplying half of expected potable water needs in this way by 2020. Although Israel's desalination plants are among the most energy- and cost-efficient in the world, achieving this target will be dependent on the validity of some optimistic assumptions, including those concerning the costs of the energy used to desalinate water and the environmental impacts of the process.

Biodiversity conservation and sustainable use

Despite its relatively small size, Israel has an exceptionally high degree of biological diversity and is an important locus for migratory birds and marine species. However, its biodiversity is subject to serious pressures from several sources, including habitat fragmentation, the introduction of invasive species, over-exploitation of natural resources, and pollution. Israel has made progress in reducing pressures on aquatic ecosystems from river pollution and in enhancing habitat protection. While a relatively large share of the total area is protected, natural reserves and parks do not adequately represent the country's diversity of habitats nor are they large enough to preserve entire ecosystems. The condition of coral reef habitats has deteriorated and the size of coastal ecosystems has decreased. Relatively large shares of fauna and flora species are threatened, especially mammals.

The National Biodiversity Strategy (NBS) adopted in 2010 provides a comprehensive framework for monitoring, conservation and sustainable use of biodiversity. The NBS signals a clear shift from previous biodiversity policy in that it recognises that economic development and biodiversity conservation objectives are not incompatible, that biodiversity considerations should be mainstreamed in all policy domains, and that economic instruments can provide incentives for sustainable use of biodiversity resources. However, the use of economic approaches (*e.g.* agri-environmental schemes, tradable fishing quotas, and levies for coastal and marine protection) is in its infancy. Policy and institutional co-ordination remains a key challenge. Co-ordination with climate change mitigation and adaptation policies, including possible trade-offs, is of growing importance.

Climate change and air quality

Emissions of greenhouse gases (GHGs) increased by 5% between 2000 and 2008 and it is estimated that they will double by 2030 compared to the 2005 level. Rapid demographic and economic growth, and the resulting increase in energy and transport demands, are the main factors underlying this upward emission trajectory. Israel's energy mix remains more carbon-intensive than that of many other OECD countries, largely due to high dependence on fossil fuels for electricity generation and the lack of interconnections with electricity grids in neighbouring countries. The discovery of off-shore gas and its progressive use for electricity generation since the mid-2000s have helped mitigate the increase in GHG emissions and have contributed to a decrease in emissions of some air pollutants. However, Israel's emission intensities of sulphur and nitrogen oxides (SO_X and NO_X) are higher than in many other OECD countries. Air pollution hotspots remain at industrial sites, as well as in major urban areas due to heavy and increasing transport pressures. The implementation of the Clean Air Law beginning in 2011 represents a major step towards addressing these challenges.

As a non-Annex I party to the United Nations Framework Convention on Climate Change, Israel is not committed to a binding GHG emissions reduction target under the Kyoto Protocol for the period 2008-12. In 2009, it set the target of reducing its GHG emissions by 20% by 2020 compared with a business-as-usual scenario, although this will mean a further increase in GHG emissions. While a national action plan for reducing GHG emissions was prepared, the system for regular monitoring and assessment of progress in implementing GHG emissions reduction measures should be strengthened. The establishment of an economy-wide carbon price, by means of a carbon tax or adjusted excise duties on fossil fuels, would help improve the efficiency of Israel's climate policy.

The main GHG emissions reduction measures are being developed in the electricity sector. In 2010, the government launched the National Energy Efficiency Programme to achieve a 20% reduction in projected electricity consumption by 2020. Feed-in tariffs and other incentives have helped to increase the use of renewables, although they entail potential overlaps and over-subsidisation. Renewables still account for a minor share of electricity production. A number of administrative barriers need to be removed if their share is to reach the targeted 10% by 2020. As in many other OECD countries, transport is a major source of GHG and air pollutant emissions. Private car ownership and distance travelled by road have grown significantly. In addition to regulatory approaches, Israel has devised market-based approaches to address these challenges, including an emission-based vehicle purchase tax and an electronic toll system on the main highway to Tel Aviv from the eastern part of the country. Despite these positive steps, distortionary incentives for car ownership and use continue to be used, leading to higher emissions from transport than would otherwise be the case. Further efforts are needed to improve public transport networks and services as an alternative to private car use.

Waste management

Municipal waste generation increased by 15% during the last decade, slower than growth of GDP and of private final consumption. Although municipal waste generation per capita decreased, it remains well above that of many other OECD countries. Rapid industrial development has contributed to rapid growth in the generation of hazardous waste. Substantial progress has been made in curtailing illegal dumping and in closing illegal dumps, which were major problems in the 1980s and 1990s. However, the vast majority of waste is still disposed in landfills.

Israel has established the basis for developing a modern waste management policy, in line with good international practices. It has set ambitious goals for waste recovery, recycling and landfilling, and has introduced new policy instruments including a landfill levy and Extended Producer Responsibility schemes. However, organisational and recycling market failures remain, and the Extended Producer Responsibility schemes have not resulted in a significant increase in the rates of recycling or recovery of municipal waste. One of the main obstacles is the persistently low cost of landfilling, despite the recent increase in the landfill levy. Introducing volume- or weight-based waste collection charges would allow greater recovery of municipal waste service costs and provide incentives to reduce waste generation. Good progress has been made in managing industrial waste, of which 60% is recycled. However, waste collection infrastructure is inadequate in some areas while the regulatory framework for hazardous waste management remains fragmented.

PART I

Sustainable development

PART I

Chapter 1

Towards green growth

In the first decade of the 2000s, Israel experienced strong economic and demographic growth. While it has managed to reduce some of the pressures on the environment, the country still faces a number of pressing and unique environmental challenges. This chapter examines Israel's framework for sustainable development and green growth. It analyses how Israel has used its public investment and taxation policies to pursue environmental objectives, including by removing fiscal incentives that can encourage environmentally harmful activities. The emergence of an internationally competitive, export-driven "clean-tech" industry is examined in relation to the overall innovation context and the policy framework for eco-innovation. This includes an assessment of eco-innovation performance as measured by environmentally related R&D and patenting activity. The chapter also identifies successful policies, as well as the obstacles to be overcome to fully harness the growth, employment and environmental benefits from the "clean-tech" sector.

Assessment and recommendations

Israel is a small, open economy that grew at a relatively fast pace for much of the 2000s. The population is increasing more rapidly than the OECD average. With a relatively small, densely populated, water-scarce territory and a highly urbanised population, pressures on the environment are often intense.

Since 2003, government ministries have been required to prepare sustainable development strategies. This has helped to raise environmental awareness in line ministries, and to foster analysis of how potentially negative environmental impacts of sectoral policies could be mitigated. However, the quality of ministerial strategies has been mixed, implementation has often been slow, and monitoring and follow-up mechanisms have often been insufficient. The information base on economic aspects of environmental policy is still weak, as are the capacity and requirements for conducting economic analysis that are needed to better integrate economic and environmental decision making.

Public expenditure on environmental protection has been at about 1.6% of civilian expenditure since 2000, in line with the share in many other OECD countries. The government budget for environmental purposes has increased significantly over the last decade, but accounts for a minor share of the total government budget. Some dedicated environmental funds, especially the Maintenance of Cleanliness Fund, have provided supplementary and relatively secure sources of funding for environmental protection. However, there is a risk that such funds will lock in spending commitments and reduce the overall efficiency of revenue allocation. Their use should be subject to periodic assessment to make sure that their continuation is justified, and that they are achieving their objectives efficiently and effectively.

In the context of a fiscal policy that has prioritised reduction of the public deficit, Israel has made greater use of environmentally related taxes and other economic instruments, including a landfill tax and a water extraction levy. The inelasticity of demand for private car transport, partly due to inadequate development of public transport, implies that vehicle and fuel taxation is an important source of revenue, but also that it does not substantially affect vehicle usage and associated environmental impacts. Revenue from these taxes (in real terms) increased by more than 50% between 2000 and 2009. In 2009, they accounted for about 3% of GDP and 10% of total tax receipts, among the highest shares in the OECD.

The vehicle tax is well designed from an environmental point of view and has encouraged a shift towards smaller and "cleaner" vehicles. However, it is relatively high compared to taxes on other goods. It could be reduced, for example with a corresponding increase in fuel taxes and road charges to better target actual car and road use. The environmental effect of this measure would be enhanced to the extent that efficient and reliable alternatives to private car transport are made available. Such a shift should be accompanied by measures to compensate poorer population groups for the impact of higher fuel prices. Taxes on transport fuels are relatively high in comparison with those in many other OECD countries. Petrol-diesel tax parity has nearly been achieved. It is commendable that the excise duty on coal was increased five-fold in 2011, which will encourage a shift away from coal in electricity generation.

However, taxes on energy products for stationary purposes should better reflect the fuel carbon content, as well as other environmental externalities.

A number of support schemes and tax breaks currently in place provide environmentally harmful incentives to production and consumption. In particular, diesel for commercial use benefits from partial tax rebates; support to agriculture is mostly coupled with production; and car allowances for banking and civil service employees and the tax treatment of company cars overly encourage car ownership and use. The Ministry of Environmental Protection should be commended for undertaking a first study of environmentally harmful subsidies in 2011. Removing environmentally harmful subsidies and expanding the use of green taxes could contribute to the government's objectives of reducing public debt while cutting income taxes.

Israel has sizeable innovative and high-tech sectors and strong potential in the field of environmental technologies. The "clean-tech" sector has been growing in recent years, mainly driven by increasing global demand, and is specialised in water and renewable energy technologies. Progress in this area has been supported by environmentally related policy measures, such as increased water prices and renewable energy support, increased public R&D funding and targeted assistance programmes. Nonetheless, domestic demand for environmental technologies is generally low, partly due to the relatively slow implementation of environmental regulations and standards. The demonstration and commercialisation of new environmental technologies could be better supported. In addition, the clean-tech industry is made up of relatively small businesses that have difficulty accessing credit and venture capital.

A number of measures have been taken to encourage good environmental performance in the business and financial sectors. Nevertheless, the environmental review criteria and procedures for Israel's trade and investment policies and practices should be strengthened. This includes future Free Trade Agreements, as well as grants and insurance coverage provided to industry under export credit programmes.

Recommendations

- Develop a whole-of-government approach to sustainable development and green growth; fully integrate environmental and green growth considerations into the government's development strategies; establish clear performance monitoring and follow-up mechanisms.
- Enhance the use of economic assessment tools in developing public policies, and ensure that environmental costs and benefits are fully taken into account; prepare consistent evaluation guidelines for this purpose; improve the scope and quality of statistical information concerning the economic aspects of environmental policy (notably expenditure, revenue, employment and eco-industries).
- Follow up on plans to introduce environmentally related taxes and economic instruments (notably the proposed air emission levy, coastal and marine protection charges, and the marine pollution levy), and gradually remove tax concessions that are potentially harmful to the environment (including concessions on the water extraction levy for farmers and on the diesel excise duty for commercial use).

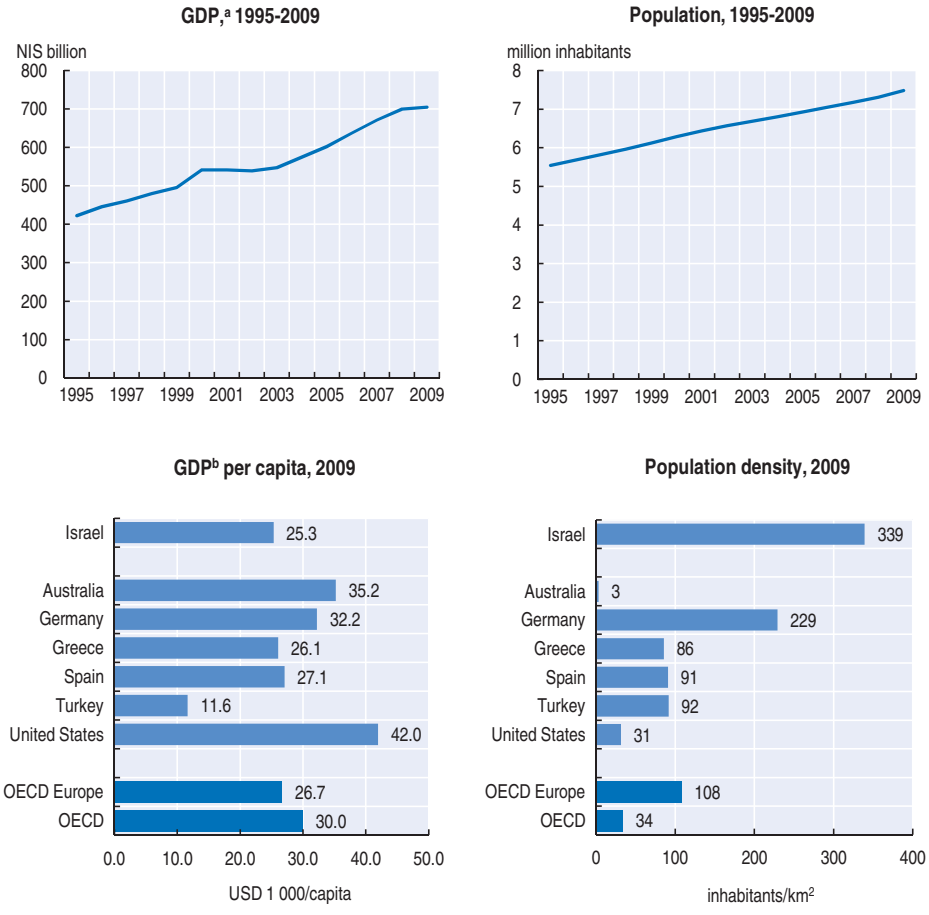
Recommendations *(cont.)*

- Review the tax treatment of company cars, with a view to eliminating the perverse incentives that result in increased car use and environmental impacts; replace the current car allowance for some services and public employees with other forms of compensation that are not linked to car ownership.
- Strengthen the mix of policies to support the commercialisation and diffusion of environment- and climate-related technologies, including more effective and efficient implementation of environmental policies, well-designed public procurement and targeted financial support.

1. Economic growth and the environment

Israel is a small, open economy that experienced strong economic growth during most of the 1990s and 2000s, supported by effective structural reforms and high added value exports (Box 1.1). The gap in living standards between Israel and other OECD economies has narrowed slowly, and GDP per capita remains below the OECD average (Figure 1.1).

Figure 1.1. **Socio-economic structure and trends**



a) GDP at 2005 prices.
b) GDP at 2005 prices and purchasing power parities.
Source: OECD, Environment Directorate; OECD (2010), *OECD Economic Outlook No.88.*

StatLink http://dx.doi.org/10.1787/888932495000

Box 1.1. **Israel's socio-economic context**

Effective macroeconomic policies and structural reforms have helped Israel sustain high economic growth since the mid-1990s. The early 1990s saw the country move towards market-oriented policies that aided the expansion of high value-added export sectors. An export-based high-tech sector emerged in this period, specialising in computer hardware and software, medical technologies and pharmaceuticals (OECD, 2010a). Services account for almost three-quarters of value-added, and industry for about 20%. Agriculture accounts for about 2% of value-added. Manufactured products (including polished diamonds) remain the major exports, accounting for more than 90% of total merchandise exports. On average, manufactured products (including machinery, transport equipment and chemicals) account for more than 80% of imports. Fuel imports have increased steadily. International trade and investment flows are substantial, but are relatively limited with regard to neighbouring economies.

Following the economic recession in the early 2000s, real GDP expanded by around 5% per year until 2007, a fast pace compared with most other OECD countries (Figure 1.1). The impacts of the 2008-09 global financial and economic crisis on the Israeli economy were less serious than in many other OECD countries, partly due to the absence of a housing bubble and the limited exposure of the banking sector to toxic assets: real GDP growth was 0.8% in 2009, but increased to 3.9% in 2010 (OECD, 2010b). Currently the debt to GDP ratio is around 80% of GDP, down from over 100% in 2003, and the government aims to bring it down to 60% by 2020. This decline was the result of a budget consolidation effort, by means of deficit limits and ceilings on annual growth in public expenditure (OECD, 2010a). Total public expenditure is relatively high, but large spending on defence means total civilian spending is only 33% of GDP (in 2008), below the OECD average of 41%.

Substantial gaps in living standards between Israel and the top-ranking OECD countries remain. GDP per capita on a purchasing power parity basis is currently relatively close to the OECD Europe average, but is only 60% of that in the United States (Figure 1.1). Israel faces deep socio-economic divides. With a Gini coefficient of 0.37, disposable income inequality in Israel is among the highest in the OECD. About 20% of households are below the relative poverty line (50% of equalised median household income) compared with the OECD average of around 11% (OECD, 2011a). Poverty is concentrated among the 20% of the population who are Arab-Israelis, with a poverty rate of around 50%, and the estimated 8% who are ultra-Orthodox Jews (Haredi), with a poverty rate of around 60%. Both groups typically live and work in communities separated from the mainstream population. Arab-Israeli poverty stems from poor education, resulting in low-paid jobs for men, as well as from cultural norms limiting learning and work for women. Religious and cultural choices are the main reasons for the Haredis' low material living standards. The ultra-Orthodox education system is unconventional, and the majority of adult men devote their lives to full-time religious studies. This also keeps labour market participation below the OECD average: about 40% of the working age population (15-64 years old) is not employed, compared with an OECD average of about 33%. The large share of low-paid, temporary foreign workers also contributes to high poverty rates (OECD, 2010a).

Israel has been profoundly influenced by successive waves of immigration. Immigration flows have declined in recent years, but population growth remains well above that in most OECD countries due to high birth rates in the Arab-Israeli and ultra-Orthodox Jewish communities (Figure 1.1). Israel has a young and generally well-educated population. In 2008, the age group of 65 and older made up about 10% of the total population, compared to an OECD average of about 15%. The tertiary attainment ratio (*i.e.* the share of individuals with a post-secondary school qualification) is well above the OECD average.

The population has also been growing at a higher rate than in most OECD countries. Population and economic activities are expanding within a relatively small, largely arid and semi-arid land area, creating increasing pressures on the environment. Israel is densely populated and highly urbanised, with more than 90% of the total population classified as urban (*i.e.* living in localities with at least 2 000 residents) (Figure 1.1). Land ownership is mostly public, a unique feature among OECD countries; land is centrally managed and the property market primarily consists of private trading in long-term leases.

Rapid increases in population and economic activity have generated pressures on energy and transport infrastructure. Energy demand, especially demand for electricity, has dramatically increased during the decade (Table 1.1). This has exacerbated concerns about energy security, due to Israel's high dependence on imports of fossil fuels and the lack of interconnections with the electricity networks of neighbouring countries. The discovery of off-shore natural gas reserves in the early 2000s has had a major impact on Israel's fuel mix, moderating dependence on imported fuels. The fuel switch from oil to natural gas for electricity generation since 2004 has been a key factor in increasing the efficiency of power generation and (slowly) reducing the overall energy intensity of the economy (Table 1.1). At 0.11 tonnes of oil equivalent (toe) per unit of GDP (USD 1 000) in 2009, the level of Israel's energy intensity was similar to that of many European countries.

Transport demand has rapidly increased. Road transport is by far the dominant mode for both passenger travel and freight haulage. The total number of vehicles, private car ownership and distance travelled by road have grown significantly (Table 1.1). Urban sprawl, poor public transport services in suburban areas, poor integration of public transport networks in larger metropolitan areas and underdeveloped rail links contribute to increasing road congestion in major urban areas (Chapter 6).

Energy and transport are the major sources of emissions of greenhouse gases (GHG) and air pollutants. Israel's GHG emissions have grown rapidly since the mid-1990s; in 2008, GHG emissions, excluding fluorinated gases and emissions/removals from land use, land use change and forestry, were 21% above the 1996 level and 5% above the level in 2000. Carbon dioxide (CO_2) emissions from energy use have increased less rapidly than GDP (Figure 1.2), resulting in a decrease in the country's carbon intensity, which is now in line with the OECD average. However, progress has been slow and Israel's economy and energy supply remain more carbon intensive than those of many other OECD countries due to high dependence on oil and coal for electricity generation (Chapter 6).

On the other hand, emissions of traditional air pollutants, such as sulphur and nitrogen oxides (SO_X and NO_X), have decreased since 2000, showing an absolute decoupling from GDP growth and fossil fuel use, especially for SO_X (Figure 1.2). This decline has mainly been the result of improvements in fuel quality and vehicle technology and the conversion of some power plants from heavy oil to natural gas. Emission intensities have also decreased, although at 1 kg of SO_X and NO_X per unit of GDP (USD 1 000) in 2008, Israel's emission intensities remain higher than in many other OECD countries. Air pollution hotspots remain at industrial sites (Haifa Bay, Ashdod and Ramat Hovav), as well as in major urban areas due to heavy and increasing transport pressures (Chapter 6).

Table 1.1. **Selected economic, social and environmental trends**

	Israel 2000-09 % change	OECD 2000-09 % change
Economic and social trends		
GDP[a]	30.2	14.1
Private final consumption[a]	31.3	18.5
Agricultural production	19.8	. .
Industrial production	19.3	–2.2
Population	19.0	6.1
Transport and energy		
Vehicle stock[b]	39.2	15.0[c]
Total primary energy supply	18.1	–1.2
Total final consumption of energy[d]	9.8	2.5
Energy intensity	–9.3	–13.4
Environmental pressures		
CO_2 emissions from energy use[d, e]	15.3	1.2
Emissions of SO_X[d]	–35.2	–30.1
Emissions of NO_X[d]	–16.9	–19.1
Water abstractions[d]	–7.6	–1.6[c]
Municipal waste generation per capita	–3.5	–3.5
Nitrogenous fertiliser use[d]	–6.3	–3.1

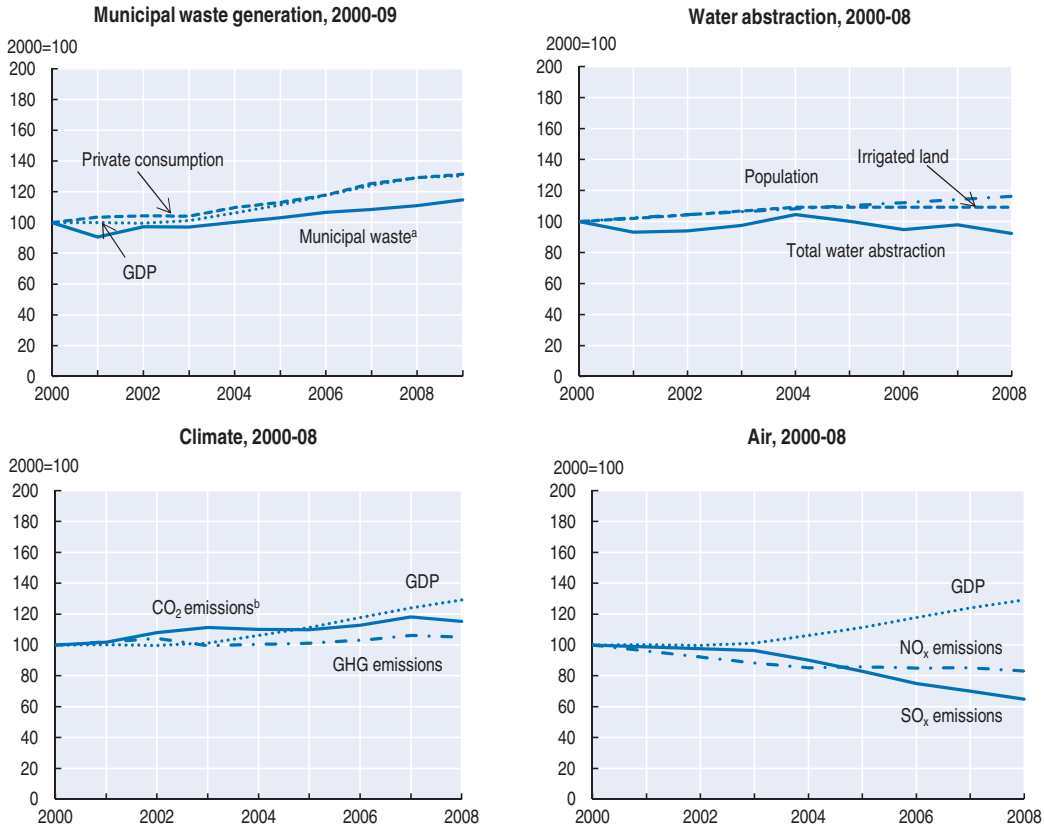
a) Based on values expressed in USD at 2005 prices and PPPs.
b) Based on values expressed in vehicles/inhabitants.
c) To 2007.
d) To 2008.
e) Sectoral approach; excluding marine and aviation bunkers.
Source: OECD, Environment Directorate; OECD-IEA; FAO.

StatLink http://dx.doi.org/10.1787/888932495703

Population growth and rising standards of living resulted in a 15% increase in municipal waste generation during the last decade, although the increase was slower than growth of GDP and private final consumption (Figure 1.2). Municipal waste generation per capita has decreased (Table 1.1), but remains well above that of many OECD countries. Rapid industrial development has contributed to fast growth in generation of hazardous waste. Substantial progress has been made in curtailing illegal dumping and closing illegal dumps, which were major problems in the 1980s and 1990s. The vast majority of waste is still disposed in landfills (Chapter 7).

Water scarcity is a major concern in Israel, a country characterised by arid and semi-arid climatic conditions. Responding to this challenge, it has pioneered the development of a range of water-related technologies. The agricultural sector is the largest water consumer, followed by the domestic sector. Freshwater abstraction fell during the last decade (Figure 1.2), mainly due to growing reuse of treated wastewater and increased supply of desalinated water. However, intensity of freshwater use is much higher than the OECD average, while rapid population and economic growth is placing additional pressure on limited water resources, in terms of both quantity and quality. The overall quality of the water in Israel's rivers has improved, owing to the extension of wastewater treatment systems and river rehabilitation investment, but most rivers remain seriously depleted and polluted. Groundwater quality has been deteriorating, with high salinity and concentrations of nitrates, micro-organisms and pesticides at some locations. Use of

Figure 1.2. **Economic growth and environmental pressures**



a) Waste collected by or for municipalities. It includes household, bulky and commercial waste, and similar waste handled at the same facilities.
b) Emissions from energy use only; excludes international marine and aviation bunkers; sectoral approach.
Source: OECD, Environment Directorate; OECD-IEA (2010); *CO_2 Emissions from Fuel Combustion*; OECD (2010), *OECD Economic Outlook No. 88.*

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nitrogenous fertilisers has decreased since 2000 (Table 1.1), but intensity of use remains well above the OECD average. There is some evidence that pesticide use has declined (Chapter 4).

Despite its relatively small size, Israel has an exceptionally high degree of biological diversity. It is at the crossroads of the migratory routes of birds and marine species. While a comparatively large share of the total land area is protected, biodiversity is subject to rising pressures from several sources: fragmentation of habitats; introduction of invasive species; over-exploitation of natural resources; pollution; and climate change. Relatively large shares of fauna and flora species are threatened, especially mammals (Chapter 5).

2. Strategic framework for sustainable development and green growth

Progress has been made in mainstreaming environmental considerations into the policy frameworks governing the main economic sectors (recognising that the latter are the driving forces behind most adverse impacts on the environment). The principal vehicle for policy and programme integration has been the 2003 government decision requiring ministries to prepare sustainable development strategies, taking into account anticipated trends and events to the year 2020. This approach differs from that followed in many other

OECD countries, which involves the preparation of a single national sustainable development strategy.

In 2003, the Ministry of Environmental Protection (MoEP) prepared a set of 16 principles which should be reflected in the strategies of all ministries. They included: "polluter pays principle", "inter-generational and intra-generational equity", "treatment or reduction at the source", "precautionary principle" and "public participation". The strategies prepared by the ministries were to be updated every three years and discussed within the Inter-ministerial Committee for Sustainable Development. The Committee, chaired by the MoEP, includes representatives of the private sector, local authorities and civil society.

These "sectoral" strategies, subsequently adopted by most ministries, have allowed the government to tailor sustainable development considerations to the priorities of the line ministries. However, the quality of the ministerial strategies is mixed and implementation has often been slow. The strategies have not been updated as required by the government decision. Overall, monitoring and follow-up mechanisms have been inadequate to ensure the effectiveness of implementation and the ability to adapt to changing circumstances and priorities.

From 2006, following the initial ministerial submissions, the Inter-ministerial Committee began to examine cross-cutting issues including sustainable transportation, sustainable production and consumption, and biodiversity conservation. In 2009, the government approved a decision on "Greening of Government". The purpose of this decision was to improve the environmental performance of government ministries, which are required to lead by example. Targets are set for reducing consumption of resources (water, energy and paper) and waste generation, and for increasing the use of recycled materials. Green public procurement is the main instrument to achieve these objectives (Box 1.2).

Box 1.2. **Green public procurement**

In 2009, the Israeli government launched a green procurement initiative to promote the use of recycled materials in all ministries and affiliated bodies. Environmental criteria are already incorporated into the public procurement of several products and services (*e.g.* computers, printers, recycled paper, etc., and hybrid vehicles) through the Governmental Purchasing Administration. Starting in 2010, environmental criteria are to be incorporated into the purchasing process for approximately ten additional products each year, including those most commonly purchased by government bodies. Recycling of paper and electronic equipment is also encouraged within the government. The government is considering the establishment of environmental criteria for public tenders, especially those for infrastructure projects, and the incorporation of environmental risk management into the activities of the Public Companies Authority. In addition, the MoEP will issue environmental guidelines for the procurement of goods and services addressed to public entities other than government ministries and affiliated bodies, such as local authorities, hospitals and the police force, as well as to private operators. All these measures would expand the domestic market for environmental products and services.

In recent years, environmental objectives have been prominently featured in the work plans of some sectoral ministries. For example, the Ministry of Agriculture and Rural Development seeks to promote the protection of open spaces, water sources and natural resources as well as supporting sustainable agriculture (Chapters 4 and 5); the Ministry of

National Infrastructures has included promoting the reduction of energy demand, energy conservation and sustainable energy for transport in its goals (Chapter 6); and the Ministry of Transport has identified promotion of public transport as its central goal (Chapter 6).

In late 2010, the MoEP and the Jerusalem Institute for Israel Studies launched the preparation of a sustainability outlook for Israel.[1] The multidisciplinary core team is to develop a set of possible scenarios for the future to 2030 (a business-as-usual scenario and four alternatives). The MoEP is also currently working with the Central Bureau of Statistics to design and implement a new set of sustainability indicators, which should better reflect resource management policies.

3. Integrating environmental and fiscal policies

3.1. Budget and expenditure for environmental protection

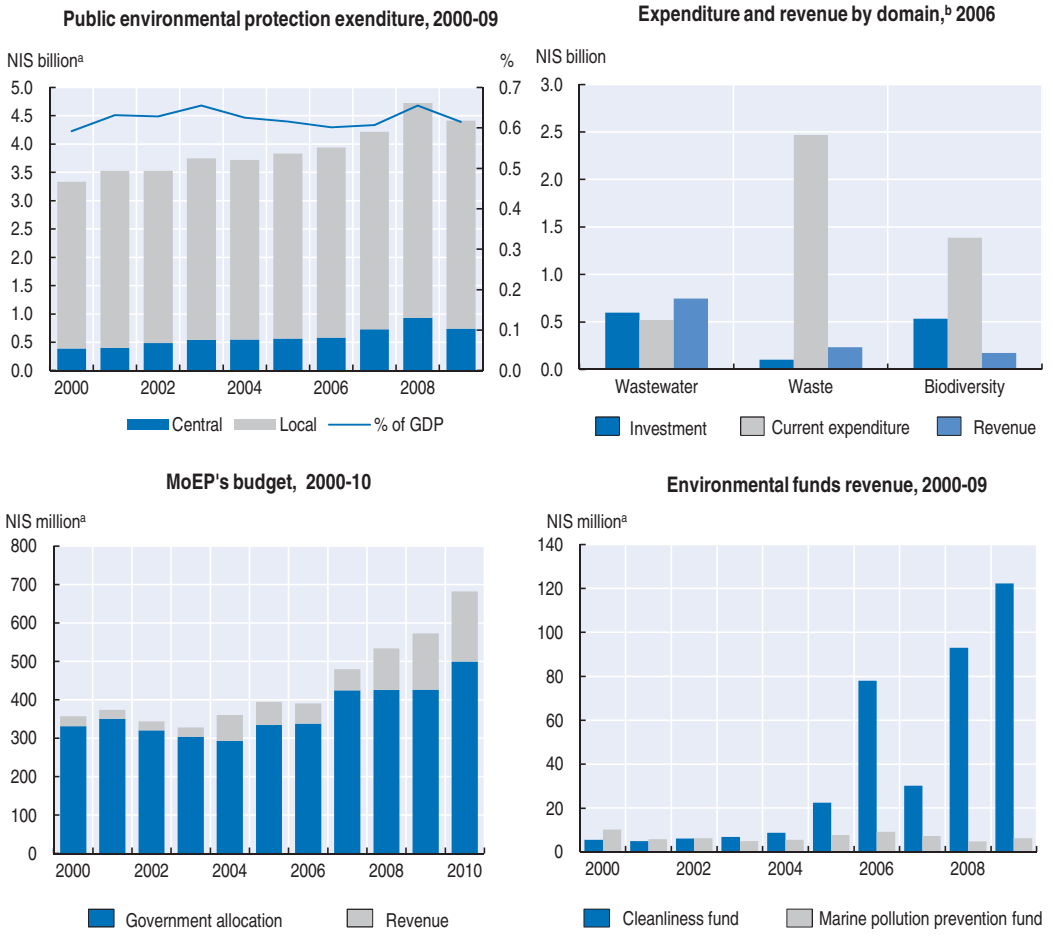
General government expenditure as a share of GDP has continued to decrease since 2000 as a result of a consistent policy of budget discipline introduced in the mid-1980s. At around 45% of GDP in 2009, total public expenditure is in line with the OECD average. The composition of expenditure has remained fairly constant over time, indicating that fiscal tightening has been spread more or less evenly across ministries. This may have led to sub-optimal allocation of resources. Public spending cuts are likely to have hampered infrastructure development, the quality of public services, and measures to alleviate poverty (OECD, 2010a).

Data on environmental protection expenditure are still only partially available in Israel. Expenditure by the private business sector is not surveyed. Although many ministries have environmentally related public expenditure, data do not include this expenditure by public institutions and agencies whose main objective is not environmental protection (Chapter 2). To a certain extent, this mirrors the government budgeting process, with the budget for environmentally related activities being split among different ministries, in some cases entailing duplications and overlaps (*i.e.* when several ministries budget the same activity) (Levtzion-Nadan, 2006). Israel is also at a very early stage of developing environmental national accounts. Lack of data prevents a comprehensive view of environmental spending in the public and private sectors, and a comparison of such spending with changes in the quality of the environment, in order to assess policy effectiveness.

According to the classification by governmental function of the national accounts (COFOG), public expenditure on environmental protection[2] increased steadily between 2000 and 2008 and then declined in 2009, probably as a consequence of budget cuts linked to the economic slowdown. Overall, public environmental expenditure increased by 35% in real terms during this period. However, it remained at around 0.65% of GDP, below the OECD average (0.8% in 2009) (Figure 1.3). Public expenditure on environmental protection has remained at about 1.4% of total government expenditure since 2000, or 1.6% of civilian expenditure (excluding Israel's sizeable expenditure on defence), in line with the share in many other OECD countries.

As in most other OECD countries, the vast majority of public environmental expenditure occurs at the local level, although this includes substantial financial transfers from the state budget. Unlike in most other OECD countries, the share of expenditure at the local level has progressively decreased over time: for instance, it was 92% in 2000, reaching about 85% in 2009 (Figure 1.3). Public specialised producers[3] account

Figure 1.3. **Expenditure on environmental protection**



a) Constant 2005 prices.
b) Expenditure and revenue of public specialised producers of environmental protection services (wastewater and waste management) and of the public sector (biodiversity).
Source: CBS; MoEP; Ministry of Finance; OECD (2011), *OECD National Accounts Database;* OECD (2010), *OECD Economic Outlook No. 88.*

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for a large share of expenditure, although there could be substantial transfers from the budgets of central and local governments. These providers include the National Water Company, *Mekorot*, which treats about 40% of Israel's wastewater as well as supplying water,[4] and the newly established municipal public-private Water and Sewerage Corporations (Chapter 4).

There is clear specialisation of expenditure by environmental domain and by spending sector. The public sector (which includes the central and local governments and government agencies) focuses on the protection of biodiversity and landscape, which accounts for about 80% of total expenditure, while its expenditure in the waste and water sectors is negligible. Public specialised producers (utilities) focus on wastewater and waste: expenditure on wastewater accounts for 70% of public producers' expenditure. The remainder is accounted for by the waste sector. This specialisation remained fairly constant over the decade, both between spending sectors and between environmental domains.

The share of investment in public sector expenditure decreased during the decade, with investment accounting for about one-quarter of expenditure by the public sector in 2006. Investment accounted for a more stable share of total expenditure by public producers (about 20%). However, investment accounted for more than half of expenditure on wastewater treatment, indicating an ongoing effort to expand and upgrade wastewater treatment facilities (Chapter 4). Revenue from wastewater and waste service provisions has increased considerably (in real terms) since the mid-1990s. However, in 2006 revenue was sufficient to cover current expenditure only in the wastewater sector; revenue generated by waste and nature conservation services covered a marginal share of their respective expenditure (Figure 1.3).

The MoEP's budget increased significantly over the decade in real terms (Figure 1.3), but it accounted for less than 0.01% of the total government budget in 2008. Its budget is much smaller than those of most other ministries. In addition to the funds allocated to the MoEP by the government, its revenue sources include some dedicated funds, such as:

- The Maintenance of Cleanliness Fund, which mainly supports the waste sector, including the prevention of waste dumping and the treatment and recycling of waste. Funds are generated from fines for environmental offenses, fees on beverage containers and the landfill levy (Section 3.2). The latter has provided an increasing share of the Fund since its introduction, from 64% in 2007 to 90% in 2009 (Chapter 7).
- The Marine Pollution Prevention Fund, which is the main source of funding for the MoEP's activities concerning the marine and coastal environment. It collects the revenue from fines for non-compliance with marine pollution prevention legislation and the marine environment protection fee (Section 3.2).

The environmental funds have acquired growing importance as a source of funding for the MoEP's activities (Figure 1.3). Other funds for environmental protection include the Quarry Reclamation Fund, managed by the Ministry of National Infrastructures to finance the rehabilitation of disused quarries. It collects revenue from the fee paid by quarry operators (Section 3.2).

These dedicated funds, which are a secure source of funding for environmental protection and restoration programmes, supplement the often limited government budget for environmental purposes. However, earmarking the revenue from levies and fees for dedicated funds could lock in spending commitments, reducing the flexibility of fiscal decisions and, therefore, the overall efficiency of revenue allocation. The use of such funds should be subject to periodic assessment, to make sure that their continuation is justified and that they are efficiently and effectively used to finance measures with the highest economic and environmental returns.

The "green" dimension of recent government budgets

The Israeli economy experienced a relatively mild downturn in the wake of the 2008 global financial and economic crisis. Prompt action with regard to monetary policy and several government measures to assist the corporate bond market, businesses and households helped cushion the recession and stimulate a quick recovery (Box 1.1). The government implemented a relatively modest stimulus package in the two-year 2009-10 budget, prudently estimated at 0.5% of GDP, which was not fully utilised (OECD, 2010a). The largest measure in the package was accelerated investment in infrastructure (NIS 9.5 billion, or 1.2% of GDP). This included investment in public transport networks and

water infrastructure (Box 1.3). The 2009-10 budget also included R&D investments of about NIS 650 million (Chief Scientist Fund budget, Bio-Technology Fund, and Periphery R&D Fund) and support measures for the energy and agricultural sectors, which can have potential positive impacts on the environment (Box 1.3). Most of these investments were part of long-term investment plans and did not represent additional anti-cyclical spending.

Box 1.3. **Environmentally related investment in the 2009-12 government budgets**

Transport

- Rail inter-urban transport (NIS 5 billion in 2010 for electrification of the rail system). electrification is expected to contribute to reducing greenhouse gas emissions.
- Development of the rail system (NIS 1.63 billion in 2010, 2 billion in 2011-12).
- Other public transport (NIS 1.3 billion in 2010, 2 billion in 2011).
- Subsidies to public transport operators (NIS 2.6 billion).

Energy

- Renewable energy sources (NIS 25 million in 2010 to support private investment).

Agriculture

- Reform of the livestock sector (about NIS 45 million in 2010).
- Land conservation (NIS 17 million in 2010, reduced to 9 million in the following years).
- Pest control (NIS 30 million per year).
- Open landscape and grazing land management (NIS 19.5 million in 2010, falling to 11 million in 2012).

Water

- Extension and upgrading of wastewater treatment plants (NIS 242.2 million in 2010, increasing to nearly 400 million in 2012).
- Water supply (NIS 416 million in 2010, decreasing to 384 million in 2012).
- Financial assistance to operation of water and sewage systems (NIS 425.5 million in 2010, 457.6 million in 2012).

Source: Israeli government.

Among the revenue-raising measures introduced in the 2009-10 budget were a permanent increase in the excise duty on petrol, reform of the vehicle purchase tax, and a temporary increase in water charges for domestic consumption (the "drought tax") (Section 3.2).

3.2. Taxation policy and the environment

Government policy to reduce the tax burden resulted in a decrease in the tax revenue to GDP ratio in the 2000s. In 2008, this ratio was about 34%, in line with the OECD average. Internationally, by comparison, the Israeli tax mix tends to rely more on property taxes and indirect taxation (VAT and other taxes on goods and services) (OECD, 2010a). Taxes on goods and services in 2008, including those on energy and transport, accounted for 37% of total tax revenue (compared with the OECD average of 32%).

Israel has made progress in applying environmentally related taxes, and there is an ongoing discussion within the government on further use of these instruments. In 2005, an inter-ministerial committee on green taxation, headed by the Ministry of Finance (Tax Authority), was established to explore the use of taxation to achieve environmental policy objectives, initially in the transport sector and subsequently in the energy sector. The work of this committee has resulted in the introduction of several sector-specific measures, including the reform of vehicle taxation (see below). The Ministry of Finance is also expected to formulate recommendations on the use of direct and indirect taxation incentives to reduce GHG emissions by August 2011. Indirect taxation, especially environmentally related taxes, may make a substantial contribution to the government's objectives of reducing public debt on one hand, and cutting income taxes on the other, especially when the scope for further reducing public spending may be limited. The regressive nature of such taxes should be addressed through targeted social benefit schemes.

As in all other OECD countries, environmentally related taxes largely coincide with taxes on energy use and vehicles. Revenue from environmentally related taxes (in real terms) more than doubled between 2000 and 2009, despite a slight decrease in 2009 due to the impact of the economic slowdown on overall tax receipts. The role of such taxes has increased since 2000. Their share in both GDP and total tax receipts has grown steadily since 2001, reaching 3.1% of GDP and 10% of total tax receipts in 2009, among the highest level in the OECD (Figure 1.4).[5]

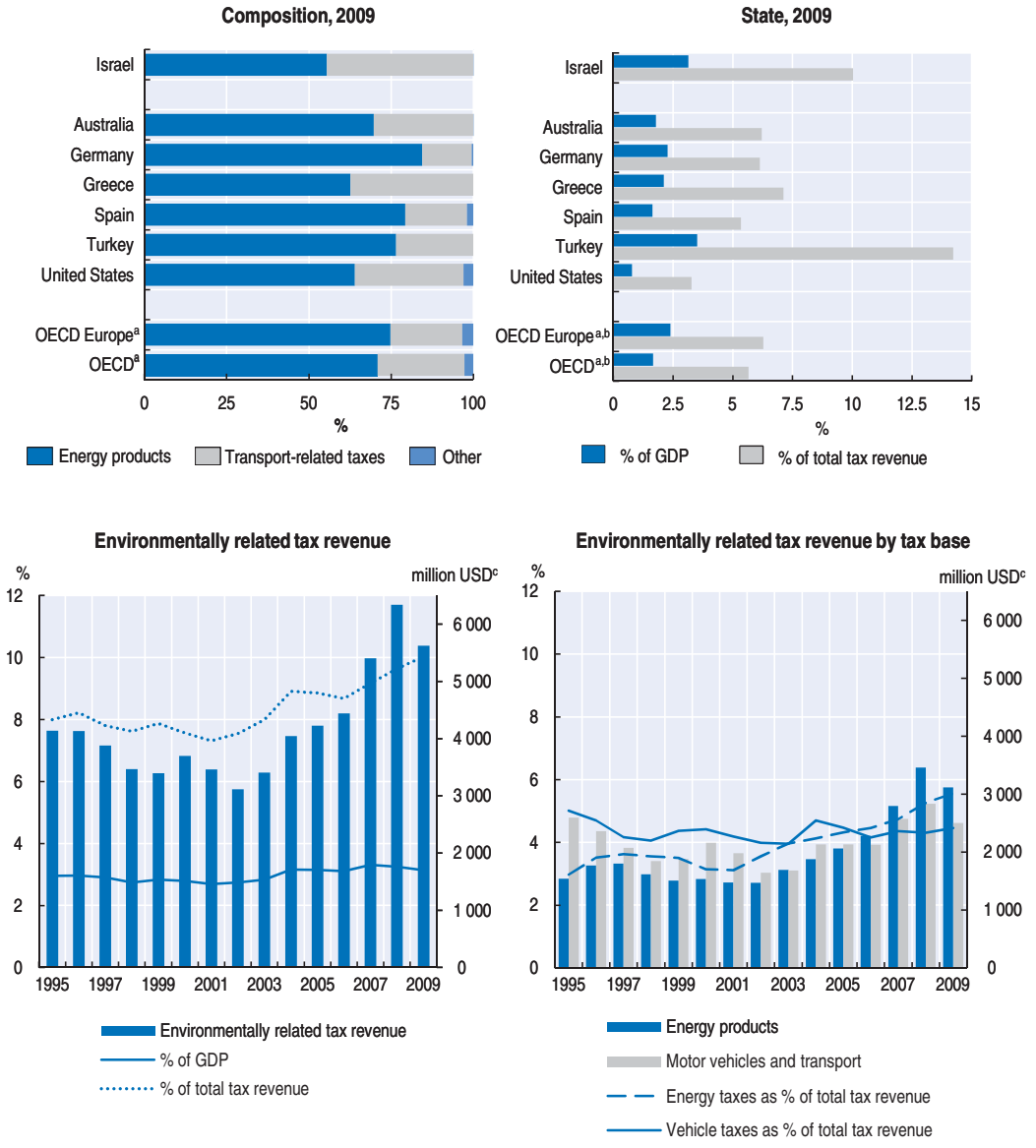
Inelasticity of demand for private car transport, partly due to the insufficient development of public transport networks and services, has turned vehicle and fuel taxation into a major source of tax revenue, but without affecting transport decisions and associated environmental impacts (BOI, 2011). Revenue from both energy taxes and vehicle taxes has increased considerably since 2000. In particular, fuel tax receipts have more than doubled due to progressive adjustments of the tax rates and increased fuel consumption. While fuel taxes have historically accounted for a smaller share of revenue than vehicle taxes, their share in total tax receipts grew steadily in the 2000s. At 5.5% in 2009, it was higher than the share of revenue made up by vehicle taxation (4.5%). As a result of rate increases (see below) and heavy reliance on road transport, Israel collects higher fuel taxes as a percentage of GDP than the OECD average. At the same time, high vehicle purchase taxes (see below) result in vehicle taxes accounting for a larger share of environmentally related tax revenue than in many other OECD countries (Figure 1.4).

Taxes on energy products

Excise duties are imposed on fuels for stationary purposes (coal and natural gas for electricity generation, fuel oil for industrial use and electricity generation, and light fuel oil for domestic use) as well as on petrol and diesel for transport purposes.

Transport fuel prices and taxes increased substantially in the 2000s and are relatively high compared to those in many other OECD countries (Figure 1.5). The government's goal since 2005 has been to attain tax parity for petrol and diesel. In contrast with many other countries, in Israel biodiesel does not benefit from any tax exceptions. In January 2011, excise duties on fuels were raised by NIS 0.2 in the framework of the fiscal consolidation programme. However, in response to public protests, this increase for petrol (the most used transport fuel) was removed soon afterward although it remained in place for diesel. As a result, in early 2011 the excise duty on diesel was only about 5% lower than that on petrol and was among the highest in the OECD. However, the shares of taxes (including VAT) in petrol and diesel retail prices are around 56% and 52%, respectively, less than in a number

Figure 1.4. **Environmentally related taxes**



a) Data refer to all current OECD member countries.
b) Weighted average.
c) Constant 2005 prices.
Source: OECD/EEA database on instruments used for environmental policy; OECD (2010), *OECD Economic Outlook No. 88.*

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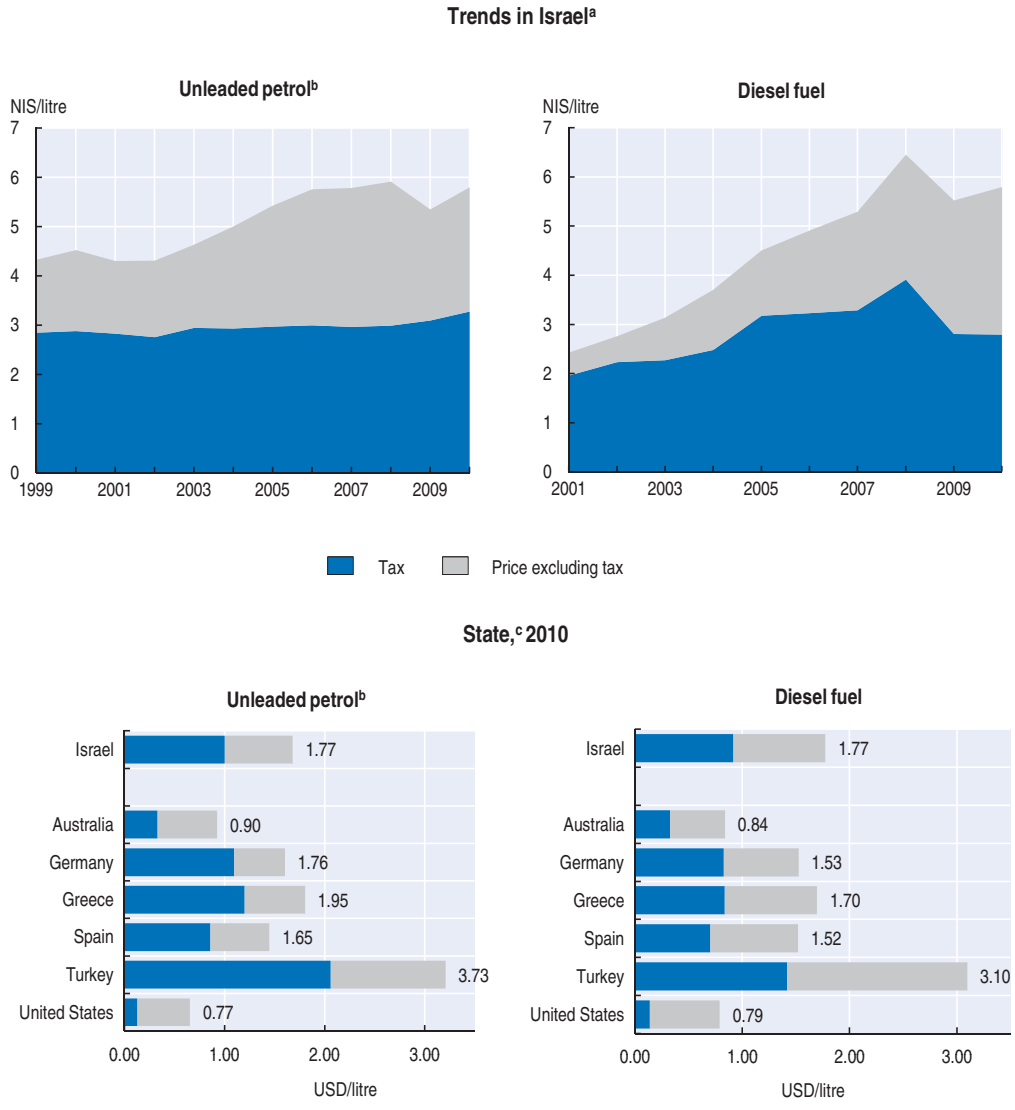
of other OECD countries (*e.g.* Germany, the Netherlands, Norway, Sweden and the United Kingdom), suggesting that there is some scope to further increase petrol and diesel taxation with a view to achieving the government's budget consolidation targets. This might prove difficult in practice, as shown by the 2011 public protests in the face of rising fuel prices and taking into account the current combination of relatively high fuel taxes and high vehicle purchase taxes.

Tax rates on fuel for stationary purposes have not changed much in the last few years, with the noticeable exception of that on coal, which used to be substantially below the rate applied to other fuels. Increased to NIS 43.3/tonne (from NIS 8.6/tonne) in 2011, it is now

substantially higher than the excise duties on heavy oil and natural gas. This is consistent with the higher externalities generated by coal combustion (notably, the carbon content of coal is higher than that of natural gas) and may further encourage a shift away from coal-fired electricity production. However, excise duty rates on coal, oil and gas generally do not fully reflect the environmental impacts of fuel use. In particular, they do not include a carbon price. Palatnik and Mordechai (2010) found that a carbon tax (per tonne of CO_2 emissions) in Israel would significantly reduce emissions with only a minor economic impact, even if the rate of taxation were set at a relatively high level. In the absence of an economy-wide carbon tax, however, excise duties imposed on fossil fuels could be adjusted to reflect a carbon price component (Chapter 6).

Figure 1.5. **Road fuel prices and taxes**



a) At constant 2005 prices.
b) Unleaded premium (RON 95).
c) At current prices and purchasing power parities.
Source: OECD-IEA (2011), *Energy Prices and Taxes Database.*

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Vehicle taxation

Vehicle taxation has long been an important source of revenue for the Israeli government. Following the so-called "Green Taxation Reform" in August 2009, the vehicle purchase tax, which had been uniform, was differentiated on the basis of vehicles' environmental performance: the tax is calculated as a percentage of the vehicle pre-tax price (83%) net of a rebate based on a "green index". In practice, the effective tax rate varies from 40% for vehicles in the lowest emission category to 83% for those in the highest (*i.e.* zero rebate). Reduced rates apply to electric and hybrid cars (10% and 30%, respectively), implying quite substantial implicit subsidisation of these vehicles (OECD, 2011b).[6]

The "green index" system differs from similar environment-based vehicle taxes in other OECD countries, in that the index is calculated according to emissions of local pollutants (carbon monoxide, hydrocarbons, nitrogen oxides and particulates) in addition to carbon dioxide (CO_2) emissions. Emissions are weighted according to their respective social costs.[7] As a result, on average, the CO_2 emission level accounts for about 90% and 65% of the green index for petrol and diesel cars, respectively. This system gives car buyers less incentive to favour diesel over petrol vehicles, as opposed to tax differentiation based exclusively on CO_2 emissions. While this can reduce the potential climate change mitigation incentive, it avoids over-incentivising diesel vehicles in a country which suffers from relatively high air pollution and is prone to photochemical smog. The green index needs to be revised regularly to take account of improvements in vehicle technology. The green index is to be revised on the basis of updated estimates of the social, environmental and health costs of pollution from transport, to be produced by the MoEP in 2011.

While taxes on vehicle ownership are theoretically less economically efficient than fuel taxes and road charges in reducing emissions (OECD, 2009), in the first year of implementation this reform contributed to shifting purchase decisions towards more fuel-efficient, low-emission cars without major changes in tax revenue (Chapter 5). Rising fuel prices in the second half of 2009 and in 2010 may also have played a role. Moreover, the overall impact on emissions also depends on actual car use and, to date, this has not been assessed.

Vehicle taxation remains very high compared to international practice. The *OECD Economic Survey of Israel* (OECD, 2010a) recommended lowering the tax rate, due to its potentially highly distortive effects, while expanding the use of fuel taxes and road charges to target vehicle use. This recommendation is supported by an analysis by the Bank of Israel (BOI, 2010). It found that a relatively moderate increase in the petrol excise duty would reduce distance travelled more than an increase in the vehicle purchase tax generating a comparable revenue; it also found that an increase in the petrol tax compensated by a decrease in the vehicle purchase tax (so as to leave tax revenue unchanged) would reduce distance travelled.

Other environmentally related taxes, charges and fees

Israel has made progress in using taxation on products other than fuels and vehicles to achieve environmental objectives, as well as in using other economic instruments such as user charges and fees. However, such taxes represent a negligible share of environmentally related tax revenue and of GDP and their use could be extended.

In the waste sector, a landfill levy was introduced in 2007 with the aim of diverting waste disposal from landfill towards more efficient management and treatment systems.

Landfill operators are charged this levy per tonne of waste sent to landfill. The levy is differentiated by type of waste and landfill, with the highest rate charged for sludge and the lowest for construction and demolition waste. The rate on unsorted household waste was initially very low (NIS 10/tonne), but is set to gradually increase to NIS 90/tonne by 2015 (Chapter 7). Revenue is collected in the Maintenance of Cleanliness Fund (Section 3.1). In 2009, the levy covered about 12% of the average cost of waste disposal, compared to an average 50% in European countries, and did not fully reflect the externalities associated with landfilling (*e.g.* soil and groundwater contamination, GHG emissions) (BOI, 2010). A 0.25% fee on the sale or import value of beverage containers (paid by manufactures and importers) and a deposit/refund system for small beverage containers are also in place (Chapter 7). The landfill levy, together with other levies foreseen in legislation on packaging and tyres, are expected to increase the share of non-fuel and vehicle related environmental taxes in GDP to 0.16% in 2015 (BOI, 2011), from less than 0.05% in 2009.

In the water sector, in addition to water and wastewater charges, a water extraction levy is imposed on water consumers and partly reflects the scarcity value of water resources. The rate is higher for groundwater than for surface water, and is differentiated by sector: farmers pay a lower rate than domestic and industrial consumers (OECD, 2010c). The introduction of a marine pollution tax on direct sewage discharges to seawater is being considered (Chapter 4).

Other fees are imposed for the purpose of quarry restoration and marine pollution prevention. Quarry operators pay a fee calculated according to the type and quantity of material quarried and sold. Ships calling at Israeli ports and oil unloading platforms pay a marine environment protection fee, which varies according to the size of the ship and the amount of oil. Both fees are paid into dedicated funds: the Quarry Restoration Fund and the Marine Pollution Prevention Fund, respectively (Section 3.1).

The introduction of other economic instruments is being considered. In particular, the Clean Air Law, which entered into force in 2011, allows for the introduction of a levy on air emissions from industrial facilities (Chapter 6). The government should implement such a levy, targeting priority pollutants emitted by large and medium-sized stationary sources. The possibility of introducing other charges for coastal and marine protection is being explored. They would be imposed on owners or operators of coastal facilities and marine installations which have potentially adverse effects on the coastal and marine environment.

The inter-ministerial committee on green taxation has estimated that introducing a tax on low-efficiency appliances would reduce electricity consumption by nearly kWh 7 billion over ten years, as well as reducing electricity peak demand. The option of introducing a tax on incandescent light bulbs (NIS 8) has also been discussed, with a view to fully banning them. In general, provided that consumers have adequate information about appliances' energy consumption, raising electricity prices so that they reflect the environmental impacts of appliance use would address such impacts more cost-effectively than taxing appliances. However, insofar as purchase taxes on durable goods are imposed for revenue raising purposes, differentiating these taxes according to energy efficiency (or, more generally, environmental performance) provides incentives to consumers to make more environmentally friendly purchases. It also helps to compensate for consumers' often imperfect understanding of the energy consumption consequences of their behaviour and short-sighted consumption decisions.

3.3. Environmentally harmful subsidies

The government provides various forms of financial assistance to businesses in a number of sectors. Tax exemptions are used extensively, but are often not economically justified or applied in a consistent manner (OECD, 2010a). Overall, while Israel is not more subsidy-oriented than many other OECD countries, some sectors (*e.g.* agriculture) benefit from relatively high levels of support. Some forms of assistance can be highly distortive and provide environmentally harmful incentives to production and consumption. Therefore, the government should consider removing them.

In 2011, for the first time, the MoEP undertook a survey of environmentally harmful subsidies. Subsidies to fossil fuel production and consumption, agriculture, and car ownership and use were identified. Surveying and quantifying such subsidies proved difficult, mainly due to inconsistencies in the legislative framework. Thus, the survey represents a commendable first step but does not provide a sufficient basis for identifying and assessing the environmental and economic impacts of environmentally harmful subsidies.

Fossil fuel subsidies

Diesel for commercial use (which accounts for nearly all diesel use in Israel) is partially exempted from excise duties. Freight transport, bus and taxi enterprises are entitled to a 45-50% tax refund. Off-road uses, *e.g.* in the agricultural and fishing sectors, are entitled to a 69% tax rebate. As in most other OECD countries, aviation fuel is exempted from taxation. Preliminary estimates indicate that revenue losses due to such exemptions and rebates have increased considerably since their introduction in 2005 and amount to about NIS 3 billion/year (Shmueli, 2011). In addition to representing lost revenue for the government, such rebates lower end-use energy prices and reduce incentives to use energy efficiently.

While many excise duties on fossil fuels were raised by NIS 0.2 in 2011 (Section 3.2), tax rates on petrol and petroleum coke remained unchanged. The tax rate on petrol was already relatively high, but that was not the case for petroleum coke, which is among the most polluting and carbon-intensive fuels. It is used almost exclusively in cement production and is completely imported. According to Shmueli (2011), lost revenue due to the exclusion of petroleum coke from the tax rise is NIS 33 million in 2011-12. This represents an implicit subsidisation of the use of such fuel instead of cleaner ones. The tax rate on petroleum coke is set to be gradually increased to NIS 78/tonne by 2014.

In December 2010, the government announced it would provide one-time incentive grants to companies switching from the use of petroleum fuels to natural gas. Some NIS 120 million (USD 35 million) was to be distributed in coming years to some 400 factories (OECD, 2011c).

Israel's concession-based regime for taxing hydrocarbon production, dating from 1952, was revised in April 2011. The previous system was particularly favourable to production companies in that it allowed for several deductions and tax breaks, which substantially reduced companies' tax liabilities. An OECD analysis (OECD, 2011c) estimated such tax benefits at more than NIS 700 million during the period 2004-09, which exceeded the government's revenue from royalties. In this respect, fossil fuel production was being subsidised. The new fiscal regime attempts to correct this type of distortion. It has significantly raised the effective tax on resources to a level much closer to that which is typical in other OECD countries (OECD, 2011b). The new regime is being applied to existing development projects and, in these cases, transitional provisions have been made to lighten the tax burden and encourage production and development.

Agricultural support

As in many other OECD countries, agricultural producers receive various forms of support. An in-depth OECD review of Israel's agricultural sector (OECD, 2010c) concluded that the level of support had declined since the mid-1990s, in terms of what is provided to farmers and the cost to the economy as a whole. In particular, support for farmers, as measured by the share of producer support estimate,[8] declined from 24% in 1995-97 to 17% in 2006-08. It is now below the OECD and EU averages (OECD, 2010c). However, according to the review, the composition of agricultural support has become increasingly distortive and is mostly tied to production levels, due to: *i*) high border protection for agricultural commodities, which pushes domestic prices above international levels; and *ii*) the large share of on-farm support provided through payments associated with production inputs. These forms of support can also be environmentally harmful since they stimulate production and input use, with potentially negative impacts on the use of water, land, fertilisers and pesticides.

Water, a key factor in agricultural production, is still heavily subsidised. Water support has decreased, especially since 2000, and water prices for agriculture have risen. However, farmers still pay water tariffs below those paid by domestic and industrial consumers and below the opportunity cost of producing freshwater. Furthermore, they pay a lower water extraction levy than industrial and domestic users, representing an implicit subsidisation of agriculture averaging NIS 90 million/year in 2000-08 (OECD, 2010c). A 2006 agreement between the government and farmers scheduled progressive increases in water charges, so that they would cover the average cost of water production by 2017 (Chapter 4).

Incentives to car ownership and use

Distortionary incentives for car ownership and use persist, with potentially negative environmental impacts. Employees in the banking and civil service sectors are eligible to receive a car allowance (for the maintenance of a private a car) as part of their salaries. A Bank of Israel analysis found that, as a result, in households with one member working in one of these sectors, the average number of cars is 12% higher than in other households. Replacing the allowance with forms of compensation not linked to car ownership has potentially high long-term costs, as including the allowance in the basic salary would increase the basis for calculation of pensions and other social benefits. However, this would reduce by about 10% the number of vehicles owned by employees in the banking and public sectors, which are mostly concentrated in large metropolitan areas and Jerusalem (BOI, 2008a). Removing the car allowance would have positive impacts on the environment, including lower emissions of GHGs and air pollutants (resulting from a reduction in car use) and of end-of-life vehicle waste.

The leasing arrangement and tax treatment of company cars also create an incentive for car use. The Bank of Israel (2008b) estimated that distance travelled by those holding a company car was 24% greater than that travelled by those who own their cars. Since company cars represent a large share of the overall car fleet, the total distance travelled was estimated to be 5% to 8% higher because of company cars. Employees have been (moderately) taxed on the benefits associated with company cars only since 2008. From 2010, the imputed taxable benefit for a company car holder is linked to the actual price of the car including the vehicle purchase tax, which varies according to emission levels (Section 3.2). This encourages companies to buy less polluting, more fuel-efficient vehicles. However, all the costs of company cars remain fully deductable from corporate taxation and, in particular,

there is no cap on deductable fuel expenses. In addition, leasing arrangements for company cars usually allow unlimited travel in return for a fixed payment. This implies that employers have no incentive to limit the use of company cars by their employees; hence, car holders do not face any additional cost linked to actual car use and have no incentive to drive less or more efficiently (Chapter 6). While it remains difficult to distinguish between personal and work use of a company car, some form of limitation on car use, *e.g.* in the form of a cap on tax deductable fuel expenses, should be considered.

Free parking for employees is also provided by many employers. For an employer, provision of parking space is an expense that is deductible from corporate taxable income; for an employee, it is a non-taxed benefit in kind. Employees who do not drive to work do not receive an equivalent benefit and are therefore discriminated against (BOI, 2008b). Not only does this form of subsidy encourage car use, but it encourages driving to work (*i.e.* mainly at rush hours and to/from particularly congested locations), exacerbating congestion, accident risks and environmental problems. Such incentives should be removed, *e.g.* by including the availability of parking spaces among taxable benefits in kind. The environmental effects of removing these distortionary incentives for car ownership and use would be enhanced to the extent that efficient and reliable alternatives to private car transport are made available (Chapter 6).

4. Promoting environmental technologies, goods and services

4.1. *Eco-innovation performance*

Israel has a strong export-oriented high-tech sector, which continued to grow in the 2000s. In 2007, high-technology industries contributed 1.6% to the manufacturing trade balance (OECD, 2010d). Contributing factors include: a fairly large defence industry; technological training during military service; a large pool of researchers; engineering and science skills brought by the wave of immigrants in the early 1990s; and high level of tertiary attainment (OECD, 2010a).[9]

Israel's innovation performance is one of the highest in the OECD. In 2008, it had the highest gross expenditure on research and development (R&D) at 4.9% of GDP, most of which was funded and carried out by the business sector. Business expenditure on R&D was 3.9% of GDP, more than in any other OECD country. With 66 triadic patents filed per million population, Israel ranked fifth in the OECD in 2008 (OECD, 2010d).[10] Medical technologies, pharmaceuticals and information technologies have long been at the core of the country's high-tech sector.

Israel has a strong potential and comparative advantage in the field of environmental technologies, or "clean-tech" (as this sector is widely called in the country). For many years, its researchers and firms have been working on ways to grow crops with scarce water resources and reduce reliance on imported fossil fuels. Water and solar energy technologies are therefore particularly advanced and have been developed in areas where Israel possesses international expertise.

As of 2007, 270 water technology companies operated in Israel, employing almost 8 000 people. About 22% were start-up companies, established after 2001 and undertaking R&D activities, especially in the area of wastewater technologies. Exports of water technologies grew from USD 700 million in 2005 to around USD 1.1 billion in 2007 (OECD, 2010e). Overall, there are about 500 companies in the clean-tech sector, most of which are specialised in water and renewables technologies. These companies' export value doubled

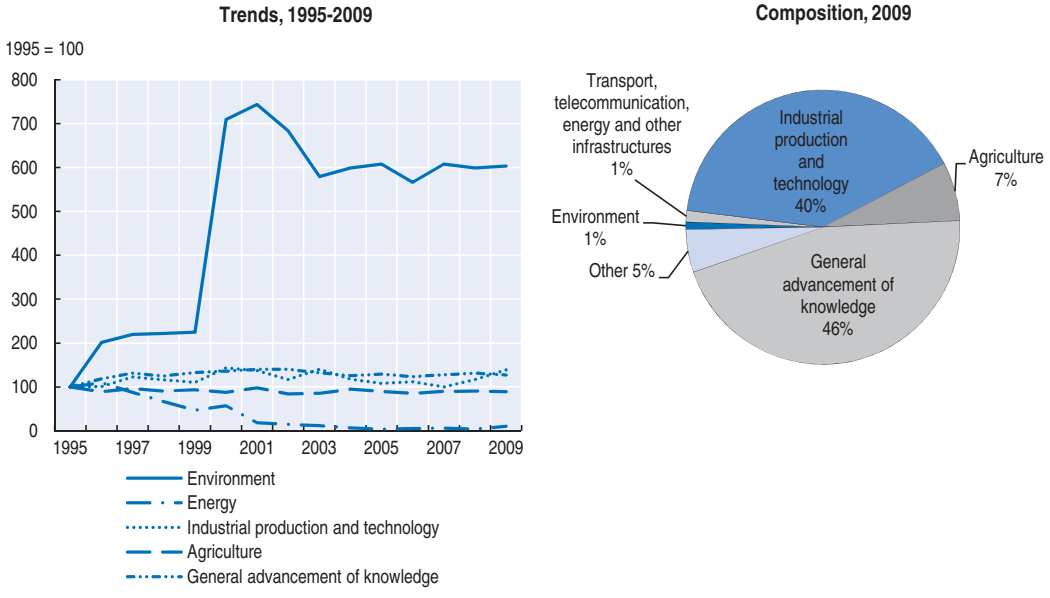
between 2005 and 2008. Many new companies have started to operate in the renewables technology sector, especially since 2008 when the first feed-in tariff for photovoltaic-produced electricity was launched (Chapter 6).

While Israel's early clean-tech development was "born out of necessity", recent growth has mainly been export driven. There is increasing global demand for environmental technologies and services to respond to rising material and energy prices, growing public awareness, and the introduction of more stringent environmental standards. Today the government and industry leaders consider the clean-tech sector to be a "growth engine".

Environmentally related R&D

As already noted, environmentally related R&D is funded and carried out mostly by the business sector. Environment represents less than 1% of government R&D outlays (excluding defence related R&D), among the lowest share in the OECD.[11] However, agricultural research, which may include research in the area of water technologies, accounts for about 7%, one of the largest shares of government R&D outlays among OECD countries (Figure 1.6). Government budgeting for R&D for environmental purposes increased seven-fold (in real terms) at the end of the 1990s, although from a very small amount, and has stabilised since 2003. This was a rate of growth not seen in any other research branch. In contrast, the R&D budget for both agriculture and energy decreased in the last decade (Figure 1.6).

Figure 1.6. **Government R&D outlays by socio-economic objectives**



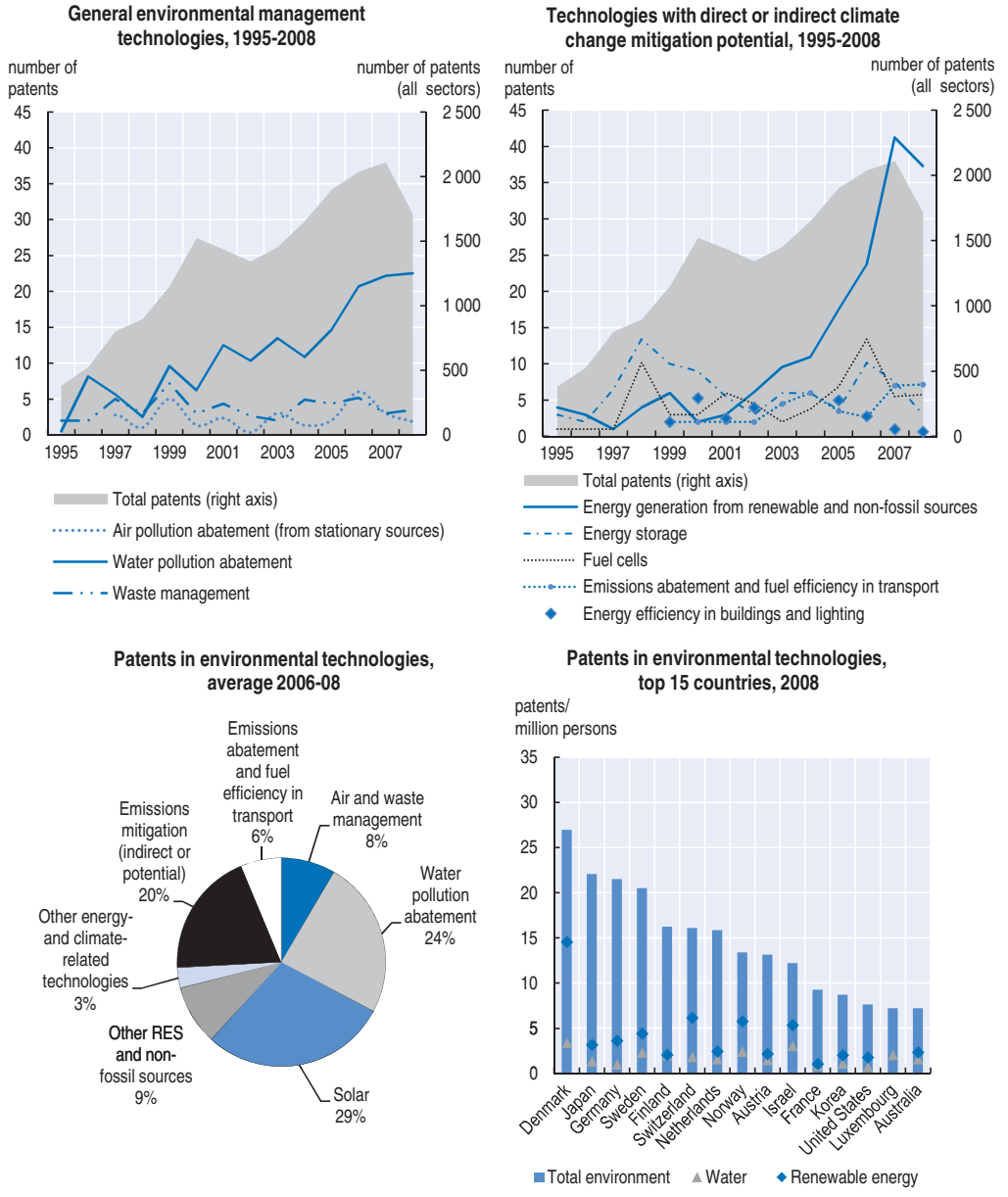
Source: OECD (2011), *OECD Science, Technology and R&D Statistics Database.*

StatLink http://dx.doi.org/10.1787/888932495095

Patents in environmental technologies[12]

Technologies for water pollution abatement stand out among environmental management technologies in terms of patent applications. The number of these applications has increased rapidly since the mid-1990s, even more rapidly than overall patenting activity since the mid-2000s (Figure 1.7). This contrasts with trends in most other

Figure 1.7. **Patents in selected environment- and climate-related technologies**[a]



a) Patent counts are based on the priority date, the inventor's country of residence and use fractional counts on PCT filings at international phase (EPO designations).

Source: OECD (2011), *OECD Patent Statistics Database*; OECD, Environment Directorate.

StatLink http://dx.doi.org/10.1787/888932495114

countries, where the number of patents in water (and waste) technologies has tended to stabilise in recent years (OECD, 2011d). Policies implemented to cope with water scarcity through the reuse of treated wastewater have largely contributed to this situation. In particular, increased prices of potable water coupled with lowered prices of treated water for irrigation, and restrictions on sewage dumping, have stimulated the development of advanced sewage treatment technologies. The steep growth in patent applications since the mid-2000s partly results from the significant increase in prices of potable water

responding to consecutive years of drought. Many water technology start-ups were established during these years (OECD, 2010e). In addition, water quotas in the agricultural sector have encouraged farmers to save water and stimulated innovation in water-efficient technologies such as drip irrigation; high prices for industrial and domestic water have contributed to the development of water-saving devices; and water loss fines for municipalities have created incentives to develop water loss detection and dynamic water pressure equipment.[13]

Since 2000, the number of patent applications in renewable energy technologies, especially solar thermal and photovoltaic, has grown even faster than in water technologies and in overall patenting activity (Figure 1.7). The main contributing factors include: wide use of solar thermal energy; a renewed policy effort to increase the share of renewables in electricity generation (Chapter 6); and increased demand for such technologies in other countries, especially in European and other Kyoto Protocol Annex I countries (Haščič *et al.*, 2010).

In 2006-08, water and solar technologies together accounted for more than half of all patents in environmental technologies, followed by energy storage, fuel cells and hydrogen technologies. This latter technology group, which has the potential to make indirect contributions to decreasing GHG emissions, made up 20% of environmentally related patents. Innovations targeting the environmental performance of the transport sector accounted for a relatively low share of patents in the same period. This area is regarded as having strong development potential in Israel; in 2011, the government launched a programme to support the development of alternatives to oil use in the transport sector (Box 1.4). Patenting activity in the areas of air pollution, waste management and energy efficiency technologies has not followed a consistent trend. These technology branches accounted for a comparatively small share of environment- and climate-related inventions (Figure 1.7).

As a small country, Israel does not account for a large share of inventions in environment- and climate-related technologies in OECD countries. However, with more than twelve patents filed under the Patent Co-operation Treaty (PCT) per million population in 2008, it ranked among the most innovative countries in environmental technologies (Figure 1.7). In particular, it had the second and fourth highest number of patents per million population in water management (3.1) and renewable technologies (5.4), mainly solar, respectively. Environment- and climate-related technologies accounted for only 4% of total Israeli patents filed under the PCT in 2006-08, a small share compared to most other OECD countries.

Overall, despite growth in both innovation and business activity in the clean-tech sector, Israel's share of the world environmental technologies, goods and services market is estimated to be below its potential (Ayalon and Lavee, 2007). Its clean-tech industry is made up of relatively small businesses that have difficulty competing with big corporations that hold a large share of the world market. In particular, the small business dimension and risk inherent in developing new technologies, especially in the environment sector, limit the possibilities of gaining access to credit and venture capital.

Moreover, the domestic market for environmental technologies is small and provides only limited opportunities for growth (OECD, 2010e). This market developed slowly during the 2000s due to slow implementation of environmental legislation and regulations and lack of clear environmental standards (Golovaty, 2006). For instance, environmental

Box 1.4. **Alternatives to oil for transport use**

Israel has undertaken a project to encourage the development of alternatives to oil for transport use. In January 2011, the government approved the national initiative for the development of petroleum alternatives in transportation. This initiative, which includes financing for ten years, aims to create a domestic industry which will serve as a "world catalyst to reduce oil dependency in transportation". It also aims to strengthen linkages among all the relevant actors, including vehicle and engine manufacturers, fuel producers and distributors, energy suppliers and policy makers.

Biofuels, synthetic fuels, electric cars, fuel cells and alternative engine technologies are among the substitutes being promoted. Israel has already carried out advanced research in related scientific fields. Investments of about USD 200 million have been made in 60 companies and start-ups. A number of existing industrial clusters (such as chemicals, software and electronics, agriculture and defence) could play a key role in developing alternatives to oil for transport.

The initiative will finance basic research, support industrial R&D and project finance, and provide technical assistance. In particular, it includes:

- funding and tax benefits for R&D companies;
- a "one-stop shop" to accelerate and simplify bureaucratic procedures for companies;
- assistance in establishing pilot facilities to test business feasibility and prospects;
- long-term research grants for academic and applied research on oil substitutes, and centres of excellence, research grants and scholarships, aiming to double the number of researchers in Israel;
- strengthening of bilateral funds and co-operation agreements with foreign R&D bodies;
- promotion of international conferences;
- instituting the Prime Minister's Award for worldwide innovation in the field of oil substitutes.

Source: Israel Prime Minister's Office, Oil Substitutes Division.

standards have mainly been imposed on companies by means of company-tailored, annually renewed business licences and administrative orders, often on the basis of internal MoEP policies. This has created uncertainty and probably discouraged firms' investment in new technologies. The situation is likely to improve with the introduction of general binding rules and best available techniques (BAT) requirements for large industrial facilities (Chapter 2). The public sector does not provide additional demand for new environmental technologies, as public procurement tenders are often biased towards traditional technologies or require the adoption of validated ones (Golovaty, 2006; Ayalon and Lavee, 2007).

4.2. The eco-innovation policy framework

Institutions

A number of ministries are involved in promoting eco-innovation and several research institutes are active in the field of environmental technologies. The Ministry of Industry, Trade and Labour (MITL) is the key public actor with regard to innovation and eco-innovation policy. Other relevant ministries include: the MoEP, the Ministry of National

Infrastructures (renewable energy and energy efficiency technologies) and the Ministry of Agriculture and Rural Development (water technologies). The Israel Science Foundation is the country's primary source of funding for basic research. With an annual budget of about USD 60 million, mostly transferred from the state budget, it sponsors more than 1 300 research grants per year.

Support programmes

The 1984 Law for the Encouragement of Industrial Research and Development (R&D Law) is the main instrument supporting R&D investment by businesses. It entrusted the Office of the Chief Scientist (OCS) of the MITL with the responsibility of overseeing all government-sponsored R&D support. The OCS manages most R&D incentive programmes, with a budget of about USD 300 million/year. These programmes are tailored to the different R&D stages (from pre-seed/seed and start-up to mature technology) and support an array of technologies, including in environmentally related sectors. Depending on the type of grant, successful projects that reap commercial returns are required to pay back grants received. This revenue represents a major source of the OCS funds (OECD, 2010a). The OCS grant mechanism is therefore similar to a system of high-risk loans through which the government shares the risk inherent in innovation projects. Other R&D grants are channelled through the offices of the Chief Scientist in different ministries. The state supports special business parks or business incubators. R&D tax benefits are also available.

In addition to existing economic incentives such as feed-in tariffs for renewable energy sources (Chapter 6), in recent years the government has launched several programmes specifically to support eco-innovation, particularly in the fields of water and energy technologies (Box 1.5).

Technology verification

According to the MoEP, the lack of a national verification process for environmental technologies is a barrier to Israel's exports since the demand is usually for technology that has been tested and verified. In 2010, the MoEP launched a programme, with a budget of USD 1.2 million, to support technology developers in obtaining verification from internationally accredited centres. This takes the place of the establishment of such a process domestically, which might be overly costly considering the relatively small size of the Israeli clean-tech market.

Overall, Israel has a well-developed system for providing financial assistance to new and innovative companies. However, there are inefficiencies in government financial support and an overall paucity of venture capital in the environmental technology field (OECD, 2010e). Assistance by the OSC covers all R&D stages, but little support is provided at the demonstration stage, which delays entry into foreign markets. R&D support programmes are focused on water and renewables, with little attention given to other environmental technologies. More financial and technical assistance to the commercialisation and marketing phases is also needed (especially to reach foreign customers), as well as export credits and insurance.

Ayalon and Lavee (2007) estimated that if the government extended clean-tech support from the start-up stage to the commercialisation phase, Israel's share of the world environmental technology market could reach 3.6% by the mid-2020s (as opposed to 1.8% under a business-as-usual scenario). After 2012, the revenue from taxes paid by clean-tech

Box 1.5. **Eco-innovation support programmes**

- NEWTech, National Water and Energy Programme: Launched in 2006, this programme aims to promote the water technology and renewable energy sectors. It is led by the Ministry of Industry, Trade and Labour (MITL) in co-operation with more than ten government ministries and agencies. The first phase of the programme focused on water technologies by financially supporting R&D and the participation of Israeli companies in water-related events. Following positive experience during the first phase, in 2008 the programme was extended to the renewable energy sector. Its goal is to double exports of water conservation and sustainable energy technologies by 2011 compared with 2008.
- WaTech: This programme supports new innovative water technology solutions, with a view to their adoption by the National Water Company (*Mekorot*) and local water utilities. WaTech provides demonstration and commercial platforms for technologies at the early stage of development, technology analysis, access to global markets and assistance with fundraising. It also offers more mature water technology vendors the opportunity to enter into commercial arrangements and joint projects with *Mekorot* and local water utilities.
- Technology Center of Renewable Energy in the Negev: The Center, to be established in 2011, aims to promote university-industry co-operation in R&D on renewable energy technologies. It is expected to oversee each project from the basic research to the technological feasibility stages, and to provide R&D assistance to industrial companies, including training. The state and the Arava Group, which won the tender for the management of the Center, are expected to invest about USD 15 million each over five years.
- Katamon: This programme supports the transfer of water technologies from academic institutions to industry through co-operation agreements. It had a budget of NIS 6 million in 2009-11.
- Magnet: This programme supports the formation of consortia of industrial companies and academic institutions to jointly develop pre-competitive technologies. There are special tracks for water and renewable energy.
- Strategy fund: This is a start-up fund for renewable energy and energy efficiency, managed by the Ministry of National Infrastructures.

Source: OECD (2011e).

companies would exceed government investment in this industry. At home, providing a clear environmental regulation framework, increasingly based on economic incentives, and strengthening implementation of environmental legislation would help increase demand for environmental technologies and related market opportunities.

5. Corporate environmental responsibility and trade policy

In the second half of the 2000s, several initiatives were taken to encourage companies and financial institutions to better consider the environmental aspects of their activities. In particular, under the 2006 Law for the Encouragement of Capital Investment, provision of public grants to companies should take into account the environmental performance of the beneficiaries (*e.g.* their record of compliance with environmental legislation). However,

this requirement has not been implemented yet and the related environmental guidelines are awaiting approval. Other initiatives include:

- the requirement for companies trading on the stock exchange to disclose environmental risk information to the Israel Securities Authority (in force since 2004, and revised in 2010);
- the Bank of Israel's guidelines on the assessment of environmental risks when granting loans to companies;
- the Ministry of Finance's guidelines on the management of environmental risks in financial institutions (pension funds);
- the Government Companies Authority's guidelines on sustainable development policies and environmental risk management in state-owned companies;
- the update of the Maala Index for Social Responsibility, which rates companies included in the Tel Aviv 100 Index according to four areas: human rights and the workplace, corporate ethics, community involvement and the environment. The MoEP has also been working on an environment-based ranking of companies listed in the Tel Aviv 100 Index.

Israel has been an adherent to the OECD Declaration on International Investment and Multinational Enterprises since 2002. The OECD Guidelines for Multinational Enterprises (part of the Declaration) are intended to encourage and assist OECD members to promote responsible business conduct, including in the field of the environment. In accordance with the Guidelines, Israel established a National Contact Point (NCP) within the Foreign Trade Administration of the Ministry of Industry, Trade and Labour. The responsibilities of the NCP include: publicising and providing information on the Guidelines within the business community; responding to inquiries; contributing to the resolution of issues relating to the implementation of the Guidelines; and reporting to the OECD.

The Israel Export Insurance Corporation, Ltd. (until 2005, the Israel Foreign Trade Risks Insurance Corporation) is responsible for encouraging exports by insuring medium- and long-term export credit transactions. Fully owned by the Israeli government, it is in the process of introducing requirements and procedures for considering environmental aspects when deciding on project support. This is in line with Israel's commitment, in the context of its accession to the OECD, to implement the 2007 OECD Council Recommendation on Common Approaches to the Environment and Officially Supported Export Credits by the end of 2011.[14]

Israel has Free Trade Agreements (FTAs) with eight partners.[15] Within the framework of the 2003 government decision on sustainable development, one of the responsibilities assigned to the Ministry of Industry, Trade and Labour is to ensure "The inclusion of environmental and social considerations in the consolidation of trade agreements and their implementation". However, no environmental annexes or stipulations are included in any of the existing FTAs or in other trade-related bilateral or multilateral agreements. This contrasts with practice in many other OECD countries, where environmental provisions are often included in FTAs (OECD, 2007).

Notes

1. The outlook is expected to be a forward looking document that considers where trends are leading and what their implications could be for environmental policy.
2. Public environmental protection expenditure estimates include all purposeful activities directly aimed at the prevention, reduction and elimination of pollution or any other degradation of the environment resulting from the production process or from the use of goods and services.

3. Public specialised producers include all corporations and quasi-corporations that provide environmental protection services mainly financed by the users, and that are subject to control by government units. Control is defined as the ability to determine general corporate policy.
4. Water supply is not included in environmental protection expenditure.
5. The share of environmentally related taxes in total tax revenue in 2009 might be due to the negative impact of the economic slowdown on corporate and income tax receipts. In 2008, it was 9.6%, much above the OECD average.
6. The rates on electric and hybrid cars are set to increase to 30% and 45%, respectively, by 2020.
7. The weights are 500 (carbon monoxide), 900 (hydrocarbons), 10 000 (nitrogen oxides), 20 000 (particulates) and 30 (CO_2).
8. The Producer Support Estimate percentage expresses the monetary value of public transfers to producers as a percentage of gross farm receipts.
9. Tertiary attainment is defined as the share of individuals with a post-secondary school qualification.
10. The triadic patent families are defined as a set of patents filed at the European Patent Office, the Japan Patent Office and the United States Patent and Trademark Office that share either or both the priority date (first date of filing of a patent application, anywhere in the world) and country (the country where the patent is first filed). Triadic patent data are consolidated to eliminate double counting of patents filed at different offices.
11. The allocation of expenditures to specific objectives is determined on the basis of managerial intentions at the time of commitment of the funds. Given the uncertainty associated with basic R&D, this may be difficult to establish with confidence.
12. The information in this section of the chapter is based on the number of patents filed under the Patent Co-operation Treaty (PCT) and on the inventor's country of origin.
13. Technologies for water efficiency are not shown in Figure 1.7.
14. This Recommendation [C(2007)65] calls for systematic reviews by member governments of proposed export credit projects to assess their potential environmental impacts.
15. EU (1975), European Free Trade Association (EFTA) (1992), United States (1985), Canada (1996), Turkey (1997), Mexico (2000), Romania (2001) and Bulgaria (2001).

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PART I

Chapter 2

Environmental management

In the last few years the government has promoted a more proactive approach to the development of environmental policy. This chapter examines Israel's environmental governance, which has traditionally been characterised by a fragmented legislative framework, highly centralised management responsibilities and extensive land use planning. It reviews progress made in ensuring the coherence of environmental legislation and regulations and in involving local authorities in implementing environmental policies. It analyses the drivers of the improved level of compliance with environmental standards, as well as the effectiveness of Israel's permitting and liability systems. Progress in promoting environmental democracy, through open access to information, improved public participation in the decision-making process and education, is also discussed.

Assessment and recommendations

During the last decade, Israel has adopted a number of important environmental laws including the Protection of the Coastal Environment Law, the Polluter Pays Law and the Clean Air Law. While these laws have strengthened the environmental regulatory framework, their development has generally been driven by NGOs and *Knesset* members rather than by a considered environmental legislative strategy on the part of the government. This has contributed to the fragmentation of Israel's primary environmental legislation. However, in recent years the government has played a more proactive role in the development of environmental legislation. Despite recent efforts to introduce integrated environmental permitting, the regulatory focus continues to be on individual media and end-of-pipe pollution control. Moreover, the widespread lack of regulations needed to implement the primary environmental laws weakens the legal framework within which individual businesses operate.

Israel has a highly centralised system of environmental governance, with officials of the Ministry of Environmental Protection (MoEP) having to address many – including relatively minor – environmental issues. This leads to inefficient use of the Ministry's limited human and financial resources. Although local authorities have recently been delegated certain permitting and enforcement powers for facilities that have low environmental impact, some smaller municipalities do not currently have the capacity to exercise these powers. The central government provides significant financial support and training to the existing local environmental units, but has limited influence over their performance in environmental policy implementation.

The MoEP is working to expand the scope and quality of environmental inspections, which has led to increased compliance levels. It also actively engages citizens in environmental compliance monitoring through a system of recruiting and training of volunteer "cleanliness trustees". However, most site inspections by the MoEP's main enforcement arm, the Green Police, remain sporadic and superficial. The low effectiveness and efficiency of inspections are exacerbated by the poor enforcement of self-monitoring requirements for regulated entities: very few businesses submit regular reports to the competent authorities, and most reports are not verified.

Israel has started important work to make environmental enforcement more rapid and proportionate to non-compliance through the development of a system of variable administrative fines for environmental offences under a broad range of environmental laws. Collection of existing fines has improved. Incorporating the recovery of economic benefits of non-compliance in environmental monetary penalties, as currently envisaged by the MoEP, would align Israel with best international practices. At the same time, the environmental liability system could be strengthened: regulated entities responsible for pollution rarely bear the costs of environmental remediation.

Israel has made significant advances with respect to non-regulatory environmental policy instruments. The government has facilitated the adoption of voluntary

environmental management standards and eco-labelling. It has also invested heavily in environmental education and has recently adopted a regulation allowing free public access to a wide range of environmental information.

While Israel has an elaborate system of strategic environmental planning, the environmental authorities operate without an adequate performance management framework. The effectiveness and efficiency of their activities are not measured, nor are they linked to planning and budget allocation. Although measuring environmental results is a well-recognised challenge, Israel could draw on the positive experience of OECD countries such as the United Kingdom and the United States to develop outcome indicators of environmental policy implementation, including compliance assurance.

Recommendations

- Implement integrated (cross-media) environmental permitting for facilities with high environmental risk; issue such permits based on advanced, process-related technological and management solutions, and using procedures that are open to public participation.
- Strengthen environmental policy implementation at the local level by making government subsidies to municipalities contingent on the establishment of viable environmental units (including units involving co-operation among local authorities), and by implementing compulsory training for such units.
- Strengthen the system of self-monitoring by requiring all facilities subject to such requirements to report regularly to the environmental authorities; enhance the capacity of environmental inspectors to undertake multi-media compliance monitoring and verification.
- Reinforce environmental liability for damage to natural resources by: expanding the use of administrative clean-up orders; strengthening legislative provisions (including those in the Prevention of Land Contamination and the Remediation of Contaminated Lands bill) for the recovery of remediation costs from responsible parties; and applying such provisions more vigorously.
- Introduce a system of performance indicators to monitor the effectiveness and efficiency of environmental policy implementation in the framework of result-oriented planning and budgeting.

1. Environmental policy and institutional framework

1.1. Institutional framework for environmental management

The main environmental authority in Israel is the Ministry of Environmental Protection (MoEP). Established in 1988 as the Ministry of the Environment (and renamed in 2006), it is the successor to the Environmental Protection Service created in 1973. The MoEP has 530 staff in some 30 divisions. By comparison, there were 305 employees in 2001 and about 600 are expected to work there in 2011. Although the MoEP's budget has increased significantly during the last decade, it accounted for less than 0.01% of the total government budget in 2008. This is much smaller than the budget of most other ministries (Chapter 1).

The MoEP operates on three different levels – national, regional and local:

- At the national level, it is responsible for formulating comprehensive environmental policy and specific strategies, standards and priorities for environmental protection and resource conservation.

- At the regional level, it operates through six regional (district) offices: North, South, Centre, Tel Aviv, Jerusalem and Haifa. The regional offices are responsible for implementing national environmental policy, participating in land use planning processes, guiding local environmental units, defining environmental conditions in the business licences of larger enterprises, monitoring and enforcing compliance with environmental requirements, and advancing environmental projects to solve regional problems, among others.
- At the local level, it provides guidance for the operation of 50 local environmental units covering about 90% of the population.[1] Some units are related to a single local authority, while joint units cover several authorities (regional environmental units or more formal associations of towns for the environment) (Box 2.1). In areas where there are no local units or associations of towns, the MoEP ensures environmental management through its regional offices.[2] The local units are responsible for environmental planning, addressing noise nuisances, waste management and recycling, and environmental education, among others. Some of these units are also responsible for air pollution monitoring and wastewater treatment systems. Over the years, more responsibilities have gradually been transferred to the local units, including business licensing and inspection of small facilities.

Box 2.1. **Associations of towns for the environment**

Associations of towns for the environment are statutory bodies, under the Associations of Towns Law (1955), with a board of directors. Each association is established by statutory order (under the responsibility of the Minister of the Interior) and encompasses several local authorities that are adjacent to one another and are specifically mentioned in the order. The function of these associations is to protect the environment and prevent environmental hazards and nuisances within their jurisdiction. An association of towns has all the powers vested in a local authority.

The first associations of towns for the environment were established in the vicinity of power stations to protect air quality in the plants' impact area. Their powers were subsequently expanded to include a wide range of environmental topics. For example, the association of towns for the environment in Hadera, established in 1979, encompasses 17 local authorities within a 30 km radius of the Hadera power plant.

Local environmental units are subordinate to local authorities and are professionally guided by the MoEP. Mayors appoint the heads of local environmental units, which report to the MoEP and to the municipal government. All local environmental units are guided by directors of the MoEP's district offices, under the supervision of a national co-ordinator.

The Nature and Parks Authority (NPA) is an independent body responsible for developing, protecting and promoting Israel's natural, historical and recreational sites and biodiversity. It is overseen by the Minister of Environmental Protection, who approves its budget and appoints its directors.

The main environmental enforcement authorities in Israel are the Green Police (the MoEP's principal enforcement arm), the MoEP's Marine and Coastal Inspectors, the Environmental Unit of the Israel Police, and the NPA's enforcement unit (Box 2.2).

Box 2.2. **Environmental enforcement authorities**

At the national level, the main environmental enforcement authorities in Israel are:

- The Green Police, the MoEP's principal compliance monitoring and enforcement force. Its 40 inspectors work in co-operation with the Ministry's national headquarters and regional offices (there are five to six Green Police inspectors in each district, but they do not report to regional office directors). The inspectors carry out facility inspections and field surveillance, investigate non-compliance, and transfer cases to the MoEP's Legal Division for the preparation of formal enforcement actions.
- The MoEP's 13 Marine and Coastal Inspectors carry out routine inspections of hundreds of vessels and oil tankers calling at Israeli ports, offshore installations handling oil, and industrial plants and wastewater plants discharging into the sea.
- The Environmental Unit of the Israel Police works in close partnership with the Green Police. This unit, set up in 2003, is funded by the MoEP and employs nine police officers, including vehicle air pollution inspectors. Collaboration between the Green Police and the Israel Police is especially important in dealing with environmental offenses where the MoEP lacks the necessary authority to act (*e.g.* to arrest suspected offenders).
- The NPA's enforcement unit is responsible for "green enforcement" (*e.g.* against illegal logging, hunting, fishing, trade in endangered species, illegal water abstraction) and protection of nature reserves. It has a total of 120 rangers in five districts (covering only rural areas), including units with powers delegated by other bodies such as the Ministry of Agriculture and Rural Areas (for fish protection) and the Water Authority (for enforcement against illegal water abstraction by farmers).
- The NPA's Yahalom enforcement unit of 12 inspectors, created in 2009, is responsible for countrywide enforcement activities for waste offences (especially those related to construction and demolition waste) under the general guidance of the Green Police.

Local authorities have their inspectors, who have traditionally enforced municipal environmental ordinances. The 2008 Local Authorities Law (Environmental Enforcement – Authority of Inspectors) significantly enhanced the powers of local inspectors, which now extend to the enforcement of 18 national environmental laws including the Hazardous Substances Law and the Abatement of Nuisances Law.

Source: MoEP.

In recognition of the need for an integrated system of water management, the Governmental Authority for Water and Sewerage (Water Authority) was established in 2007 to concentrate Israel's water governance within a single administrative body. The Water Authority is responsible for the management, allocation and control of the country's water resources, from water abstraction to sewage treatment. This includes: regulating the production, supply and consumption of water; designing and implementing water supply schemes; preventing water pollution; and regulating water pricing. The Water Authority is subordinate to the Ministry of National Infrastructures (MoNI), but its Council is an interagency body composed of high-level representatives of the MoNI, the MoEP, the Ministry of the Interior (MoI) and the Ministry of Finance.

The Kinneret Drainage and River Authority, established in 1969, is a special body responsible for protecting Lake Kinneret (also known as the Sea of Galilee) and its watershed and making it a sustainable source of freshwater. The Kinneret Authority is funded by the Water Authority and works with the MoEP, the Fishing Division of the

Ministry of Agriculture and Rural Development, and other bodies to regulate and monitor water pollution in the area around the lake. The Yarkon, Beer Sheva and Kishon River Authorities have been created for the rehabilitation of the three rivers. These authorities are overseen by the MoEP, but they collaborate with the Water Authority in designing water allocation plans.

A range of sectoral ministries also have environmentally related functions. The Ministry of Health is responsible for drinking water quality, water quality in recreational areas, quality of wastewater treatment, quality of recycled wastewater used in agriculture, and safe management of toxic waste from hospitals. The Ministry of Agriculture and Rural Development has responsibilities for nature and landscape protection. The MoNI, in addition to supervising the Water Authority, may enact regulations pertaining to efficient production and use of energy and other energy-related issues. The MoI oversees local authorities which are responsible for providing essential environmental services.

Israel's environmentally related laws (together with hundreds of pieces of secondary legislation) commonly give executive authority to more than one ministry. For example, the MoEP shares its authority under environmental laws mostly with the Ministries of the Interior, Health, and Agriculture and Rural Development. This fragmentation (partly due to political compromises) reduces the effectiveness of policy implementation and increases costs (*e.g.* ministries sometimes "double budget" the same activity but do not work together to implement it).

The need for institutional co-operation between stakeholders is currently addressed mostly through inter-ministerial committees, including, among others:

- Inter-ministerial Committee for Climate Change, headed by the Ministry of Finance;
- Inter-ministerial Committee for Sustainable Development, headed by the MoEP;
- Inter-ministerial Committee for Green Taxation, headed by the Ministry of Finance;
- Committee for National Infrastructure, a national-level planning authority which includes representatives of seven ministries, local governments and NGOs and is headed by the MoI.

In these committees, ministries are usually represented by high-level professionals who meet fairly frequently, depending on the issues being addressed. Inter-ministerial committees can make binding decisions on behalf of the ministries, which become effective unless one or more ministries appeal them.[3]

Recently, inter-agency co-operation has begun to be developed at the district level. Regular co-ordination meetings take place between the regional offices of relevant ministries in an increasing number of districts (most ministries in Israel have a similar form of territorial organisation).

1.2. National environmental policy objectives

Environmental policy objectives have been established in the MoEP's annual work programmes since 2000. In 2007, the MoEP initiated a comprehensive internal strategic process aimed at setting long-term policy, including a ministerial vision, goals and targets.

As a result of this process, the vision of the MoEP was formulated as follows: "The environment in the State of Israel will provide quality of life and environmental security to the residents, based on the wise use of resources and the protection of ecosystems and on the commitment to human welfare and natural, landscape and heritage values for present

and future generations. The State of Israel will be one of the world leaders in sustainable development."

The official list of the MoEP's priorities encompasses a wide range of issues related to air, water and soil pollution, management of hazardous substances, biodiversity protection and sustainable consumption and production, among others. In addition, in October 2009, the MoEP defined the following five short-term targets for the Ministry:

- transforming waste from a source of nuisance to an economic resource and reaching a 50% recycling rate by 2020;
- preventing and reducing air pollution through implementation of the Clean Air Law;
- taking action to mitigate climate change and committing to ambitious reductions in greenhouse gas emissions;
- increased enforcement, with an emphasis on administrative monetary penalties;
- promoting environmental education and a sustainable lifestyle, including extensive training of kindergarten and school teachers.

Accountability is one of the MoEP's priorities. It is developing indicators to help evaluate the results of its activities, measure performance in achieving targets, and monitor the effectiveness of the policy measures employed. The MoEP's internal auditor produces three to four evaluation reports per year on different issues,[4] which are available to the public only on request. The MoEP is also subject to external audits by the State Comptroller, whose reports are available on the Internet.

1.3. *Environmental and sustainable development planning*

Israel has an elaborate system of strategic environmental planning. National and regional master plans cover a wide range of environmental management issues. Several national plans are targeted at protecting specific natural resources considered to be of high value as part of the natural and cultural heritage (national parks, nature reserves and forested areas) as well as other sensitive ecosystems such as the Mediterranean coast, Lake Kinneret and the Dead Sea:

- The National Master Plan for National Parks, Nature Reserves and Landscape Reserves (1981) designates specific areas as national parks or nature reserves for purposes of nature conservation, protection of landscapes from unsound development, and preservation of areas with high recreation and tourism potential.
- The National Master Plan for Forests and Afforestation (1996) grants certain areas legal status as protected forested areas.
- The National Master Plans for Coastal Areas of the Mediterranean (1983) and for Lake Kinneret (under preparation) aim at the protection of large coastal areas as nature reserves, national parks and coastal reserves and the designation of other coastal areas for tourism and recreation. A national master plan for the Dead Sea (currently being prepared) is aimed at resolving the conflicts between the development and preservation of the Dead Sea basin and will address implications of the Dead Sea's rapidly falling water level.

Other national plans also target the integration of environmental, land use and development issues. The National Master Plan for Rivers and Drainage (2006) regulates multiple uses of the country's rivers and defines zones subject to different degrees of protection along each of some 120 waterways. The Sustainable Solid Waste Management Master Plan (2006), adopted by the National Building and Planning Board, is a

comprehensive framework for environmentally sound management of solid waste, including approaches, criteria and long-term goals, which gives particular attention to spatial planning and land use concerns.

Performance management is a major challenge in environmental and sustainable development planning in Israel. There is a general lack of provisions for regular progress evaluation, review and adjustment of national and regional master plans.

The MoEP also wants to make progress in integrating planning and budgeting processes. Traditionally, budgets have been allocated not on the basis of targets, but rather as a result of political negotiations among government coalition partners. The first attempt at results-oriented budget planning was made in 2010 for the 2011-12 budget.

2. Environmental legislation

In Israel, environmental provisions are included in a wide range of legislative instruments rather than in a single environmental law. There are laws focused on specific environmental issues, such as the Clean Air Law and the Water Law. In addition, there are several cross-sectoral laws that include environmental considerations, including the Planning and Building Law and the Business Licensing Law (Box 2.3).

Box 2.3. **Major environmental laws**

Wildlife Protection Law of 1955, amended 1990
Plant Protection Law, 1956
Water Law, 1959
Abatement of Nuisances Law, 1961
Planning and Building Law of 1965, amended 1994
Business Licensing Law, 1968
Prevention of Sea Pollution (Dumping of Waste) Law, 1983
Maintenance of Cleanliness Law, 1984
Prevention of Sea Pollution from Land-Based Sources Law, 1988
Collection and Disposal of Waste for Recycling Law, 1993
Hazardous Substances Law, 1993
Protection of the Coastal Environment Law, 2004
Polluter Pays Law, 2008
Clean Air Law, 2008 (effective 2011)
Packaging Law, 2011
Environmental Enforcement Law (2011)

In the past, environmental laws (*e.g.* the 2008 Clean Air Law) were initiated by NGOs and supported by individual *Knesset* members, while the MoEP has not always adopted a proactive law-making position. While this lack of a legislative strategy for the environment has resulted in the fragmentation of environmental legislation, the MoEP is currently initiating and leading an increasing number of environmental legislation efforts.

Environmental laws in Israel require the development and promulgation of a significant number of implementing regulations. For example, the Clean Air Law, which went into effect in January 2011, requires regulations for air quality standards (ambient, target and alert values), emission permits and rules, administrative fees for emission permits, levies (charges) on pollutant emissions, and prevention of air pollution from mobile sources, among others. However, such regulations are missing under many of Israel's environmental laws, so that some legislative provisions remain unimplemented.

3. Establishment of environmental requirements

3.1. Land use planning

Under the provisions of the Planning and Building Law (which is likely to be revised in the near future), all land use activity must comply with statutorily approved national, regional and local master plans. Efficient use of scarce land resources and the protection of open spaces are fundamental principles of the land use planning system, as emphasised in the National Master Plan for Building, Development and Conservation until 2020 (Box 2.4).

Box 2.4. **National Master Plan for Building, Development and Conservation until 2020**

Before the National Master Plan for Building, Development and Conservation (also known as TMA 35) was adopted, it took several years to build consensus between different stakeholders. Since its regulatory approval in 2005, TMA 35 has been Israel's dominant land use planning policy document.

The Master Plan defines a minimum level of building density for residential construction and imposes limits on expansion into rural areas, thereby making a major contribution to the protection of open spaces. Decisions concerning the location of development projects follow the MoEP's designation of areas of high landscape sensitivity, such as stream corridors, landscape reserves and landscape strips. Proposals for development in open landscapes require submission of additional planning documents concerning the impact of the development on the protection of open spaces.

The Master Plan also imposes special restrictions on development in coastal areas and catchment areas, which are important for water supply, as well as a requirement to establish sewage collection and treatment systems before new dwellings may be inhabited. The National Planning Board is currently reviewing the effectiveness of TMA 35 and assessing the need to revise it.

Source: MoEP.

The Planning and Building Law establishes a hierarchy of multi-stakeholder planning committees, some of which have the authority to issue building permits. The National Board for Planning and Building, headed by the Director General of the MoI and comprising representatives of 11 ministries (including the MoEP) as well as of local governments, academia and NGOs, is authorised to issue directives for the preparation of national master plans and to approve regional plans. Similar regional planning committees are headed by Regional Directors of the MoI.

The Planning and Building Law provides for a public notification and participation process with respect to land use planning. The public is informed of schemes presented to

regional and local planning authorities through public notices appearing in the official register, in offices of the local authority and in daily newspapers. The public is entitled to inspect land use plans and submit objections during the deposition period. The law also provides for an appeal process if an objection is rejected.

3.2. Environmental impact assessment

The Planning and Building (Environmental Impact Assessment) Regulations (1982, amended in 2003) require an environmental impact assessment (EIA) of a wide range of projects with potential environmental implications, particularly in environmentally sensitive areas such as coasts and riverbanks. Apart from a list of sectors for which an EIA procedure is mandatory according to the law or a national, regional or local master plan (*e.g.* power plants, major infrastructure projects, quarries), the competent planning authority may require an EIA for any project if it considers this appropriate. Proposed projects for industrial plants to be constructed in approved industrial zones usually do not undergo an environmental assessment.[5] This shows that the scope of EIA application in Israel is significantly narrower than in the EU, where the EIA Directive (97/11/EC) requires the assessment of projects involving, for example, hazardous industrial (*e.g.* chemical, asbestos) installations, groundwater abstraction sites and large poultry farms.

The environmental impact statement prepared by a developer is reviewed by the MoEP, which then submits an opinion to the (national or regional) planning authority authorised to make a decision concerning the project proposal. EIA statistics from the last decade show that projects subjected to an EIA in Israel were primarily roads, waste disposal sites, residential, commercial or industrial areas, quarries, power plants, ports and marinas, wastewater treatment facilities, and tourism and recreation sites. A decrease in the number of EIAs since the mid-1990s is partly due to regional planning authorities frequently opting for a so-called "environmental opinion" (involving less scrutiny than an EIA) for projects with "well-established technological solutions". In reality, this means that many proposed projects for industrial plants do not undergo an EIA, and that plants are constructed without location-related mitigation measures.

A planning reform bill promoted by the government aims at removing alleged regulatory obstacles to infrastructure development by shifting decision making from multi-stakeholder planning authorities to government officials. According to the bill, the impact assessment would be reviewed not by the MoEP but by a private environmental consultant to the planning committee. Environmental NGOs are concerned that the proposed increased role of private consultants in advising the government on the environmental impacts of development projects could compromise EIAs' effectiveness.

There are currently no formal provisions for strategic environmental assessment (SEA) in Israel. However, in practice SEA is an integral part of Israel's strategic planning process. The system of national (and respective regional) master plans (Section 1.3) integrates environmental considerations from the earliest planning stages until final approval of the planning documents.

3.3. Environmental standards

The Minister of Environmental Protection has the authority to promulgate regulations defining ambient and emission/effluent standards. Regulations under the Water Law set maximum ambient concentration levels for 20 inorganic water pollutants. The Public Health Regulations on Effluent Quality Standards (2010) establish concentration limits for

dissolved and suspended substances in effluents allowed for unrestricted irrigation and discharges to rivers. Business licensing regulations on salt concentrations in industrial sewage (2003) set threshold values for discharges of chlorides, sodium, fluorides and boron to wastewater treatment plants. There are also plans to establish water quality standards and maximum discharge limits for approximately 50 organic contaminants.

The recent Clean Air Law establishes, among others, a framework for setting emission standards for mobile and stationary sources of air pollution and for the revision of ambient air quality standards (currently established for 24 pollutants). Regulations on emission standards have recently been approved.

Noise standards are established under the Abatement of Nuisances Law through Regulations on Unreasonable Noise (1990) and Prevention of Noise (1992), which restrict various sources of noise in residential areas, as well as the Regulation on Unreasonable Noise from Construction Equipment (1979), which sets noise standards for the construction sector. There are also threshold levels and concentrations for hazardous substances which require a permit, occupational health and safety standards (*e.g.* for asbestos) and energy efficiency standards for appliances, among others.

3.4. Licensing and permitting

The Licensing of Businesses Regulations (1995) list categories of businesses that require approval of their business licences by different government ministries. Business licences are granted by local authorities under the mandate of the Ministry of the Interior (MoI), in consultation with the MoEP, the Ministry of Industry, Trade and Labour (MITL), the Ministry of Agriculture and Rural Development, the Ministry of Public Security and the Ministry of Health. Environmental conditions in business licences are established by the MoEP separately under each medium-specific law and for different periods of time. Self-monitoring obligations under a number of environmental laws and regulations are also specified in the licence. When there are no specific environmental requirements (*e.g.* standards for air emissions or wastewater discharges) in the law, the conditions in the licences are set based on internal MoEP policies. General binding rules are expected to be introduced in the near future for certain segments of the regulated community.

Since 1997, intensive efforts have been made to increase the efficiency of the licensing system. An important step was the classification of all businesses listed in the Licensing of Businesses Regulations into three levels (A to C) according to their potential environmental risk, with C-level facilities associated with the lowest risk. The MoEP's district offices are responsible for developing and enforcing the environmental conditions of business licences for A- and B-level facilities, in consultation with the Ministry's central Industry and Business Licensing Division. Local environmental units have similar powers with respect to C-level businesses. The entire licensing process is computerised to allow for effective review and follow-up of each application.

In addition to environmental conditions in business licences, separate permits are issued for water use, marine discharges, handling of hazardous substances, and, starting in 2011, air emissions:

- Water may be used only according to a permit issued annually by the Water Authority, and for the water purposes specifically listed in the law (domestic, agricultural, industrial, commercial, public services and ecological uses) (Chapter 4).

- The Prevention of Sea Pollution from Land-Based Sources Law requires a permit for waste discharge and dumping into the sea, to be issued by a special inter-ministerial permit committee.
- A Poisons (hazardous materials) Permit is required for handling hazardous materials listed in an annex to the Hazardous Substances Law. The permit includes conditions for proper storage and marking of hazardous materials, emergency preparedness and response, transport and treatment of hazardous waste, among others. A Poisons Permit holder is required to maintain a toxic substances register in which details of all sales and purchases of hazardous substances are recorded. The import or export of hazardous waste is also subject to a permit (Chapter 7).
- The recent Clean Air Law establishes emission permitting requirements for large industrial facilities on the basis of best available techniques (BAT).[6] All air permits must be issued by 2015. There will be an air permit fee consisting of a substantial one-time fee and an annual fee (payable over seven years), depending on the economic sector's environmental impact. The revenue will go to the general budget (Chapter 6).

While co-ordination across the environmental media is currently attempted through a single business licence, the regulatory focus on end-of-pipe measures rather than process-related pollution prevention is a serious shortcoming of Israel's present environmental licensing/permitting system. In an effort to address this issue, the MoEP has developed a strategy for the transition to integrated environmental permitting for large installations in line with the EU Integrated Pollution Prevention and Control (IPPC) Directive (2008/1/EC). The step-by-step implementation plan envisages a number of pilot projects during the first phase. The pilot projects were initially launched in two major industrial hotspots – Ramat Hovav in 2006 (Box 2.5) and Haifa Bay in 2007 – where industrial facilities are required to submit a permit application with a gap analysis with respect to the use of BAT in accordance with the EU BAT reference documents (BREFs). Environmental conditions in the business licence and specific permits for marine discharges, hazardous material handling and air emissions would then be

Box 2.5. **Environmental permitting at the Ramat Hovav industrial park**

Ramat Hovav, an industrial park in the south of Israel, is considered one of the country's most polluted hotspots. In an effort to drastically reduce the pollution load, the MoEP issued new business licence conditions to Ramat Hovav's industries in 2004. However, local industries appealed to the courts against the "unreasonable" conditions and timetables imposed by the MoEP. In 2005, the court called for a mediation procedure to help resolve the differences. Some 40 stakeholders participated, including representatives of the government, the industries, NGOs and the public.

After more than a year and a half, and following recommendations by three external mediators (an Israeli expert, a Dutch consulting group and a US EPA specialist), a mediation agreement was concluded in 2006. It was signed by the MoEP, the plant operators, the Ramat Hovav Industrial Council, and Sustainable Development for the Negev, an NGO.

As part of the Ramat Hovav Action Plan and the mediation agreement, new conditions for air pollution abatement were incorporated in the business licences of the industrial park's facilities in March 2008. They require the operators to prepare emissions reduction plans based on BAT.

Source: MoEP.

based on BAT requirements. However, even with a link to BAT, these environmental requirements will continue to be medium-specific. Moreover, the implementation of BAT is likely to be more difficult in the absence of cross-media legislation to support it: the MoEP is not planning to develop an integrated permitting law in the short term.

According to the MoEP, about 150 industrial facilities will eventually be subject to integrated permitting in Israel. The actual introduction of integrated permitting is planned for 2012-16, with the gradual incorporation of two to three sectors or subsectors (some 30 facilities) into the system each year, based on their level of environmental impact, ability to comply with requirements, and the regulator's capacity to process integrated permit applications.

Within the framework of the revision of the Business Licensing Law, the MoEP started to streamline requirements for medium- and lower-risk categories of facilities by developing Integrated Environmental Permitting Guidelines and Binding Rules for small and medium-sized enterprises (SMEs). Sector-specific requirements have been prepared for about 30 business sectors (from petrol stations and metal plating industries to dairy farms and garages – all B- and C-level facilities) to serve as a basis for business licence conditions. These sector-specific rules have been published on the MoEP website. In some instances, such conditions have already been incorporated in business licences while in others they are introduced at the time of renewal of business licences. The target is to have general binding rules for about 60 economic sectors. The development of these rules has been welcomed by industry because it provides certainty and national consistency with regard to environmental requirements.

3.5. Non-regulatory instruments

Voluntary environmental standards are widely used in Israel. The ISO 14000 series of environmental management system (EMS) standards were adopted as national standards by the Israeli Standards Institute in 1997, and additional guidelines and requirements for their implementation were published in 2005. About 630 organisations (80% of which are industries) have since been accredited under ISO 14001 (two-thirds by Israel's Standards Institute, and the rest by an independent certifier).

In 2010, the requirements of the forthcoming ISO 50001 energy management standard were also incorporated in several Israeli laws and regulations. A voluntary code for energy efficiency in new buildings was adopted by the Israeli Standards Institute in 2005.

The MoEP has established a NIS 0.5 million fund to provide technical assistance to SMEs (defined in Israel as enterprises with between 20 and 200 employees) through compliance and energy efficiency audits. It has set aside NIS 1 million to stimulate the phase-out of hazardous substances in their activities. The MoEP co-operated with the Manufacturers Association of Israel to establish an online Clean Production Centre which presents environmental management information on different economic sectors.

A 2001 government decision called on the MoEP, the MITL and the Standards Institute to prepare a list of products with reduced environmental impact that would be subject to eco-labelling. The Green Label Committee, which involved those government bodies along with representatives of industry, Chambers of Commerce and environmental and consumer NGOs, formulated green label specifications and award criteria in Israel (Standard 1738). For compatibility with best international practices, this standard was

replaced in 2010 by two ISO standards (14020 and 14024) on environmental labelling and declarations, which were adopted as Israeli standards.

By 2010, 34 standards for green labels (including electrical appliances, computers, paper and plastic products, and paints) had been approved and 100 of these labels had been granted. Importantly, producers with a history of environmental violations are not eligible for a green label. In addition, energy ratings were established for residential buildings in 2005 and for office buildings in 2007.

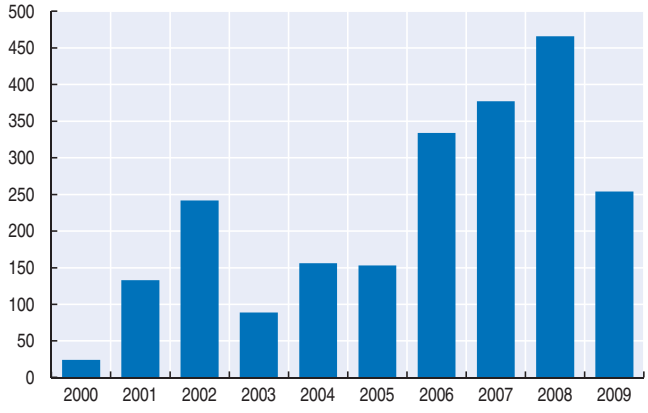
In 2009, the Israeli government launched a green procurement initiative to promote the use of recycled materials in all ministries and affiliated bodies. Environmental criteria are already incorporated in the public procurement of several products and services through the Governmental Purchasing Administration (Chapter 1).

4. Environmental compliance assurance

4.1. *Compliance monitoring*

The MoEP's Green Police have been conducting environmental inspections since 2000. A- and B-class facilities are inspected before a business licence is issued. C-class facilities are inspected within a year of obtaining a licence. Regular inspections are unannounced and are performed either by a single inspector or by a team (for large facilities). Their frequency depends (according to an internal MoEP policy) on the regulated facilities' risk level: A-class facilities should be inspected once a year, and B-class facilities once every two years. There is no defined frequency for C-class facilities, which are inspected irregularly (since 2008, jointly with local authorities as the latter gradually take over the inspection of small operators). In addition to routine inspections, the Green Police carry out several enforcement campaigns each year targeted at problematic industrial areas such as Ramat Hovav and Ashdod, or in specific sectors such as petrol stations, dry cleaners, garages, quarries and metal plating industries. The annual number of inspections of industrial facilities during the past decade increased in the review period (Figure 2.1). A sharp drop in 2009 resulted from deep budget cuts in 2008.

Figure 2.1. **Number of site inspections by the Green Police, 2000-09**



Source: MoEP.

StatLink http://dx.doi.org/10.1787/888932495133

Until recently, most inspections focused on detecting offences related to illegal waste disposal. While the scope of compliance monitoring has now significantly expanded, the capacity of MoEP inspectors to carry out in-depth, multi-media compliance evaluation remains low. Site visits primarily consist in verifying compliance with end-of-pipe standards for air emissions and wastewater. To address this problem, the MoEP plans to introduce professional specialisation of Green Police inspectors and improve their qualifications. The recent law on environmental enforcement initiated by the MoEP (effective 1 August 2011) consolidates and enhances inspectors' investigative powers, which have so far been specified in different environmental laws.

Self-monitoring requirements are part of the business licences of all operators. The frequency of measurements varies from twice a year to once every two years. However, operators (except those with very large air emissions or those handling hazardous substances) are not required to provide regular reports to the MoEP and must only keep self-monitoring records for three years and make them available to inspectors during site visits. MoEP inspectors usually do not have the capacity to verify self-monitoring results, which seriously weakens the compliance monitoring system.

The level of compliance improved during the last ten years. The percentage of exceedances of air emission limits declined from 42% of facilities (installations) inspected in 2001 to 31% in 2009. Similarly, the percentage of water quality samples[7] showing violations fell from 41 to 18% between 2001 and 2009. This may, however, be explained by the increased number of tests during the same period, as the percentage of facilities found in non-compliance dropped significantly only in 2008-09 (from 50% to just over 30%). The MoEP publishes data concerning facilities where violations were discovered on its website.

In addition to government inspectors, environmental compliance assurance in Israel involves a system of "cleanliness trustees" – unpaid volunteers recruited from the general public and trained by MoEP officials. Some 4 500 active volunteers currently take part in this system, filing reports on violations of the Maintenance of Cleanliness Law that they observe in their everyday life. Since 2002, some 14 000 of them have joined the system. In 2008, some 1 200 cleanliness trustees submitted at least one non-compliance report. Of 20 814 "cleanliness reports" submitted to competent authorities in 2008, 75% were made by cleanliness trustees, 11.5% by the Green Police, 10% by other MoEP inspectors and 3.5% by the Israel Police (MoEP, 2009).

The cleanliness trustee system actively engages citizens in environmental enforcement, increases public awareness of environmental requirements and promotes compliance. However, this system is not yet very efficient due to the lengthy process of registering and responding to non-compliance reports (which, more generally, is a problem of Israel's environmental enforcement authorities). The MoEP intends to develop a fully computerised system combining a Cleanliness Trustee Forum on the Ministry's website, with possibilities to report violations by e-mail, SMS or voicemail.

4.2. Enforcement

Environmental enforcement in Israel makes use of a variety of tools, ranging from informal actions (*e.g.* discussions with, or warning letters addressed to, owners or operators of pollution sources), to formal administrative enforcement, to criminal prosecution. Enforcement decisions are usually made in the central office of the MoEP (sometimes in different divisions, such as the Air Quality Division for air-related offences), with the exception of the marine and coastal inspectors who decide on sanctions themselves.

The effectiveness of environmental enforcement in Israel has been hampered to some degree by the fragmentation of enforcement authorities and the disproportionate emphasis on enforcement of the Maintenance of Cleanliness Law, to the detriment of other environmental laws. To address these issues and make the entire enforcement system more consistent, effective and efficient, in 2009 the MoEP issued a new enforcement policy for both administrative and criminal enforcement throughout the country. This policy significantly shortens timeframes for dealing with environmental offenders. It requires all enforcement actions, from discovery of the offence, through administrative enforcement, to the submission of a draft criminal indictment to be completed within a maximum period of 12 months.

The MoEP's enforcement policy defines appropriate responses depending on the type and gravity of an offence. Competent authorities may use the following administrative enforcement tools: compliance orders with deadlines (so-called "personal decrees" of the Minister of Environmental Protection); administrative closure (permit revocation) in cases of high actual or potential environmental risk;[8] and administrative fines. Criminal sanctions under all Israeli environmental laws include fixed and variable fines and imprisonment.

Most enforcement in Israel has so far been carried out based on the provisions of criminal law. The Polluter Pays Law of 2008 stipulates fines for relatively minor violations within the scope of 14 environmental laws (*e.g.* cleanliness offences, waste disposal, noise, air pollution from motor vehicles, marine pollution). Different fine levels are set for individuals and corporations, with sharp increases for repeated offences.

The "finable offence" scheme is similar to a parking ticket system. Following the report of an environmental offence detected by the Green Police, the Israel Police or another competent authority, a payment notice for a fixed fine is sent to the alleged offender by registered mail. In 2009, fines amounting to NIS 3.7 million were collected for 18 115 finable offences. The revenue from the fines is deposited in the Maintenance of Cleanliness Fund and used to finance a broad range of environmental activities. Although "finable offences" are considered criminal, they are not reflected in an individual's criminal record, which reduces their deterrence effect.

While fixed fines are criminal sanctions according to the law, even higher administrative fines exist for several categories of violations (related to handling of hazardous substances, asbestos pollution, ocean dumping and others). Furthermore, the MoEP plans to review existing environmental laws and introduce variable administrative fines for all environmental offences in order to make enforcement more time-efficient and monetary sanctions more proportionate to non-compliance. However, the fact that revenue from fines goes to the MoEP rather than the general treasury may lead to a perverse incentive to impose penalties for the sake of generating income for the Ministry.

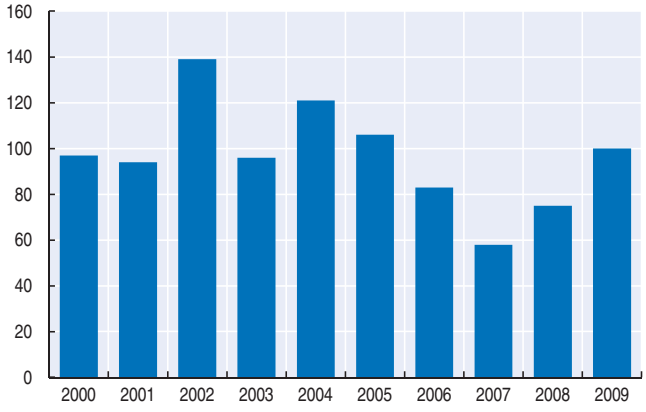
In more serious cases, as well as when negotiations and administrative enforcement fail to achieve compliance, a criminal investigation is carried out by the relevant enforcement unit. Depending on the seriousness of the case, criminal indictments are handled by private law firms under the MoEP's supervision. In addition to government bodies, criminal complaints can in some cases be filed by a private individual who has suffered physical or economic harm from an offence, by an environmental NGO, or by a local authority in whose jurisdiction the offence was committed.

Criminal enforcement proceedings against a company or local authority are generally accompanied by prosecution of high-ranking company managers or local officials. In

addition, the State Attorney's Office has published policy guidelines for "indicting local authorities and their senior officials in the field of the environment". Guidelines are also being drafted by the State Attorney's Office on the indictment of civil servants for criminal (including environmental) offences.

The number of criminal indictments submitted by the MoEP in the period of 2000-09 is shown in Figure 2.2. The majority of criminal enforcement cases were related to illegal waste disposal and water pollution (171 and 118 cases, respectively, out of the 462 cases handled by the MoEP's Legal Department in 2009, only 100 of which led to an indictment). The overwhelming majority of criminal procedures end with a plea bargaining agreement and payment of so-called "fine-or-trial" penalties – criminal penalties imposed in lieu of an appearance in court. The MoEP's policy is to limit plea bargaining related to environmental offences in order to increase deterrence. Every request for an out-of-court settlement requires approval of the MoEP's Legal Adviser.

Figure 2.2. **Number of criminal indictments submitted by the MoEP, 2000-09**



Source: MoEP.

StatLink http://dx.doi.org/10.1787/888932495152

The rate of conviction in criminal enforcement cases is quite high. For example, there were only two acquittals in 75 environmental trials in 2008 (MoEP, 2009). Prison terms were imposed for only 1% of convictions in 2000-06, and there were suspended prison sentences in some 3% of cases. During the same period, fines were imposed in 98% of criminal cases that ended in convictions (Karassin, 2009).

A 2005 amendment to the Prevention of Sea Pollution from Land-Based Sources Law authorises the courts to impose fines that reflect the polluter's benefit from the discharge of waste into the sea. Similarly, the 2008 Polluter Pays Law stipulates that the polluter's benefits from non-compliance are to be calculated in determining the size of fines in criminal enforcement cases to ensure that it is no longer more economically feasible for companies to pollute than to prevent and treat pollution. Economic estimates of polluters' illegal profits have already been presented to Israeli courts in several major cases. To institutionalise this practice, the MoEP is developing a methodology for calculating a polluter's financial benefits from non-compliance and recovering these benefits as part of a fine. This methodology, similar to the BEN model used since 1984 by the United States

Environmental Protection Agency, is expected to be produced in 2011 by external experts contracted by the MoEP. This important work, together with the expansion of the system of variable administrative fines for environmental offences, would make environmental enforcement in Israel more proportionate to non-compliance.

The collection of fines has significantly increased in the last several years, from 38%[9] to over 75% currently, but remains a challenge. The State Comptroller performed an audit in 2007 to evaluate the collection of environmental fines by the MoEP and issued recommendations to improve the situation.[10] Since 2008, the MoEP has stepped up its fine collection efforts and transferred over 30 000 cases of unpaid fines to two collection companies chosen through a tendering process. The MoEP also recently established an electronic system to manage information on unpaid debts. These efforts had resulted in the collection of over NIS 10 million in overdue fines as of April 2011.

4.3. *Environmental liability*

Israel currently has legal provisions for traditional (tort) civil liability (under the Torts Law and Section 17 of the Lands Law) and fault-based (not strict) civil liability for damage to land or water resources (under the Hazardous Substances Law and the Water Law). The courts can order a responsible polluter to undertake clean-up or recover the clean-up expenses for remediation actions carried out by the government, but this happens very rarely. Over the period of 2000-06, for an average of 118 trials ending in conviction each year, only five remediation orders were issued, representing 4% of cases (Karassin, 2009). Clean-up orders continue to be used very infrequently.

Israel has a high percentage of contaminated soils. However, state ownership of most industries in the past and continued state ownership of land (over 90% of the land area is owned by the state or quasi-state agencies) complicates the implementation of past liability and the determination of the responsibility of current land owners or lease holders.

The Prevention of Soil Pollution and Contaminated Lands Bill, proposed by the MoEP in 2008, had not been adopted at the time of writing because of the potential financial implications of liability for past land contamination (it was endorsed by the government in January 2011). This bill envisages the establishment of a fund under the MoEP for clean-up of contaminated sites, following the example of the Superfund in the United States. The fund would comprise financial resources from the state budget as well as from surcharges, taxes and fines in order to cover clean-up costs and indemnify owners and lease holders of land contaminated by a third party that cannot be identified and held accountable. As for current liability, the bill would give the MoEP the authority to issue an administrative order to cease, prevent or remove soil contamination and introduce criminal sanctions for non-compliance with such an order. The MoEP adopted decontamination standards as part of its internal policies in 2004, but these standards have not been promulgated in an official regulation.

Insurance companies in Israel have not yet incorporated the environment in the coverage they offer for damage liability. Environmental requirements are not a parameter in setting insurance premiums and are not considered a financial risk for which companies seek insurance cover.

5. Promoting environmental democracy

5.1. *Environmental information*

The Freedom of Information Law (most recently amended in 2005) requires that all information in the possession of public authorities be made available to the public upon request (with certain restrictions for public safety or commercial confidentiality reasons). The 2009 Freedom of Information Regulations on Public Access to Environmental Information (in force since September 2010) go further. They provide for free-of-charge online access to 22 categories of information held by public authorities, covering air, water and marine pollution, hazardous and non-toxic waste, noise, odour, radiation and soil contamination.

A dedicated section of the MoEP website already presents this information. The website also contains information on environmental conditions of the business licences of more than 250 industries and data on operators found to be in violation of environmental requirements. However, the MoEP's online information could be more user-friendly and better organised.

The Israel Securities Authority requires companies trading on the stock exchange to disclose information on their environmental risks with financial implications. It publishes this information on its website. The Public Companies Authority has recently issued a similar requirement.

The government also disseminates information on good environmental behaviour to target audiences. For example, the websites of the MoEP, the Water Authority and the Israel Water Company provide information on water-efficient irrigation techniques to farmers and on best practices for water conservation to the general public.

Israel has taken the first steps towards establishing a Pollutant Release and Transfer Register (PRTR), in line with its commitments related to OECD accession. The MoEP, in co-operation with the Manufacturers Association of Israel and public representatives, is developing legislation which would require industries to make data on pollutants and wastes available directly to the public. The PRTR implementation is expected to be gradual, starting with pilot projects at ten industrial facilities in 2010 and proceeding to reporting by selected industrial sectors in 2012. Draft PRTR legislation has been developed and submitted for government consultation and public comments.

5.2. *Public participation in environmental decision making and the role of NGOs*

Environmental awareness in Israel has been increasing continuously during the last decade, as evidenced by the dramatic growth in the number of environmental NGOs – from a handful at the beginning of the 1990s to about 150 today. Dozens of small grassroots and volunteer groups have also been formed to address specific local environmental issues. Most environmental NGOs are members of Life and Environment, the umbrella organisation that co-ordinates countrywide activities. Israeli NGOs are primarily funded by membership fees and grants from domestic and international charitable funds.

The 2002 Law on Representation of Environmental Public Bodies (Legislative Amendments) requires the inclusion of representatives of environmental NGOs in most statutory inter-ministerial committees established to address environmental issues. Provisions for public participation are included in several Israeli environmental laws and regulations, notably the Planning and Building (Environmental Impact Assessment – EIA) Regulations. Public participation in EIA is fairly common, although some local authorities do not use it. While the recent Clean Air Law includes a requirement for public

participation in the process of issuing emission permits, the issuance of business licences currently does not involve public representation.

Israel's environmental NGOs help to advance environmental activities in all areas – from promotion of better public transport, to protection of open spaces and coastlines, to public participation in planning and decision making, to advocating environmental justice. They are extensively engaged in preparing publications, educational programmes and seminars. Many use the media to disseminate their messages, and several stage demonstrations or participate in legal petitions and claims. In addition, many Israeli NGOs lobby the *Knesset* and decision makers to promote environmental change.

The NGO coalition for promoting sustainable development (called "Paths to Sustainability") has worked in close partnership with the MoEP, produced parallel "alternative" reports to respond to government reports on environmental issues, and actively participated in preparing sustainable development strategies. A roundtable dialogue on sustainable consumption and production patterns took place in 2008-09, with participation by representatives of the government, the private sector, civil society and academia. The MoEP recently proposed establishing a body of "environmental guardians", involving youth and local community groups, and expanding the dialogue between the government's local environmental units and environmental NGOs.

5.3. *Access to courts*

The Abatement of Nuisances (Civil Action) Law of 1992 enables citizens and NGOs to file lawsuits in cases of environmental pollution or nuisances. The law stipulates strict liability, so there is no need to prove intent or negligence of the responsible party. The Class Action Law of 2006 specifies that class action suits may be submitted by an individual, a public authority or an organisation in relation to a restricted list of subjects, including environmental hazards. NGOs and private citizens may also file requests for administrative injunctions against local authorities in an administrative court or sue government ministries directly in the Supreme Court.

Although few environmental lawsuits are filed by citizens, partly due to their high cost, several successful court cases have been initiated by the public through environmental NGOs (*e.g.* the Society for the Protection of Nature in Israel and the Israel Union for Environmental Defense). As one example, compensation was awarded to individuals who used to swim in the polluted Kishon River, based on suspected links between industrial pollution and the incidence of cancer.

5.4. *Environmental education*

During the last decade, the Israeli government has made major investments in promoting public responsibility and commitment to the environment through formal and informal education, thereby strengthening public awareness and reinforcing the drive for environmental improvement. One major initiative is the Green Education Project, which encourages kindergartens, schools and universities not only to teach environmental subjects but also to act in a sustainable manner, conserve resources and advance eco-efficiency.

A comprehensive programme for integrating sustainable development into the educational system was adopted by the MoEP and the Ministry of Education in 2009. The annual budget for environmental education increased from NIS 3 million in 2009 to NIS 30 million in 2010. The programme places particular emphasis on training of school

and kindergarten teachers and the preparation of environment-focussed curricula. About 5 000 teachers will eventually be covered.

Other activities have focused on promoting sustainable lifestyles through educational institutions, community awareness and media campaigns. The MoEP has allocated NIS 6 million to the environmental certification initiative, under which schools demonstrating good environmental practices (*e.g.* water conservation, collection of paper, batteries and beverage containers) receive grants of NIS 10 000 per certified school. As of 2010, 400 schools had been accredited and 250 more were undergoing the "green school" process; 600 kindergartens had been accredited as "green kindergartens"; and 20 universities and colleges had been accredited as "green campuses" with five more in the pipeline. The number of certifications is expected to grow in the next decade.

6. Environmental management at the local level

Several of Israel's laws and regulations incorporate environmental requirements for local authorities.[11] The most important is the Municipalities Ordinance. The 2005 amendment to this Ordinance calls for the establishment of environmental quality committees, formed by local elected officials, with representatives of the MoEP and of the public acting as observers. Most local authorities have such a committee, as well as a professional environmental unit with a defined status and budget. However, some small, usually poor municipalities are unwilling to engage in environmental management activities, and the MoEP does not have the power to force them to do so.

Local environmental units are supported financially by the MoEP through grants to local authorities. The rate of general operational support provided by the MoEP is determined according to objective criteria. It varies between 50% for new and small local environmental units and 10% for older, established ones (30% on average, for a total of NIS 11 million per year in 2010). A further NIS 25 million per year is allocated to selected projects, such as rehabilitation of beaches, implementation of rural sustainability strategies, environmental education, noise monitoring, and response to accidents involving hazardous substances. For example, in 2010 the municipality of Jerusalem allocated NIS 23 million for "special activities", of which 74% was provided by the government while the MoEP contributed only 10% to the operational budget. It is difficult for weaker local authorities to comply with government financing requirements and they are often unable to use available funds. In addition, local authorities sometimes feel constrained by the MoEP's conditions on funding: they have to reconcile ministerial and local priorities, which is usually achieved in informal discussions between municipal and MoEP officials.

6.1. Local regulatory programmes

Local authorities may enact and enforce their own environmentally related regulations going beyond national laws, although only a few do so.[12] The 2008 Law on Local Authorities (Environmental Enforcement – Authorities of Inspectors) allows mayors to grant environmental inspection powers to municipal employees to monitor compliance with a number of national environmental laws. Such powers include requests for documentation, taking measurements or sampling, conducting an investigation, issuing clean-up orders and imposing fines.

To use these powers, local authorities must have their inspectors trained (in courses organised by the MoI) on national environmental requirements, conform to several

competence criteria, and receive authorisation from the MoEP. This is a long process: it may take several years before the new compliance monitoring functions can be exercised. Some municipalities prefer to leave compliance assurance entirely to the MoEP's regional offices. Other important barriers to local enforcement lie in the local authorities' poor knowledge of the regulated community (*e.g.* in Jerusalem only businesses that have a hazardous substance handling licence are properly registered) and lack of competent personnel. In the transition period, the MoEP and local inspectors usually conduct site visits jointly.

6.2. Local environmental initiatives

In 2003, the MoEP, in consultation with NGOs, developed "Ten Principles of Sustainable Management in Municipal Government" to help local government officials implement environmentally sustainable practices in such areas as management of local natural resources, public participation in government, public procurement, protection of open spaces, education, transportation policy and waste management. The "Ten Principles" have become the conceptual basis for promoting local sustainability in Israel.

Many local authorities in Israel either actively engage in national environmental initiatives or launch their own programmes, primarily driven by public awareness and citizen pressure. In 2008, for example, 18 major Israeli municipalities signed the Convention of the Forum 15 for Reducing Air Pollution and Climate Protection[13] calling for the development of municipal master plans with clear, measurable targets for reducing urban greenhouse gas emissions and air pollution (Chapter 6). Local action plans in a number of municipalities include measures to encourage public transportation, energy conservation in buildings, waste recycling and development of green spaces (Box 2.6). The Israel Center of Regional Councils has initiated the formulation of strategic plans for sustainable development.

Some local authorities are developing indicators with which they can present their achievements (or failures) to local residents and compare their performance with that of other municipalities. The national government is also interested in using indicators to measure the environmental performance of local authorities in order to identify where they are taking adequate measures and where more investment is needed to upgrade local environmental programmes.

Apart from budget support to local environmental units and targeted programmes, the MoEP has spearheaded training sessions and the dissemination of information on sustainable development. As environmental performance varies greatly across local communities, the MoEP is currently developing an initiative for smaller, less environmentally active municipalities.

The national government's efforts to promote local environmental sustainability have been reinforced by the non-governmental project "Promoting Local Sustainability in Israel" (partly supported by the European Commission). Under this initiative, the Center for Local Sustainability was created in Tel Aviv in 2006 to build the capacity of local government officials. During its first three years, it organised more than 70 training activities in 38 municipalities. Particular emphasis is placed on environmentally friendly procurement, energy efficiency, greenhouse gas emissions reduction and waste management. The Center has been facilitating the development of sustainable development strategies by local authorities, with over 50 municipalities having joined the process (Ronen and Shalit, 2009).

Box 2.6. **The "green city" of Kfar Saba**

Kfar Saba is a municipality with a population of about 85 000, located in Israel's Center District (north-east of Tel Aviv). It has a declared goal of becoming a "green city". Kfar Saba recently became the first municipality in Israel to be recognised as a sustainable city by ICLEI (Local Governments for Sustainability), thanks to the local authority's efforts with regard to a number of environmental initiatives including:

- creation of a "green city administration" responsible for all aspects of urban planning;
- a plan for greenhouse gas emissions reductions under the Forum 15 Convention;
- a master plan for municipal solid waste management (Kfar Saba is the first municipality in Israel to separate organic waste from other waste streams and plans to establish a regional facility to treat it);
- a binding standard for energy-efficient buildings (adopted through a municipal ordinance), applicable to all new construction in the municipality;
- a multi-annual plan for greening the local authority's own facilities (*e.g.* in terms of energy efficiency, recycling, green procurement);
- development of green spaces, with an objective of more than 20 m^2 of green area per resident;
- a plan for integrating environmental education into the municipality's educational, cultural, sports and welfare activities. Kfar Saba has seven certified green kindergartens and four green elementary schools; it wants to achieve green certification for all of its educational institutions within five years.

Kfar Saba and four smaller neighbouring municipalities (a total of 250 000 residents) are served by the Sharon regional environmental unit. The MoEP contributes only 10-15% of the unit's operating budget, but about 80% of the costs of its various environmental projects.

Source: Municipal Authority of Kfar Saba.

Notes

1. This number fluctuates since, in certain years, a few small municipalities may not provide funding for a local environmental unit.
2. Amendments to the Municipalities Law in 2005 required the appointment of an environment committee in each municipality. This requirement applies to all municipalities, not just to those with a population of more than 20 000. Many committees have been established, but they do not exist everywhere. There are no sanctions on local authorities that refuse to engage in environmental activities.
3. The State Comptroller started an audit in 2010 on issues that are the subject of inter-ministerial disputes and the effectiveness of *ad hoc* inter-ministerial committees. The audit results are expected to be published in 2011.
4. According to the Internal Audit Law of 1992, every public organisation in Israel is required to have an internal audit unit.
5. Industrial plants to be constructed in approved industrial zones require a building permit rather than a plan, whereas EIAs apply to plans (projects) and not to building permits.
6. Air emissions from other facilities will continue to be regulated through business licences.
7. "Water quality samples" refers to both wastewater discharge samples and water quality samples in rivers.
8. Administrative closure orders accounted for less than 0.5% of all administrative enforcement measures in 2000-06 (Karassin, 2009).

9. In 2000-06, an average of 62% of fines were not paid voluntarily or were sent for collection (Karassin, 2009).
10. Annual Report 58B of the State Comptroller (2008).
11. Local authorities in Israel include 75 municipalities (with a population of more than 20 000); 127 local councils for towns and rural communes with a population of between 2 000 and 20 000; and 53 regional councils for rural and communal settlements in a specific geographic region.
12. Local authorities must also comply with national environmental legislation and may face enforcement measures by the MoEP if they do not. For example, the MoEP has threatened to sue the municipality of Jerusalem over its waste and wastewater management practices.
13. The Convention is a local version of the Cities for Climate Protection campaign initiated by ICLEI – Local Governments for Sustainability.

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PART I

Chapter 3

International co-operation

The scope of Israel's international and regional environmental co-operation considerably expanded during the review period, despite some geopolitical constraints. Israel is a party to most major global environmental conventions and has entered into various bilateral and regional environmental agreements, including on the protection of the marine environment, biodiversity conservation, water management, desertification, and trade in environmentally sensitive goods. As a new OECD member, it has moved rapidly to adjust to the Organisation's requirements and to the standards expected of its members. This chapter discusses Israel's progress in engaging in multilateral and bilateral co-operation and in fulfilling its international commitments, as well as the extent to which Israel's domestic policies have benefited from adherence to international environmental agreements and associated guidelines. The environmental dimensions of its official development assistance programme are also addressed.

Assessment and recommendations

Israel's international environmental co-operation activities have increased appreciably since 2000 and are carried out at both bilateral and multilateral levels. Israel has demonstrated its willingness to fulfil its international environmental commitments, and to contribute its substantial expertise to help meet international and regional environmental challenges. It is a party to most major global environmental agreements, and has a good record of providing data and progress reports as required under these agreements, as well as transposing key elements into domestic law. To inform and support its domestic responses to environmental challenges, it has drawn effectively on recommendations, procedures, guidelines and resource support related to various international programmes. However, Israel has not yet ratified some important multilateral environmental agreements, regional conventions and associated protocols. These include global agreements on prior informed consent, persistent organic pollutants and biosafety, together with recent protocols under the Mediterranean Action Plan of the United Nations Environment Programme (UNEP).

Geopolitics continues to constrain Israel's ability to participate with its immediate neighbours, and with some other countries, in collaborative work on environmental issues. This affects its ability to participate fully in international organisations and regional groups, and to propose and pursue regional and transboundary initiatives. Nonetheless, during the past decade Israel has become a member of, and has actively participated in, the UNEP Governing Council and the United Nations Commission on Sustainable Development. As a new OECD member, it has moved rapidly to adjust its policies and procedures to conform with OECD legal instruments and policies. It has also increased its environmental co-operation with the European Union and in the Mediterranean region, notably by actively participating in the Mediterranean Action Plan and by joining the Mediterranean Climate Change Initiative.

Effective management of transnational rivers and aquifers (the main sources of Israel's water supply) has also been affected by the specific geopolitical situation. Ever-increasing demand for freshwater by the riparian parties has been responsible for water quantity and quality problems, and for the exacerbation of disputes over water rights and responsibilities. However, increased effluent reuse and seawater desalination has eased some of the pressures on water supply.

During the past decade, Israel has made significant progress in strengthening coastal and marine management, managing the living resources of the Mediterranean Sea, curtailing marine pollution and being prepared to respond to oil spills. Comparatively small oil spills and the dumping of contaminated bilge water are now exceptional events. There are fewer pollutant discharges into marine waters from municipalities and land-based industries than some years ago, but these discharges have not been eliminated. The 2004 Protection of the Coastal Environment Law imposes strict regulations on development in the coastal region. Beaches are cleaner than at any time in recent decades as a result of

the Clean Coast programme. However, in certain coastal areas and harbours, pollution (largely discharges of industrial and municipal wastewater into rivers) continues unabated.

New measures have been introduced to curtail trade in endangered species of plants and animals, and Israel has joined the International Whaling Commission. It has made considerable progress in meeting requirements for the phase-out of ozone depleting substances under the Montreal Protocol on Substances that Deplete the Ozone Layer. Notably, production and use of methyl bromide, an economically valuable substance of which Israel is one of the world's largest producers, have been dramatically reduced. Efficient use of funding for international environmental efforts will be essential if Israel is to fully meet its various goals and commitments. Funding priorities should include: improving the management of internationally recognised conservation areas; and strengthening monitoring, inspection and enforcement related to marine pollution, illegal trade in ozone-depleting substances, endangered species and hazardous waste.

Official development assistance (ODA) as a share of gross national income is significantly less than the contributions of other OECD members, as well as those of most other middle-income countries. The share of its ODA allocated to environmental management is relatively small. A significant increase in financial support for the latter would be a sound investment, as Israel has demonstrated that it can carry out highly effective environmentally related development co-operation activities when resources are available. Such activities have focussed, in particular, on natural resources management, including management of water resources, in Middle Eastern and African countries.

Recommendations

- Expedite ratification of major global and regional environmental conventions and protocols, particularly in the areas of chemicals, waste, biosafety, biodiversity and protection of the Mediterranean Sea.
- Mainstream and strengthen the environmental component of official development assistance within an expanding volume of development aid.
- Strengthen the government's monitoring, inspection and enforcement capabilities in order to curtail the illegal introduction of alien species and trade in endangered species, hazardous waste and ozone-depleting substances.
- Continue to explore avenues of co-operation with neighbours on pressing marine pollution and transboundary water and waste management problems, particularly at sub-national level and through non-governmental channels, as well as through accession to relevant international agreements.

1. Policy objectives and institutions

1.1. Policy objectives

Israel recognises that the field of environment offers unique opportunities for constructive engagement with other countries. Its broad objectives in pursuing international environmental co-operation include:

- Be a full and active partner, with other countries, in regard to meeting regional and global environmental challenges (including marine pollution, biodiversity conservation, stratospheric ozone depletion, climate change, and water and waste management), contributing Israel's experience and expertise.

- Draw on the capabilities, experience and resources of other countries, and of international organisations, to help address domestic environmental problems and policy development.
- Fulfil obligations under international environmental conventions and implementing agreements, and support and exert influence within international bodies and programmes (*e.g.* FAO, IMO, the OECD and UNEP).
- Support international efforts to respond to the 2002 World Summit on Sustainable Development (WSSD) and, in doing so, promote the integration of environmental and economic policy at country level.
- Support the over-riding foreign policy goal of engaging other countries and parties in peaceful co-operation.
- Ensure that domestic environmental problems do not contribute to political friction or disputes in the region.
- Assist developing countries to address their environmental management needs by sponsoring capacity-building and training activities.

Numerous specific policy objectives appear in the range of environmental plans and reports that Israel has prepared to meet the requirements of the international and regional conventions and declarations to which it is a party.[1]

1.2. Institutional responsibilities

A number of public and private bodies in Israel take part in international environmental activities. Some have specific responsibilities with respect to international and regional environmental agreements and programmes; others carry out domestic activities (*e.g.* in the areas of health, transport, internal affairs and agriculture) that directly or indirectly respond to Israel's international commitments.

The Ministry of Foreign Affairs (MoFA) provides overall foreign policy guidance; negotiates government-to-government agreements and international conventions; and includes Israel's Agency for International Development Co-Operation (MASHAV), which manages Israel's bilateral development assistance programme. Under a new "environmental diplomacy" theme, the MoFA is establishing environmental counsellor posts in Israel's foreign embassies, starting with Moscow and Berlin.

Within the central government, the Ministry of Environmental Protection (MoEP) has primary responsibility for managing and carrying out international and regional environmental activities. It also initiates and co-ordinates bilateral agreements on environmental matters. Its International Relations Division plays a co-ordinating role. The MoEP also has responsibilities for implementing international environmental commitments, including those relating to marine pollution, international chemical safety, transboundary movements of hazardous wastes, biodiversity conservation, and ozone-depleting substances.

The Israeli Nature and Parks Authority (NPA), an independent statutory body under the responsibility of the MoEP, is the Administrative Authority for the Convention on Wetlands of International Importance (Ramsar Convention). It manages marine reserves and enforces coastal fishing regulations. The NPA oversees Israel's efforts in support of the conventions on International Trade in Endangered Species of Wild Fauna and Flora, on Biological Diversity, and on the Conservation of Migratory Species of Wild Animals. It

represents Israel in the International Union for Conservation of Nature (IUCN) and participates in other international projects and networks.[2]

Other ministries, including those responsible for agriculture, transport, health and industry, also have important international environmental mandates and carry out related activities. Israel has established a number of intra-governmental councils, committees and interdisciplinary bodies to provide policy analysis, guidance and co-ordination with respect to international conventions and multilateral programmes.[3]

At the sub-national level, municipalities, local authorities and regional councils sponsor projects that support international environmental objectives, some of which involve financing by international sources including the European Union.[4] Jerusalem and other municipalities take part in international networks of major cities to help identify best practices, and are reaching out to Palestinian municipalities in the West Bank to try to resolve waste and water management problems (Box 3.1).

Box 3.1. **Jerusalem's international outreach**

The environmental outreach activities of the Jerusalem municipality include participation in a number of international networks with a view to strengthening its own policies and programmes, and to helping address regional and global-scale environmental issues.

The municipality is a member of the World Health Organization's Healthy Cities programme. The Old City is a UNESCO World Heritage Site. In 2008, the Mayor signed the "18-Cities Charter" for reducing air pollution and climate change, considered to be a contribution to Israel's efforts to support the UN Framework Convention on Climate Change by reducing carbon emissions 20% by 2020. In 2009, the city became a founding member of the Green Pilgrim Cities Network (GPCN), a programme supported by the Alliance of Religions and Conservation (ARC), whose purpose is to maintain the world's major pilgrim routes.

In 2009, the city joined the international LABNetwork (Local Action for Biodiversity network), an urban biodiversity initiative involving 21 major cities around the world launched by ICLEI – Local Governments for Sustainability in partnership with the IUCN. Under this programme, the city is committed to a series of actions based on a three-year programme aimed at improving biodiversity.

The municipality has co-operated in an initiative for the restoration and development of the Kidron River Basin, which extends from Jerusalem to the Dead Sea and is home to some 200 000 people. The goal is to develop and implement, in concert with Palestinian municipalities and NGOs, a master plan for the river basin involving treatment of raw sewage, legalisation of structures, and restoration of the scenic and cultural heritage of one of the most important pilgrimage routes.

Several Israeli universities and their affiliated institutes offer environmental training and research opportunities to foreign students and have international environmental studies programmes. Environmental non-governmental organisations (NGOs) have also been making important contributions in the international environmental area (Chapter 1).

The role of municipalities and environmental NGOs is especially important in Israel, given the political situation that limits government-to-government co-operation with its immediate neighbours. These limits are overcome, in part, by municipality-to-

municipality engagements and by NGOs such as Friends of the Earth Middle East (FoEME), a trilateral organisation with offices in Tel Aviv, Bethlehem and Amman that brings together Israelis, Palestinians and Jordanians to study, for example, ways to combat the environmental degradation of the Jordan River and Dead Sea watersheds.

Overall, Israel's institutional structure for international environmental co-operation is well-defined. Mechanisms exist for co-ordination and co-operation among ministries and between public and private sector institutions. The principal deficiency consists of limitations on the funds and manpower available to various stakeholders so that they can carry out their responsibilities.

1.3. Participation in multilateral organisations

Israel participates in a number of multilateral organisations within and outside the United Nations structure. It has long attached special importance to the activities of the United Nations Environment Programme (UNEP). Israel's objectives include benefiting from UNEP's policy directions, long-term environmental outlooks, chemicals management activities, and the Mediterranean Regional Seas progamme. It has been a strong supporter of UNEP-sponsored conventions and follow-up programmes, especially those on hazardous wastes, stratospheric ozone depletion, biodiversity, desertification and climate change. Israel has been elected to the Governing Council of UNEP, as a Western European and Others Group (WEOG) member, and participates in the UNEP-sponsored Mediterranean Commission on Sustainable Development (MCSD).[5]

Israeli officials take an interest in the activities of the Food and Agriculture Organization of the United Nations (FAO) concerning dryland agriculture, water management and fisheries, and those of the World Health Organization (WHO) concerning water quality monitoring and chemical safety. Israel's approach to maritime safety and oil pollution has benefited from its participation in the International Maritime Organization (IMO).

Israel also participates in UNESCO's Man and the Biosphere (MAB) Programme, World Cultural and Natural Heritage Programme, and work programme on environmental education. In addition, it has taken part in the environmental management and sustainable development activities of the World Tourism Organisation. Israel has been a member of the World Trade Organization since 1995, although it has not been active in that body's environmentally related activities.

Israel is a member of the United Nations Economic Commission for Europe (UNECE), but it has not signed or ratified any of the UNECE's environmental agreements, *e.g.* on transboundary water and air management (Sections 3.2 and 3.3). This is the result of limited manpower and financial resources, together with Israel's geographical separation from other UNECE members, which has led it to focus on other regional forums. Nonetheless, Israel implements the UNECE Strategy for Education for Sustainable Development and participates in the UNECE/WHO Transport, Health and Environment Pan-European Programme. It might be timely for Israel to re-examine its position with respect to participation in some of the UNECE's environmental agreements, such as the Aarhus Convention, and related activities.

In 2005, Israeli environmental experts began to attend, in an observer capacity, meetings of OECD committees and working groups in the fields of waste prevention and recycling and chemical safety. By the time it became an OECD member in 2010, its involvement had expanded markedly. For example, Israel fully participates in the

OECD system of Mutual Acceptance of Data in the testing of chemicals. It has now accepted all of the OECD's Decisions and Recommendations in the field of environment (with mutually agreed timeframes for the implementation of certain instruments) and is fully engaged in the OECD environmental work programme.

2. Bilateral co-operation and development assistance

The geopolitical situation has adversely impacted environmental co-operation between Israel and its immediate neighbours in the past two decades. Israel has diplomatic relations with only Egypt, Jordan and Turkey among Middle Eastern countries. There were signs of a considerable expansion of bilateral relations in the 1990s, but the scope and intensity of joint activities have been scaled back since the beginning of the Second Intifada in 2000, especially at government-to-government level.

Israel's co-operation with its neighbours on environmental issues mainly takes place within the framework of programmes sponsored by multilateral organisations, *e.g.* UNEP's Mediterranean Action Plan (MAP), and through multi-country projects initiated by the European Union, the World Bank, and other OECD countries.[6]

2.1. Bilateral agreements

Since 1991, Israel has entered into 22 formal bilateral environmental agreements, 10 of which were negotiated after 2000. Only two of these agreements are with immediate neighbours: Egypt (1993) on agricultural ecology; and Jordan (2003) on general environmental co-operation. Most are with other OECD members. Types of co-operation include technical meetings, workshops, and exchange visits by officials and scientists. The portfolio of formal bilateral environmental agreements is managed by the MoEP. Government-to-government agreements with environmental components also exist in other areas (*e.g.* agriculture and health) and are administered by other ministries.

Bilateral co-operation with Jordan and with the Palestinian Authority takes place in the framework of the Israel-Jordan Treaty of Peace of 1994 and the Interim Agreement of 1995 between Israel and the Palestinian Authority, known as the "Oslo II" Agreement. In both cases, Joint Water Committees were established and have continued although other committees established under the accords ceased meeting following the Intifada in 2000 (Section 3.2). Co-operation with Egypt has been limited to joint efforts to detect and respond to marine pollution, especially oil spills, in the Red Sea (Section 3.1).

Under a 2003 Memorandum of Understanding (MOU) between Israel's Ministry of Environmental Protection and Jordan's Aqaba Special Economic Zone Authority (ASEZA) (MoEP, 2007b), the Northern Gulf of Aqaba Management Program was established to maintain the core elements of an earlier successful transboundary Red Sea Marine Peace Park Co-operative Research and Monitoring Program (RSMMP) (Section 3.1). Other priorities are joint pest control (fruit flies, mosquitoes, rodents) along the Arava Valley, and finding solutions for rehabilitating the Dead Sea.

With respect to the Palestinian Authority, outside of the Joint Water Committee there is currently no framework for environmental co-operation at the central government level. Some joint activities, such as consultations on a waste disposal site at Ramallah and rehabilitation of the Kidron River Basin, are carried out by municipalities and local authorities. Private institutes also foster co-operation. In 2007, a 14-person team of Israeli and Palestinian researchers (from the Arava Institute for Environmental Studies in Israel

and the Water and Environment Organisation on the Palestinian side) produced a plan to restore the quality of 15 rivers flowing through the West Bank. Environmental NGOs, especially Friends of the Earth Middle East (FoEME), have provided opportunities and venues for collaboration between non-governmental environmental institutions and experts from both sides.

A number of international organisations have worked to stimulate and catalyse environmental co-operation between Israel and the Palestinian Authority. In 2005, with support from the European Union's LIFE-Third Countries programme, a project on "The Sources of the Jordan River, Humans and Nature" was launched by the Upper Galilee Regional Council, leading to the development of a master plan for the area where the river has its source.

Pursuant to decisions by its Governing Council, UNEP conducted three studies with implications for environmental co-operation between Israel and the Palestinian Authority: a 2003 "Desk Study" on the deterioration of the environment on the West Bank and in Gaza; a 2006 UNEP study related to Gaza; and a 2009 review of environmental damage in Gaza. Each involved intensive (but separate) consultations between UNEP and Israeli representatives, and between UNEP and Palestinian representatives. The Desk Study included 136 recommendations, which thus far have not been considered jointly by Israel and the Palestinian Authority although Israel has expressed its willingness to do so.

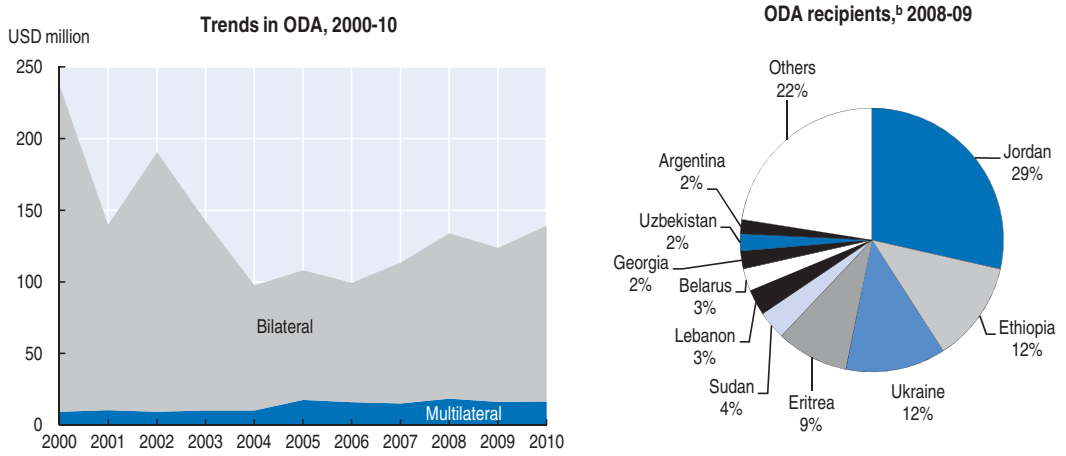
2.2. Bilateral development assistance

Israel's development assistance programme is administered by Israel's Agency for International Development Co-operation (MASHAV) of the Ministry of Foreign Affairs. Its mandate is to promote social, economic and environmental sustainability and its point of reference is the Millennium Development Goals adopted by the United Nations General Assembly in 2000. MASHAV funds short- and long-term consultancies by Israeli experts, as well as training courses for students and experts from developing countries. It operates through a "training network" of national institutions and partners.

In 2010, Israel provided about USD 140 million in official development assistance (ODA), of which 88% was for bilateral assistance. The total represented 0.07% of gross national income (GNI), compared with more than 0.1% in 2002. This is a relatively small share compared with that of the OECD's Development Assistance Committee (DAC) member countries and the non-OECD countries that report annually to the DAC. The total amount of multilateral assistance increased between 2000 and 2010. Bilateral assistance fluctuated during this period, but the total amount (in real terms) decreased by about 45% (Figure 3.1). Israel's ODA is focused on the Middle East, with Jordan receiving over 29% of average bilateral assistance in 2008-09, and on the African countries bordering the Red Sea (Ethiopia, Eritrea and Sudan), which received 25% of Israel's bilateral aid flows in 2008-09. Some countries in Eastern Europe, the Caucasus and Central Asia are also among the top ten beneficiaries of Israel's support (Figure 3.1).

Israel does not fund major infrastructure as part of development assistance, and therefore does not have an environmental assessment process in place for such funding. However, in support of the relevant OECD Recommendation[7] and DAC guidelines on environmental assessment principles and methodology for development assistance, it is establishing an inter-ministerial framework to design a formal impact assessment process that will be applicable whenever it becomes relevant for Israel. It is important for Israel to

Figure 3.1. **Official development assistance**[a]



a) Net ODA disbursement expressed at 2009 prices and exchange rates. 2010 data are preliminary.
b) Average net disbursements of bilateral ODA.
Source: OECD-DAC (2011), *Development Aid Database.*

StatLink http://dx.doi.org/10.1787/888932495171

recognise that environmental impacts relate not only to infrastructure activities, and that appropriate screening needs to be in place for all co-operation activities.

Although the environmental component of the MASHAV programme is small in terms of funding, it has supported institutions and capacity-building that promote sustainable agriculture, biodiversity conservation in desert ecosystems, control of desertification, water and waste management, control of marine pollution, and safe use of pesticides. To expand and focus environmentally related assistance by Israel, MASHAV has signed co-operative memoranda of understanding with other Israeli agencies and with UN bodies.

Apart from the MASHAV programme, several Israeli universities, NGOs and private institutions assist developing countries to address environmental problems by providing research and training opportunities and sponsoring demonstration projects. The Jewish National Fund, for example, supports a broad range of land reclamation, water conservation and afforestation activities internationally.

3. Regional co-operation

There has been regional environmental co-operation involving Israel and more than one of its neighbours since the early 1990s. As part of the UN-sponsored Multilateral Peace Process for the Middle East, working groups involving Egypt, Israel, Jordan and the Palestinian Authority were created on environmental protection and water resources management (MoEP, 2007a). Since then a number of multi-party projects have been carried out, mostly involving private sector institutions and scientists, to address oil pollution, desertification and natural resources management, arid land management and saline water use, and air pollution.

Under a Middle East Regional Co-operation Program (MERC) sponsored by the United States Agency for International Development (USAID), for 15 years scientists and officials from Israel, Jordan the Palestinian Authority, and, in some cases, Cyprus,[8] Greece and Turkey have collaborated in a wide-ranging effort to protect bird populations in the Middle

East. MERC financing has also supported Israel-Jordan-Palestinian Authority studies along the Jordan River and Egypt-Israel-Palestinian Authority demonstration projects on wastewater treatment technologies.

The EU has become increasingly important to Israel's environmental efforts in the past 15 years. Co-operation is largely carried out within the framework of the Euro-Mediterranean Partnership (EMP) and the European Neighbourhood Policy (ENP) (Box 3.2).

Box 3.2. **Co-operation with the European Union**

To a great extent, environmentally related co-operation between Israel and the European Union is carried out within the framework of the Euro-Mediterranean Partnership (EMP) launched in 1995 (also known as the "Barcelona Process"). Following the signing of an Association Agreement in 1995, Israel began to receive support for environmental efforts under the EU Life-Third Countries programme. During the next ten years, the EU provided a series of small grants, principally to local Israeli councils, NGOs and private sector institutions, for projects ranging from the restoration and conservation of fauna and flora, to capacity-building for Local Agenda 21 initiatives, to municipal solid waste demonstration projects.

In 2004, the EU launched the European Neighborhood Policy (ENP) to strengthen its engagement with neighboring countries (EC, 2006). Following Israel's ratification in 2004 of a new Association Agreement, a National Action Plan for Israel setting out priority areas for co-operation was agreed, and a bilateral Environment Subcommittee was created to plan and oversee collaboration. Additional EU financial support has been provided to Israel since 2007 through the European Neighbourhood and Partnership Instrument (ENPI).

Israel and the EU also co-operate in the context of the Environmental Strategy for the Mediterranean, developed under the Euro-Mediterranean Partnership. This effort is co-ordinated with related regional environmental activities carried out under UNEP's Mediterranean Action Plan through a formal EU-UNEP/MAP agreement.

Israel has requested European Environment Agency (EEA) observer status.

3.1. Protecting the marine environment

Israel's marine and coastal resources are among its most valuable natural assets. They are of great importance for both economic and social development. Some 70% of Israeli citizens live in coastal zones. Israel's approach to marine issues has been heavily influenced by its participation in the Mediterranean Action Plan (MAP) and by international commitments under the 1976 Barcelona Convention for the Protection of the Mediterranean Sea against Pollution. Israel is a signatory to six of the seven Convention protocols, although ratification is pending for some of them.

Israel participates in virtually all of the MAP's numerous components and is active in five MAP Regional Activity Centres (RACs).[9] It has held a position on the MAP Bureau of Contracting Parties since 2008. MAP concepts and requirements, as well as the financial support available through a variety of MAP-related programmes, have helped to shape Israel's marine monitoring and assessment, control of land-based sources of pollution, oil spill emergency response, integrated approaches to coastal zone management, and marine turtle protection. Israel also participates in the Mediterranean Commission on Sustainable Development (MCSD). In 2005, Israel and the other contracting parties to the Barcelona

Convention approved a Mediterranean Strategy for Sustainable Development, produced by the MCSD, which is helping to guide Israel's work in this area.

Marine pollution

In addition to the Barcelona Convention, Israel has signed and ratified the 1973 International Convention for the Prevention of Pollution from Ships, as modified by the Protocol of 1978 (MARPOL 73/78) and several of its annexes (it has still not ratified three annexes). Israel is not a party to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 and 1996 Protocol thereto (the London Convention and Protocol).

The legal framework for preventing marine pollution is well-established. Both the dumping of waste into the sea from vessels or aircraft and land-based discharges are regulated by strict permitting systems overseen by an Inter-ministerial Permit Committee. These systems are in line with the protocols to the Barcelona Convention on dumping at sea and from land-based sources. Dumping at sea has effectively been halted, with the exception of dredged material (sand) from maintenance operations in the ports of Haifa and Ashdod, discharges from the cooling plants of coastal power stations, and discharges of industrial brines and other waste products following pre-treatment.

Pollution surveillance and enforcement efforts are principally carried out by 15 professional marine and coastal inspectors and experts belonging to the MoEP Marine and Coastal Environment Division. They are charged with routine inspections of oil tankers and other vessels, shore-based oil installations, and local industrial and wastewater treatment plants. The number of enforcement actions taken against polluters of the marine environment has been limited by the small number of inspectors. Ship inspections for onboard safety measures and ship maintenance are conducted by the Ministry of Transport's Shipping and Ports Administration. Some 25% of foreign ships have been subject to such inspections in recent years, a percentage that is in accord with the Paris Memorandum of Understanding on Port State Control (Paris MoU). Monetary resources for combating marine and coastal pollution are generated by the marine environment protection fee that ships calling at Israeli ports pay into the Marine Pollution Prevention Fund (Chapter 1).

In 2002, water quality standards were formulated for Israel's Mediterranean waters and a comprehensive marine pollution monitoring programme was initiated. In 2005, systematic surveillance of coastal seabed populations and the effects of pollution began, including satellite use for mapping and monitoring.[10] Israel also has strong capabilities in marine research and data management.

Oil pollution

Oil tankers offload more than 12 million tonnes per year in Israeli ports along the Mediterranean and Red Sea coastlines. Another 2 million tonnes are exported through Israel's fuel terminals. There is a high risk of a severe pollution incident in the Mediterranean Sea, particularly in the eastern basin: about 30% of global marine trade and some 20% of the global volume of fuel transported by sea traverses the Mediterranean. However, Israel has not experienced any major offshore oil spills in the last decade.[11] It is a strong supporter of the International Maritime Organization's maritime safety and marine pollution control activities, and is a party to most of its conventions and protocols. These include the 1992 Protocol to the Convention on Civil Liability for Oil Pollution

Damage (CLC), the 1992 Protocol to the Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND) and the International Convention on Oil Spill Preparedness, Response and Co-operation (OPRC).

Israel has taken significant steps to address the threat of marine oil pollution. A study on the coastline's sensitivity to oil spills and an oil spill risk assessment have been carried out. In 2008, Israel adopted a National Contingency Plan for Combating Marine Oil Pollution that covered all coastal areas, in accordance with the OPRC Convention. Implementing the plan is the responsibility of the MoEP, supported by the Ministry of Transport and affected municipalities.[12]

All major Israeli ports have reception facilities for oily bilge and ballast wastes. Emergency response capabilities for oil spills have been significantly boosted by the establishment of oil pollution control centres in Haifa and Ashkelon, which can handle spills of up to 4 000 tonnes. To prevent and control oil pollution in the Gulf of Eilat/Aqaba, Israel has established a Marine Pollution Prevention Station between its coral reef reserve and a major oil terminal. This station serves as a command centre and logistical base.[13]

In regard to co-operation with neighbouring countries, a 1995 agreement between Cyprus,[14] Egypt and Israel on preparedness for and response to medium and large-scale oil spills remains in effect. The agreement requires each party to stockpile pollution abatement equipment which will be available to the partners in case of a spill in open waters. By mobilising their forces, the three parties are able to deal with a spill of up to 15 000 tonnes. Within the framework of the multilateral Middle East peace talks, Egypt, Israel and Jordan have agreed to co-operate to respond to oil spills and other major pollution incidents in the Gulf of Eilat/Aqaba. This requires placing pollution control equipment at each other's disposal at marine pollution prevention stations in Eilat (Israel), Aqaba (Jordan) and Neuiba (Egypt).

Land-based marine pollution

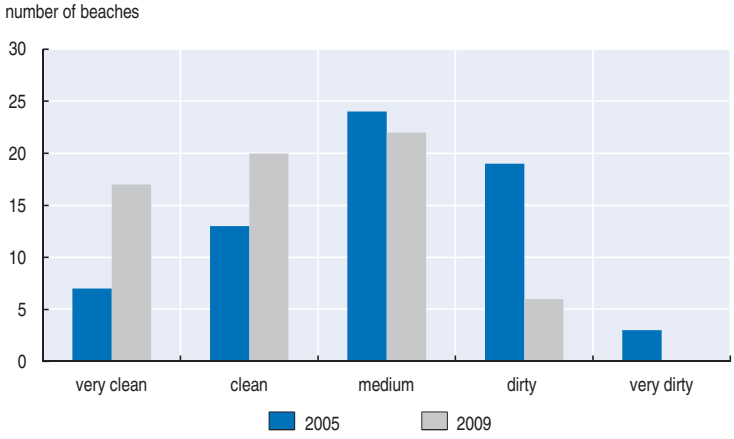
The quality of Israel's Mediterranean and Red Sea coastal waters has been under heavy pressure from discharges of urban and industrial effluents, as well as runoff from agricultural land (Chapter 4). This situation has been addressed by the government in the past decade with varying degrees of success. Substantial efforts and investments have been made to control indirect marine pollution from watercourses. Industrial firms in the coastal zone are now required to pre-treat wastes before discharging them to the sea via outfalls.

Particular attention has been paid to Haifa Bay, on the Mediterranean coast, identified as a pollution hotspot. A principal problem has been the inflow of industrial and municipal wastes from the Kishon River. As the result of efforts by the municipality and central government in the past decade, fish have returned to the river and there is now a focus on removing sediments from the riverbed.

In 2005, the MoEP launched a Clean Coast programme involving continuous cleaning (60%); education, advocacy and public relations (20%); and enforcement (20%). Israel's Clean Coast Index in 2009 showed that 70% of its beaches were "clean" or "very clean", compared to 27% in 2005 when the programme began (Figure 3.2).

A major step with respect to addressing land-based sources of marine pollution was taken in 2004 when the Protection of the Coastal Environment Law was enacted. It imposes strict regulations on areas within 300 metres of the coastline, prohibits development within 100 metres, and makes it possible for legal action to be taken against any

Figure 3.2. **Cleanliness status of 65 Israeli beaches, 2005 and 2009**



Source: Israel's 4th country report to the UN CBD, 2009.

StatLink http://dx.doi.org/10.1787/888932495190

individuals who cause damage to the coastal environment. It also imposes levies on legally permitted discharges of industrial effluents to the sea and adjacent rivers.

Israel was a leading country in the development of the Protocol on Coastal Zone Management to the Barcelona Convention, which it signed 2008. While it has not yet ratified this protocol, Israel abides by all its requirements. Adoption of the protocol by other countries in the region should help ensure improved management of coastal and marine resources elsewhere, thereby reducing external impacts on Israeli coastlines. The multi-government planning and negotiation process leading to the development of this most recent protocol to the Barcelona Convention drew on Israel's planning policy and its national legislation, including the 2004 Protection of the Coastal Environment Law and the National Master Plan for the Mediterranean Coasts.

In addressing issues related to land-based marine pollution, the national government has effectively engaged local governments and private sector institutions in the planning process. Several Israeli NGOs have been active and influential. The Israel Union for Environmental Defense has successfully used the courts through petitioning to block proposed projects in coastal zones and to demand the preparation and public disclosure of environmental impact statements.

Marine living resources management

Israel's marine fish catch comes principally from the Mediterranean Sea. Total production from the marine environment (approximately 80% from coastal waters) is small and steadily declined between 1990 and 2008 (Eurostat, 2008).[15] Low catches reflect the relative impoverishment of fish stocks in the eastern Mediterranean and the small size and range of Israel's fishing fleet. Fishing is concentrated along a narrow, 273 km long continental shelf, with the industry operating from six main fishing ports (Table 3.1).

The bulk of Israel's fish production comes from aquaculture (fresh water production) and mariculture (cultivation in cages in marine coastal waters). In 2008, fish farms of both types provided some 83% of the country's total fish catch. In the mid-2000s, however, the

Table 3.1. **Israel's marine fish catch, mariculture production and aquaculture production, 2000-09**

Tonnes live weight

	Marine catch[a] (pelagic and nearshore)	Mariculture production	Aquaculture production
2000	3 739	2 914	17 184
2001	3 654	3 161	18 157
2002	3 739	3 056	19 200
2003	3 473	3 110	17 667
2004	2 992	3 353	18 949
2005	2 200	3 196	19 208
2006	2 756	2 725	19 382
2007	2 219	2 251	19 168
2008	2 067	2 261	17 731
2009	. .	1 003	. .

a) Mediterranean Sea.
Source: Ministry of Agriculture and Rural Development.
StatLink http://dx.doi.org/10.1787/888932495722

government (under strong pressure from NGOs) began to curtail mariculture operations in the Gulf of Eilat/Aqaba due to concern about impacts on the vulnerable reef complex in the Red Sea, a major tourism attraction. In 2008, all fish cages were dismantled and mariculture in the Gulf ceased.

Particular attention is being paid to protecting and rehabilitating the coral reefs of Eilat. Beyond eliminating mariculture operations, Israel has taken measures to propagate reef fragments in order to: support recovery and growth; create artificial reefs; close portions of the reef to snorkelers and divers; and conduct research on "coral gardening". In 1993, Israel and Jordan (which share the shoreline around the northern Gulf of Eilat/Aqaba) established the Red Sea Marine Peace Park to protect the fragile reef ecosystem (Box 3.3).

Some mariculture operations are located along the Mediterranean coast, but growing pressure for alternative uses of the coastline may result in their closure in the near future. Commercial trials have begun to establish a practical cage farming industry in the open sea. If this succeeds, the potential exists for rapid growth of mariculture.

In 2000, Israel's Ministry of Agriculture and Rural Development concluded that the capture fishing industry in the Mediterranean Sea had reached exploitation limits for most species. It began to introduce more stringent regulations on fishing methods and fishing areas to promote recovery of stocks, but limits on the size of catches have not been established. The size and capabilities of the fishing fleet are, however, being controlled. No new fishing vessels (*e.g.* trawlers, launches) have been allowed in the Mediterranean Sea since 1995. Minimum sizes of net grid have been established for all commercial fish.

The Nature and Parks Authority enforces regulations to prevent illegal fishing in marine waters. Drawing on both the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and domestic legislation to identify species in need of protection, it polices Marine Protected Areas and Marine Nature Reserves established under international conventions and agreements (where fishing is completely prohibited). The Ministry of Agriculture and Rural Development is responsible for fisheries research and development and manages laboratory units that carry out stock monitoring, fish surveys and fishing gear development.

Box 3.3. **The Red Sea Marine Peace Park**

Israel and Jordan share 41 km of coastline around the northern Gulf of Eilat/Aqaba. This area contains outstanding coral reefs which attract large numbers of visitors and associated tourist development.

In 1994, during the Trilateral Peace Negotiation Process between Jordan and Israel with the support of the United States, the two countries agreed to develop a Red Sea Marine Peace Park within the framework of an Agreement on Special Arrangements for Aqaba and Eilat. Protection of the fragile reef ecosystem was the principal motivation. The Agreement calls on the parties to "collaborate in research efforts on coral reefs and marine biology, and in implementing comparable policies and regulations designed to protect the coral reefs as a tourist attraction which is soundly managed from an ecological point of view".

Jordan established a marine park off the coast of Aqaba and designated a protected coral reef strip stretching 7 km along the eastern side of the northern Gulf of Eilat/Aqaba. Israel has set aside the southern part of the Eilat coast for nature conservation. There is a 4 km "marine protected belt" in the sea, approximately parallel to the two on-shore nature reserves, which stretch from the southern end of the city of Eilat to the border crossing to Egypt at Taba. On the Israel side, the park is managed by the Nature and Parks Authority.

A cross-boundary co-operative research, monitoring and management programme was assisted by the United States National Oceanographic and Atmospheric Administration (NOAA) and USAID. At the conclusion of the programme in 2003, the two sides signed a Memorandum of Understanding to co-operate in maintaining the core elements of a recently initiated ecosystem monitoring and data management programme in the northern Gulf of Eilat/Aqaba. While each party funds its own monitoring efforts, the programme is overseen by a joint Steering Committee. Joint training of experts and contingency planning are carried out in preparation for any emergencies, including oil spills.

Source: MoEP.

Despite strengthened regulation and enforcement, some members of Israeli scientific and environmental communities (and of the general public) have raised concerns that fishing off Israel's coasts is endangering other living marine resources, including marine mammals. A 2010 University of Haifa research study indicated that commercial trawling is endangering the Common Bottlenose Dolphin (*Tursiops truncatus*), although the small population of about 350 currently appears stable (Science Daily, 2010).

In 1995, Israel was a leading contributor to the development of FAO's Code of Conduct for Responsible Fisheries. It also played a prominent role in negotiating an international agreement on the Management of Straddling Fish Stocks and Highly Migratory Stocks, under the UN Convention on the Law of the Sea, which Israel has yet to ratify. Israel is a signatory to (but has not ratified) the International Convention on Fishing and Conservation of Living Resources of the High Seas, an instrument developed under the International Law Commission in support of the Law of the Sea Treaty, as well as the Agreement for the Implementation of the Provisions of the Convention relating to the Conservation and Management of Straddling Fish Stocks and Highly Migrating Fish Stocks.

Assessment

While early efforts to control marine pollution focussed on sea-based sources, this focus broadened during the past decade to include land-based sources: municipal wastes,

industrial effluents, and agricultural runoff into rivers flowing to the sea or discharged directly from outfalls. This two-pronged effort has led to an impressive reduction of pollution loads, especially those of heavy metals, organic pollutants and oils. The main findings of water quality monitoring show that levels of pollution in Israel's coastal waters are not high compared with international environmental quality standards and criteria, except in Haifa Bay and at a few other locations.[16] Of the six hotspots on Israel's Mediterranean coastline at the beginning of the decade, only two, Shafdan and Agan, continue to need major attention. In particular, there have been delays related to the termination of the direct discharge of sewage sludge from the Dan Region Wastewater Reclamation Project (Shafdan) to the Mediterranean Sea (Chapter 7). In the Gulf of Eilat/Aqaba, water quality has at least been stabilised in the face of heavy pressure from urban growth, tourism and industry. Overall pollution levels fell during the first half of the decade and were stabilised in the second half.

Despite substantial progress, major challenges remain. Following several years of improvement, pollution monitoring in Mediterranean coastal waters indicates that, while levels of nutrients, heavy metals and organic matter fell or were stabilised during the past decade, concentrations in the seabed remain in the medium to high range in some areas. Although inspections and enforcement have improved, pollutants are still being discharged into the sea. Further, while new river restoration programmes have been initiated, several of Israel's 15 rivers that empty into the Mediterranean have been found to be highly polluted, and the 15-year trend of decreasing heavy metal loads in shellfish has levelled off during the past five years. Monitoring of the Red Sea between 2005 and 2009 revealed severe deterioration of the coral reefs in the Gulf of Eilat/Aqaba in recent years, attributable to sewage discharge (which has recently ceased), phosphate contamination from an industrial plant, tourist overload, and fish cage-based mariculture (which has now been phased out). Concerns have also been raised within Israeli's science community and by environmental NGOs about possible negative impacts on water quality and marine life from the series of large coastal desalination plants Israel is constructing (Chapter 4).

3.2. Transboundary water management

From the time it was established, Israel has confronted the challenge of building a society and economy in the face of severe shortages of freshwater (Chapter 4). Compounding this challenge is the fact that its major sources of water, both surface and subsurface, are shared with neighbours.

The Jordan River

The Jordan River has great economic significance for Israel. Today it is a relatively small stream along most of its length, reduced in size through water diversion and withdrawals. Pressures have been exacerbated during the past decade by prolonged drought. In a 2010 study of the Lower Jordan River, Friends of the Earth Middle East found that: over 98% of the historic flow of the lower Jordan is being diverted by Israel, Jordan and Syria for domestic and agricultural use; the remaining flow consists mainly of sewage, fish pond water, agricultural runoff and saline water diverted into the Jordan from salt springs around Lake Kinneret; and the river has lost over 50% of its biodiversity due to the total lack of fast-flow habitats, as well as floods and high salinity.

Regional co-operation on managing water availability and quality in the Jordan River has ebbed and flowed with the status of the Middle East peace process. The Israel-Jordan Treaty

of Peace of 1994 contained an extensive water clause acknowledging the insufficiency of freshwater sources in the region and called upon the two parties to act in the "spirit of co-operation to resolve short-term water shortages". A Joint Water Committee was created to oversee water allocation, storage, water quality protection, information transfers and data sharing, and generally to co-ordinate action in alleviating water shortages. Jointly established monitoring stations were to operate under the guidance of the Joint Committee. Bilateral consultations on water issues have continued throughout the decade within the Joint Water Committee, which has met on average every two to three months.

In 2010, the Israeli Ministry of Environmental Protection released the terms of reference of a master plan to rehabilitate the northern part of the Lower Jordan River from Lake Kinneret to the Bezeq Stream (on the edge of the West Bank). This plan has been presented to Jordanian and Palestinian stakeholders for comment. The Israeli and Jordanian governments are also co-operating to reduce significantly the flow of untreated sewage into the Lower Jordan, including activation of new sewage treatment plants in their respective jurisdictions. In addition, Israel's Lower Jordan River Drainage Authority has drafted the terms of reference of a master plan for landscape development of the Lower Jordan. The master plan will address economic issues and include cost-benefit analyses, finance and management.

Co-operation on Jordan River issues has also taken place in recent years at the sub-national level of municipalities and regional councils, among research institutions of Israel, Jordan and the Palestinian Authority, and among environmental NGOs. In 2007, a 14-person team of Israeli and Palestinian researchers – from the Arava Institute on the Israeli side and the Water and Environment Organisation on the Palestinian side – prepared a plan to restore the quality of 15 rivers, some of which feed into the Jordan. In 2010, Friends of the Earth Middle East published a transboundary diagnostic analysis of the Lower Jordan River (FoEME, 2010). This analysis focuses on opportunities to redirect freshwater resources to the Lower Jordan through strategic water savings from within the national water economies of Jordan, Israel and the Palestinian Authority.

The Dead Sea

The Dead Sea, the southern terminus of the Jordan River, is one of the world's unique ecosystems. It is the lowest spot on earth, 422 metres below sea level, and the world's saltiest large body of water (33% salinity). Historically, it has been an economically important tourism site. In addition, Israel's Dead Sea Works and Jordan's Arab Potash Company together employ over 4 500 workers and generate revenue of USD 75 million annually from the recovery of sodium chloride, potash, bromine, caustic soda and magnesium metal from Dead Sea brines.

With only 10% of upstream Jordan River water now reaching the Dead Sea, and the minerals industry extracting brines, the level of the Dead Sea has been falling by approximately 1 metre per year. The consequences include the loss of one-third of the sea's surface area since 1930, drying up of natural springs that supported a diversity of wildlife, and a growing number of large sinkholes in the area.

The 1994 Israel-Jordan Treaty of Peace described the Dead Sea as a "special geographical area" and identified a number of priorities for co-operation: nature reserves and protected areas; pest control; protection of water resources; industrial pollution control; and tourism and historical heritage. However, there is currently no transnational co-ordinating and supervisory body for the Dead Sea.[17]

Israel and Jordan have discussed a plan to construct a 180 km "Peace Canal" from the Gulf of Eilat/Aqaba to the Dead Sea (US Congressional Research Service, 2008). This would involve building a desalination plant and sending the brine effluent (diluted with seawater) northward to replenish the Dead Sea. The freshwater produced by the plant would be allocated to Israel, Jordan and the Palestinian Authority in the West Bank, while hydropower would be generated by canal water cascading down to the Dead Sea. The World Bank launched a feasibility study in 2008, supported by a multi-donor trust fund. A steering committee is composed of representatives of the three riparian parties (World Bank, 2007). Concerns have been raised about both the costs of financing the project and its potential environmental impacts.

There is also a plan to rehabilitate the Kidron River Basin, a source of polluted surface water inflows to the Dead Sea. For 30 years there have been ongoing deliberations concerning solutions for the rehabilitation of the Kidron Basin, including building a joint sewage treatment plant. A steering committee comprising representatives of the Jerusalem Municipality, the Ministry of Environmental Protection, the Peres Center for Peace, the Jerusalem Institute for Israel Studies, the Milken Institute and the Dead Sea Drainage Authority was established to elaborate a master plan, in concert with Palestinian NGOs and experts (Municipality of Jerusalem, 2008). The goal is to establish a framework for collaborative integrated basin management between Israel and the Palestinian Authority, based on the successful model of the Yarkon River Master Plan in the Tel Aviv region.

The Mountain and Coastal Aquifers

Aquifers are the major source of freshwater for municipal, industrial and agricultural uses in both Israel and the Palestinian Authority. The most productive is the Mountain Aquifer (made up of three sub-aquifers) in north-central Israel. An estimated 70% of this aquifer lies under the West Bank, which also contains over half of the recharge area. For the 2.5 million West Bank residents, the Mountain Aquifer accounts for 90% of annual water consumption, with 70% devoted to agricultural uses. The water supply is under threat, however, from the drawdown of the Mountain Aquifer due to over-pumping both in Israel and in the West Bank, and pollution by infiltration of pesticides, fertilisers and sewage. Given the large volume of untreated raw sewage that continues to be disposed of by communities in the West Bank recharge area, and the extended "travel time" before it reaches the aquifer, a water pollution problem of major proportions may be slowly and inexorably building (Israel Water Authority, 2009).

Arrangements between Israel and the Palestine Liberation Organisation on water allocation and management, both in the West Bank and the Gaza Strip, were set out in 1995 in an Interim Agreement (also known as the Oslo II Accords) (Tal and Rabbo, 2010). The parties agreed to take all necessary measures to ensure that their exploitation of natural resources, including surface and subsurface water, does not damage the environment on the other side. They further agreed not to discharge wastewater and/or effluents to water bodies and water systems if it may cause harm to the other party. A Joint Water Committee was established to provide a forum for discussions of water and waste management, to monitor progress, and to oversee the development of water supply and sewage installations in the West Bank. At the present time, the 1995 Interim Agreement remains the sole legal instrument for co-operation between Israel and the Palestinians on transboundary water (and wastewater) issues.

In addition to the Mountain Aquifer, Israel taps a second major aquifer, the Coastal Aquifer, which lies under the Mediterranean coastal plain in west central Israel and the entirety of the Gaza Strip. All water supply and sewage systems in the Gaza Strip are under Palestinian control. In contrast to the West Bank situation, the Gaza Strip is downstream of Israel with respect to its aquifer. Thus, use of water from the aquifer in Gaza has no impact on Israel and Israel's water use does not prevent the flow of groundwater (or indeed of surface water) into Gaza. In keeping with the 1995 Interim Agreement, Israel constructed a water pipeline to supply Gaza with an agreed allocation of water. However, the corresponding connecting pipeline has not yet been constructed.

Disputes continue about the amount of water each side is drawing from aquifers, as well as about insufficient wastewater treatment in the West Bank and Gaza Strip. Israel maintains that it has fully met the terms of the existing Interim Agreement, and that a variety of continuing and emerging water management issues need attention. It has stated its willingness to co-operate with the Palestinians in arriving at a practical and fair arrangement.

Assessment

Israel faces the prospect of increasing pressures on its surface and groundwater resources from a combination of demographic and economic growth, the possibility of sustained long-term drought, and the demands of other water-limited riparians. Reducing the risk of water shortages and water quality degradation requires strengthened regional co-operation. The political situation in the region remains the major impediment to such co-operation. In the short to medium term, expanded donor support for West Bank wastewater treatment plants, wastewater reuse and water conservation efforts could help to maintain the quality of groundwater resources shared by Israel and the Palestinians.

The large number of master plans for rehabilitating the Upper and Lower Jordan, the Dead Sea, and West Bank river basins that have recently been developed provide a good basis for moving forward. The fact that most have involved consultations with Israel's neighbours (at least at the municipal, regional and NGO levels) should enhance the plans' credibility and legitimacy.

Israel could also explore the possibility of becoming a party to the 1992 UNECE Convention on the Protection and Use of Watercourses and International Lakes (Water Convention), as well as the 1997 UN Convention on the Non-Navigable Uses of International Watercourses. Both conventions call for states sharing river courses and lakes to co-operate on their management, to avoid actions harmful to neighbouring state(s), and to promote equitable allocation and use of the waters among the parties – measures that Israel has accepted in other international agreements and forums. Israel is currently examining joining the Protocol on Water and Health to the Water Convention.

3.3. Transboundary air pollution

Israel is not significantly impacted by transboundary air pollution. Nor has pollution generated within Israel, and transported through the atmosphere, given rise to problems with neighbouring countries. Israel is not a party to any regional or global conventions on transboundary air pollution, including the UNECE Convention on Long-range Transboundary Air Pollution and its eight protocols.

Understanding the nature and extent of possible transboundary air pollution in the region has been the subject of a number of co-operative scientific investigations, largely

carried out by non-governmental institutions in Israel, Jordan and the Palestinian Authority.[18] A 2007 joint Israeli, Jordanian and United States study examined a large brown cloud regularly observed over the Red Sea. It found that southerly winds carry local transport emissions (from trucks and ships) and possibly some industrial emissions towards the north end of the Red Sea, while northerly winds are associated with the regional transport of ozone.

In 2009, a comprehensive four-year study of the effects of atmospheric aerosols on health, climate and the environment was initiated by the Arava Institute for Environmental Studies in co-operation with Al-Quds University (Palestinian Authority) and the Jordanian Society for Sustainable Development. Air monitoring sites were established at 11 locations. The study is examining the sources of particulate matter from industrial and transportation sources within the Middle East, as well as from Europe and Africa.

4. Co-operation on global environmental issues

4.1. *International conventions and protocols*

Israel is party to the majority of the major international conventions on environmental management and resources conservation, together with the implementing protocols and associated agreements (Annex Table I.C). Most fall within the family of United Nations-sponsored multilateral environmental agreements (MEAs) that collectively address a broad spectrum of pressing environmental concerns: biodiversity (Chapter 5); endangered plant and animal species; hazardous wastes; desertification; stratospheric ozone depletion; climate change (Chapter 6); marine pollution; whaling; and cultural and natural heritage sites.

Israel has consistently made "good faith" efforts to respond to responsibilities assumed under international environmental agreements. It provides data and progress reports in a timely manner, and participates actively in technical and planning meetings on convention implementation. At the same time, its domestic environmental policies and programmes have benefited from the calls for action and guidelines emanating from the international agreements, as well as from the ideas, experiences and funding associated with the multilateral forums and programmes established under the conventions. However, Israel has not yet ratified a number of important global environmental agreements to which most other OECD countries are parties. Early ratification of these agreements could be considered, notably in the areas of transboundary movements of wastes (Section 5.1), chemicals (Section 5.2) and marine pollution (Section 3.1).

4.2. *Sustainable development*

Israel attended the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil. It was only a decade later, in conjunction with the World Summit on Sustainable Development (WSSD) in Johannesburg, South Africa, that the sustainable development concept and the Agenda 21 work programme received significant public exposure and concerted government attention in Israel (MoEP, 2002).

The WSSD engendered fruitful co-operation between the government and a coalition of NGOs. Such co-operation has been maintained since, for example through the Inter-ministerial Committee for Sustainable Development established in 2003, which includes representatives of the private sector, local authorities, civil society and the central government.

Following the Johannesburg World Summit, Israel became an active member of the United Nations Commission on Sustainable Development (CSD), the body established to promote and facilitate worldwide efforts to pursue the Agenda 21 work programme and sustainable development policies and activities more broadly. Israel joined the CSD in 2005 as a representative of the Western European and Others Group (WEOG) of the United Nations Economic and Social Council, later serving on the Bureau for two years. In this role, it has helped to shape an international response to the Plan of Implementation approved at the WSSD. Summaries of sustainable development activities in Israel are set out in documents submitted to the annual meetings of the CSD with the title *Towards Sustainable Development in Israel*.

4.3. Stratospheric ozone depletion

Israel has been a party to the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer since 1992, with "developed country" obligations. It has also ratified the subsequent four amendments to the protocol.[19]

Israel has made substantial progress in reducing or phasing out the substances controlled under the Protocol (Table 3.2). It phased out the consumption (*i.e.* production plus imports *minus* exports) of the two major ozone depleting classes of chemicals, chlorofluorocarbons (CFCs) and halons, by 1996 and 1993, respectively, in line with the internationally agreed phase-out schedule. In both cases, the chemicals had been imported but never produced in quantity in Israel. With respect to hydrofluorochlorocarbons (HCFCs), Israel's consumption has decreased to 197 tonnes ODP (ozone depleting potential) in 2009 (from the 329 tonnes ODP baseline).[20]

Table 3.2. **Israel's consumption[a] of ozone depleting substances**

Tonnes of ODP[b]

	1986	1989	1991	1993	1996	2000	2004	2008	2009	Baseline[c]
CFCs	4 142	4 560	. .	3 524	7	–	–	–	–	4 142
Halons	2 405	. .	. .	1 571	–	–	–	–	–	2 405
HCFCs	. .	201	. .	210	129	123	141	115	197	329
Methyl bromide[d]	. .	. .	2 148	. .	1 164	1 574	643	360	–2 055	2 148

a) Consumption equals production plus imports minus exports (exports to non-protocol parties are not included).
b) ODP is "ozone depleting potential", a figure based on the relative depleting strengths of the various ozone depleting substances (ODS).
c) Production level on which phase-out schedule is based. Varies with a particular chemical.
d) Does not include amounts used by party for quarantine and pre-shipment applications, nor amounts exported.
Source: UNEP – Ozone Secretariat.

StatLink http://dx.doi.org/10.1787/888932495741

Curtailing the production and use of methyl bromide has been a particular challenge, given Israel's prominent position among world suppliers of this economically valuable commodity.[21] Production in Israel has been based on extraction of bromine from Dead Sea brines by the Bromine Compounds, Ltd. Plant in Sedom, the world's largest bromine plant.

Like the other OECD countries, under the Montreal Protocol Israel committed to phase out methyl bromide by 2005, although it can make use of approved critical use exemptions (CUEs) and can produce specified quantities of the chemical for "quarantine and pre-shipment" purposes and for export.[22] Israel has considerably reduced its consumption of methyl bromide (Table 3.2), as well as the use of CUEs. However, in the last few years its CUEs accounted for a larger share of the baseline amount (in tonnes ODP) than was the

average in OECD countries (OECD, 2010). In 1991, its production of methyl bromide was 16 800 tonnes. By 2009, in response to the international phase-out schedules, Israel had substantially reduced its production for domestic "quarantine and pre-shipment" purposes and export to non-producing countries. Nonetheless, in 2009 it still was the world's second largest methyl bromide producer, behind the United States.

Israel has made successful efforts to respond, with Bromine Compounds, Ltd. experts and government officials participating actively in UNEP's Methyl Bromide Technical Options Committee. Since 2005, use of methyl bromide has been restricted and controlled by the Ministry of Agriculture and Rural Development (MoAG) jointly with the MoEP. More stringent regulations were adopted in 2009. The MoAG is the administrative body with respect to rules and procedures for distributing methyl bromide used in plant protection, while the MoEP is responsible for uses related to structures and commodities.

With the aid of expert committees and research groups, Israel has investigated numerous chemical alternatives to methyl bromide as well as various "agrotechniques" to reduce demand, including solarisation, steam sterilisation, resistant crop varieties and crop rotation. A significant reduction in consumption has been accomplished through a combination of Integrated Pest Management in agriculture, expanded use of thermal-based disinfection of commodities, employment of mixtures of methyl bromide and CO_2 (which allows a 50% reduction in methyl bromide use), and better atmospheric controls in disinfection spaces (OECD, 2010).

A reduction of the use of ozone depleting substances (ODS) overall has largely been achieved through the use of import and export licenses. In the mid-1990s the Ministry of Industry, Trade and Labour began to require import licenses for freons (CFCs), which were then restricted in number year-by-year. The same approach was applied to HCFC imports, while the gradual phase-out of methyl bromide is based on the control of export licenses. This is supported by a rigorously enforced regulatory framework that requires industry reporting and government inspections. The sale of new equipment (*e.g.* refrigerators, air conditioners) which uses controlled substances has been prohibited, and regulations have been drafted to address the problem of ODS in existing systems (*e.g.* through recovery of ODS from products and equipment, leakage prevention from systems, and bans on supply of ODS in disposable containers). Restrictions on ODS are set out in a 2004 regulation on Hazardous Substances – Implementation of the Montreal Protocol, and in an Official Standard from 2007 prohibiting the use of CFCs in air conditioning units. However, Israel needs to make a more concerted effort to reduce consumption of HCFCs and completely abandon production of methyl bromide and its use in agriculture, as recommended by the OECD review of Israel's agricultural policies (OECD, 2010).

4.4. *Internationally recognised conservation areas*

In 1996, Israel ratified the 1971 Ramsar Convention on Wetlands. In the same year, two of its wetland areas were added to the Ramsar List of Wetlands of International Importance: the Hula and En Afeq Nature Reserves (MoEP, 2008). The MoEP is the Administrative Authority for Ramsar wetlands, while the National Park Authority is the National Focal Point for interaction with the Convention secretariat.

Both of these Ramsar wetland reserves are man-made. They are undergoing rehabilitation involving, for example, planning and installation of water systems to ensure regular supply, revegetation, surveys and research. The En Afeq Nature Reserve includes an

education centre for wildlife and natural area conservation. The Hula Natural Reserve is on a migratory route for birds from Europe, Asia and Africa. Israel, together with several African countries, has proposed to UNESCO that this reserve in the north and a bird park in the south become part of a future Rift Valley Flyways to help protect international bird migration along the Great Rift Valley. This would support the African-Eurasian Waterbird Agreement, which Israel signed in 2002 under the 1979 International Convention on the Conservation of Migratory Species (Bonn Convention). Israel is the temporary home (and therefore *de facto* guardian) of more than three-quarters of Europe's migratory birds, which stop there on their way south in the winter and again on their return in the spring. Because of stringent hunting laws and active wildlife protection, Israel is a refuge for many of the region's endangered species.

International status has also been accorded to Mount Carmel, a north-western coastal range running from the Mediterranean south-east for 39 km to Jenin. It is one of 531 sites worldwide (involving 105 countries) designated as a Biosphere Reserve under UNESCO's Man and the Biosphere Programme (MAB).[23] The Mount Carmel Reserve is administered by the Nature and Parks Authority. An Israeli National Commission for UNESCO maintains linkages with the MAB secretariat.

Under the United Nations Convention on Biological Diversity, Israel has designated a number of marine protected areas (MoEP, 2009a; MoEP, 2009c). The designation of additional marine areas is constrained, however, by conflicts of interest between protection of species and Israel's fishing industry. Impetus for further designations may come from Israel's ratification of the Protocol of the Barcelona Convention on Specially Protected Areas in the Mediterranean and Biological Diversity, under which parties are asked to designate Specially Protected Areas of Mediterranean Importance (SPAMIs). The Regional Activity Centre for the Mediterranean Action Programme (MAP) (RAC/SPA) in Tunis, Tunisia, is responsible for promoting and assisting countries with SPAMI designations. As it is not a party to the protocol, Israel has not made any SPAMI designations. Once the pending ratification is completed, it will be able to do so.

4.5. *Desertification*

Israel has built and maintained a prosperous, modern-day industrial society in an environment that is mostly arid or semi-arid land. As a result, it is particularly well-placed to contribute to international efforts to combat desertification. It has consistently shown its willingness to share experience, knowledge and technical competence in this area with other countries.[24] In the early 1990s, Israel played a prominent role in the Intergovernmental Negotiating Committee on Desertification that led to the 1994 UN Convention to Combat Desertification (UNCCD). This included chairing the committee that drafted the Implementation Annex for Asia, which became part of the Convention. Israel ratified this Convention in 1996.

Israel decided not to prepare a dedicated National Action Plan to Combat Desertification, as required under the UNCCD, because it considered that existing national plans for the development and management of its desert and dryland regions adequately served this purpose. It has submitted *National Reports on Combating Desertification in Israel* every two years to the Convention secretariat (MoEP, 2006). In 1996, Israel also established an Intra-governmental Steering Group for Combating Desertification, chaired by the Ministry of Foreign Affairs (MoFA), to co-ordinate the activities of government departments and allocate budgets. A Professional Advisory Committee to the Steering Group was

created, with representation from leading private sector research centres and universities. These two bodies no longer function. Technical support is currently provided by the Center for Environmental Conventions at the Blaustein Institute for Desert Research.

An early action by the Intra-governmental Steering Group was to identify anti-desertification priorities for the country. They included: designing and implementing measures to prevent soil erosion in the irrigated croplands of the northern Negev desert; increasing use of treated wastewater for dryland agriculture, while minimising the danger of soil and aquifer contamination; and promoting alternative livelihoods for those who live in the desert, including ecotourism, aquaculture, and environmentally friendly industries. These are still priorities today.

During the past decade, Israeli experts have assisted a number of other countries, especially developing countries in Asia and Africa, in addressing desertification and dryland management. Much of the support for this international outreach has been provided under Israel's development assistance programme, managed by the Ministry of Foreign Affairs' Agency for International Development Co-operation (MASHAV) (Section 2.2). Valuable support for Israel's desertification-related international outreach is also provided by the Jewish National Fund (KKL-JNF).

Co-operation at the inter-governmental level has included a regional project initiated in 1999 involving Egypt, Israel, Jordan, the Palestinian Authority and Tunisia: the Initiative for Collaboration to Control Natural Resource Degradation (Desertification) of Arid Lands in the Middle East.[25] In 1999, an intergovernmental agreement for a Regional Agricultural Programme was signed by Egypt, Israel, Jordan and the Palestinian Authority. Denmark was the initiator and main supporter. At a meeting in Paris in 2003 under OECD/DAC auspices, the programme was singled out as an example of successful North-South co-operation.

Despite substantial progress during the past decade, Israel faces a continuing battle against desert encroachment and degradation of land from the effects of overgrazing, intensive cultivation, and expansion of urban areas. For all forms of land degradation there is a lack of monitoring and information on their spatial range, temporal change, and knowledge of agriculture's role in exacerbating or ameliorating these land degradation processes (OECD, 2010). The major challenge for government policy makers is managing the disparity between Israel's growing demand for water for domestic, industrial and agriculture uses, and the available supply, which has been affected by extended drought and possibly the impacts of climate change.

5. Trade in environmentally sensitive goods

5.1. *Hazardous wastes*

Israel's international commitments regarding imports and exports of hazardous wastes derive principally from its accession in 1994 to the 1989 United Nations Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (the Basel Convention). Israel is in full compliance with the provisions of this Convention, and with the 1995 Ban Amendment prohibiting exports of hazardous wastes from EU and OECD countries to other convention parties (although it has not yet ratified this amendment). With its accession to the OECD in 2010, Israel is bound by the OECD's framework of decisions and procedures governing international movements of hazardous wastes. The Ministry of Environmental Protection is responsible for overseeing domestic compliance with the Basel requirements, in co-operation with the Customs Authority, and serves as the National Focal

Point for the Basel Convention. Exporters and importers of hazardous wastes must have a permit and report waste movements to the MoEP (Chapter 7).

Israel has the domestic capacity and capabilities to treat most of the hazardous and other wastes generated in the country, in conformity with the self-sufficiency principle of the Basel Convention. Wastes that cannot be treated in Israel, due to lack of appropriate technologies or inadequate capacity (*e.g.* organic waste), are exported for treatment according to the Convention's provisions (Chapter 7). Israel's accession to the OECD has opened up opportunities for a larger programme of waste importation for recycling, which is expected to enable better use of treatment facilities.

Israel's trade in hazardous wastes is small. In 2008, about 2.5% of hazardous wastes generated in Israel was exported for recycling/reclamation or incineration. The main hazardous wastes exported were metal wastes for recycling, batteries, and hazardous organic wastes. Israel imported nearly 5 000 tonnes of hazardous wastes in 2008, of which some 80% consisted of lead-acid batteries obtained for recycling. Used battery imports are important to Israel with respect to maintaining the economic viability of the Hakurnas Lead Works, Ltd. and expanding its capacity to respond to Israel's domestic waste treatment needs (Chapter 7).

To fill a gap in its otherwise comprehensive approach to management of hazardous wastes in international trade, Israel could consider ratifying the 1999 Basel Convention Protocol on Liability and Compensation, which establishes rules for damages caused by accidental spills of hazardous wastes during export, import or disposal.

5.2. Chemicals in international trade

The export of chemicals and chemical products (*e.g.* fertilisers, pesticides, pharmaceuticals, drugs and cosmetics) plays a significant role in Israel's economy. Chemicals and pharmaceuticals account for over 30% of total industrial exports (by value).

Israel has an advanced framework of laws and regulations to ensure that production, use and distribution of hazardous chemicals involved in international trade are carried out in an environmentally responsible manner. As an OECD member, it is committed to adhere to the Organisation's comprehensive rules and procedures regarding chemicals management and is moving expeditiously to strengthen its capacity and fill gaps in order to be in full conformity. In particular, Israel adheres to the OECD Council Acts related to the Mutual Acceptance of Data in the assessment of chemicals. A new unit is being established in the MoEP to co-ordinate the implementation of a Pollutant Release and Transfer Register (PRTR), as well as of integrated permitting. Work has begun to establish a system for complying with the PRTR requirements, including the preparation of related legislation.

At the multilateral level, Israel has signed but not ratified the 1998 Rotterdam Convention on Prior Informed Consent (PIC) as applied to chemicals export and import, and the 2001 Stockholm Convention on Persistent Organic Pollutants (POPs) (MoEP, 2009b). The PIC Convention is expected to be ratified in the near future. In support of its implementation, chemicals with health and safety risks require an import license, and existing regulations cover the needs for testing and restrictions on use. Regarding the POPs Convention, a National Implementation Plan is being prepared according to the Convention guidelines. Israel has neither signed nor ratified the 2000 Cartagena Protocol on Biosafety, designed to protect biological diversity from undesirable effects of the products of modern biotechnology.

Israel supports the Strategic Approach to International Chemicals Management (SAICM).[26] It has established a focal point for follow-up to SAICM, as well as an inter-disciplinary committee to establish an integrated approach to chemicals management across the country and to identify any gaps and needed activities in relation to the Strategic Approach.

Israel's chemicals industry has been closely involved in developing a national policy on environmentally sound chemicals policy at the international level. The Manufacturers Association of Israel (MAI) has played a leadership role. In 2001, on behalf of the chemicals industry, it accepted membership in the international Responsible Care and Product Stewardship programmes. Twenty-seven leading Israeli chemical firms, including the country's largest, have accepted Responsible Care commitments which emphasise constant improvements in environmental health and safety as well as transparency towards the community regarding activities, products and performance. The MAI also handles certification of industrial facilities under ISO 14001 environmental standards.

However, Israel lacks a clearly defined chemicals safety policy and a programme for the systematic investigation of existing chemicals. The existing approach to industrial chemicals management focuses on users of chemicals and "cradle to grave" supervision of production, import, storage and waste disposal. Further, chemicals registration and licensing are being applied to only a few chemicals in the areas of biocides and for medication and food use. Remedial action will require new legislation and modified institutional arrangements and procedures. Israel established an interdisciplinary committee with the objective of developing an integrated approach to chemicals management throughout the country. It has committed to make other changes necessary to ensure that the country's approach to chemicals conforms to OECD legal instruments by 2013. All chemicals produced domestically or imported are to be registered, and chemical uses, marketing, import and production will be controlled.

5.3. *Endangered species*

Israel has created a legal and administrative framework to control trade in endangered species of plants and animals, consistent with its obligations under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Israel ratified CITES in 1979, but has not yet ratified its 1979 Bern and 1983 Gaborone Amendments. In 2006, Israel joined the International Whaling Commission. Whaling is therefore illegal in its waters.

The Wildlife Protection Law and the National Parks, National Reserves, National Sites and Memorial Sites Law (Chapter 5) are Israel's implementation tools for CITES. Trading, possessing or transporting protected species without a permit is forbidden. Government authority for CITES management, including scientific inquiry, permitting and enforcement, is the responsibility of the Nature and Parks Authority (NPA).

In Israel there is little commercial export of wildlife. The NPA reports that there have been very few infringements of the Wildlife Protection Law recently, with some three to four cases a year. An informal arrangement with the Customs Office and employees of the Ministry of Agriculture and Rural Development at major ports allows a certain level of control on the import of exotic wildlife. However, there is a need for stronger legislation and increased staffing for NPA and the Customs Office at ports for the inspection of wildlife and protected species (especially parts and derivatives, to ensure that they are not products of endangered species). The NPA is in close contact with INTERPOL's Wildlife Crime Unit.

5.4. Forest products

As the result of aggressive tree planting campaigns, Israel is one of the few countries in the world where forest cover has consistently expanded during the past two decades. Nonetheless, forests and wooded land represent only some 7% of the land cover of this small country, requiring Israel to rely heavily on imports to meet its demand for most industrial wood and wood products. Israel imports 100% of sawn wood, 90% of pulp for paper, 77% of industrial round wood and 55% of wood panels. It also imports small quantities of tropical wood for furniture, mainly cut wood, valued in 2009 at about USD 14 million. The Forestry Department of the Ministry of Agriculture and Rural Development is the government entity responsible for overseeing importation of uncut and processed wood. It also provides Israeli representation in the forestry programmes of regional and multilateral institutions.

Israel does not have laws or regulations requiring importers of forest products to certify the environmental sustainability of the source of imports, including tropical hardwoods. Although it is a member of the FAO's European Forestry Commission and the UNECE's Timber Committee (both of which promote sustainable forest policies and practices), it has not been active in these and other international forums on matters related to environmentally sound forest management, including the environmental certification of wood and wood products, standard-setting for production, and trademark assurance. Israel is not a member of the International Tropical Timber Organisation, nor has it signed the 1994 International Tropical Timber Agreement.

While Israel's demand for wood and other forest products represents a very small share of worldwide trade, it should nonetheless consider participating in international efforts to promote sustainable forest management.

Notes

1. These include the environmental elements of the UN Millennium Development Goals; annual reports to convention secretariats on biodiversity, climate change and hazardous wastes; biennial reports to the Barcelona Convention; and Israel's national contribution to the 2002 World Summit on Sustainable Development in Johannesburg and in subsequent annual reports to the UN Commission on Sustainable Development.
2. For example, INTERREG III on management of large ecosystems in the Mediterranean Sea; BioCASE, which enables the Authority to link with European museums; and MedPAN, a network of managers of marine protected areas in the Mediterranean.
3. They include the Inter-ministerial Committee for Climate Change (headed by the Ministry of Finance); Inter-ministerial Committee for Sustainable Development (headed by the MoEP); and an Interdisciplinary Committee on Integrated Pesticides Management (headed by the MoEP).
4. Recent examples are projects on desertification control, "Clean Beach" programmes, and management of the Lower Jordan River Basin.
5. Under a 2007 Memorandum of Understanding, Israel works with UNEP in identifying developing countries where Israeli expertise could be of benefit in such areas as water conservation in agriculture and marine pollution. A 2009 "Training Workshop on Ecosystem Approaches to Coastal and Ocean Management: Focus on Ecosystems Management in Eastern Africa", conducted by Israeli experts, was one product of that relationship.
6. For example, a dryland agriculture programme involving Egypt, Israel, Jordan and the Palestinian Authority funded by Denmark; and USAID-initiated studies of regional air pollution involving Israel, Jordan and the Palestinian Authority.
7. Recommendation of the Council concerning an Environmental Checklist for Possible Use by High-Level Decision-Makers in Bilateral and Multilateral Development Assistance Institutions

[C(89)2/Final] and *DAC Guidelines and Reference Series: Applying Strategic Environmental Assessment. Good Practice Guidelines for Development Co-operation*, *www.oecd.org/dataoecd/4/21/37353858.pdf*.

8. *Footnote by Turkey:* The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of United Nations, Turkey shall preserve its position concerning the "Cyprus issue".
Footnote by all the European Union Member States of the OECD and the European Commission: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

9. MAP, the first of UNEP's Regional Seas Programmes, was adopted in 1975 by 16 Mediterranean riparian states, including Israel, and the European Community. Its scope was expanded in 1995 to place greater emphasis on the coastal zone, and MAP was renamed the "Action Plan for Protection of the Marine Environment and the Sustainable Management of the Coastal Zone of the Mediterranean (MAP Phase II)". Today, MAP involves 21 countries and is supported by a legal system based on the Barcelona Convention and its seven associated protocols.

10. Israel's National Monitoring Program for the Mediterranean Sea is conducted by the Israel Oceanographic and Limnological Research Institute. Since 2003, a monitoring programme in the Gulf of Eilat/Aqaba has been implemented on behalf of the MoEP by the Interuniversity Institute in Haifa. Monitoring of coastal bathing water is the responsibility of the Ministry of Health.

11. However, in 2005 a collision between a ship and tanker near the Nile Delta in Egypt caused tar to wash up on Israel's Mediterranean coastline from the south to the centre.

12. The plan sets out a three-tiered system for preparedness and response to marine oil pollution incidents. It calls for mapping of sensitive areas along the coast, development of risk scenarios, elaboration of policies and procedures for combatting spills, and specification of control and clean-up operations.

13. The use of chemical dispersants is banned, given the sensitivity of the reef ecosystem.

14. *Footnote by Turkey:* The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of United Nations, Turkey shall preserve its position concerning the "Cyprus issue".
Footnote by all the European Union Member States of the OECD and the European Commission: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

15. Marine fish catches amounted to 2 607 metric tonnes in 2008, out of the country's total domestic fish production of 25 047 (FAO, 2007) metric tonnes. This is the smallest marine capture among the EU's "Mediterranean Partner Countries", *i.e.* Algeria, Egypt, Jordan, Lebanon, Morocco, Syria, Tunisia and Turkey – with the exception of Jordan, which reports no marine fish catch.

16. In Haifa Bay, microalgae with the potential to emit toxins are found, and mercury and other toxic metal contaminants from industrial effluents have rendered fish unsuitable for food.

17. Friends of the Earth Middle East (FoEME) has proposed that the Dead Sea be jointly designated a UNESCO Biosphere Reserve and/or a World Heritage Site as a step in that direction and to give the sea an improved level of protection (FoEME, 2004). Proposals have also been made to create a standing body of scientists and policy experts from Israel, Jordan and the Palestinian Authority that would undertake research and planning to inform and advise government authorities in regard to managing the Dead Sea on a co-operative basis, possibly modelled on the Canada-United States International Joint Commission (IJC).

18. In 2000, a *Middle-East Transboundary Pollutant Transport Study* was carried out by researchers from the Hebrew and Tel Aviv Universities, the Israeli Meteorological Service, the Applied Research Institute-Bethlehem in the West Bank, the Environmental Protection and Research Institute in Gaza, and San Diego State University in the United States. The study measured and tracked the flux of atmospheric pollutants from Gaza into Israel and from Israel into the West Bank. A USAID-sponsored Israeli/Palestinian Authority/Jordan study was undertaken in 2004 to investigate emissions from the highly populated and industrialised Israel-Gaza coast and their impact on ozone levels in Jordan.

19. London (1992), Copenhagen (1995), Montreal (2003) and Beijing (2004). These amendments expanded the scope of chemical coverage, tightened controls on ozone-depleting substances, and improved the scientific and technical basis for control decisions.

20. HCFCs were first introduced as an alternative to CFCs, but later controlled under the Protocol due to their substantial ozone-depleting properties.

21. Methyl bromide is used as a fungicide to control a broad spectrum of soil-borne agricultural pests, and as a fumigant in international quarantine, as well as to eliminate pests in empty spaces and during pre-shipment sanitation operations.

22. Given the importance of methyl bromide in agriculture and public health, coupled with lack of effective alternatives for certain priority uses, the Protocol parties agreed to allow producing countries to continue to manufacture limited, specified quantities of the chemical for "quarantine and pre-shipment" purposes and for export (UNEP, 2009). At the same time, all parties are expected to work to introduce substitute chemicals and otherwise reduce reliance on methyl bromide for these special applications on an expedited basis.

23. UNESCO/MAB recognition is given to sites which innovate and demonstrate approaches to conservation and sustainable development. The concept involves the host country sharing its experiences and ideas nationally, regionally and internationally within the UNESCO/MAB framework, while (as in the case of the two Ramsar sites) retaining national jurisdiction over the locations.

24. Illustrative of the comprehensive and integrated approach that Israel applies to desertification issues, it has raised in the UN Commission on Sustainable Development the issue of the importance of identifying and developing synergies among the international conventions on biodiversity, climate change and desertification, as well as the non-legally binding principles for sustainable forest management. In 2007, the UN General Assembly adopted an Israeli-sponsored resolution that promotes environmentally friendly agricultural practices in dryland regions, including many designed in Israel.

25. This emanated from the Working Group on Environment of the Middle East Peace Talks, and was facilitated by the World Bank.

26. This was adopted in Dubai in 2006 at an international conference convened by UNEP and WHO, in co-operation with the Intergovernmental Forum on Chemical Safety (IFCS) and the Inter-organisation Programme for the Sound Management of Chemicals. The SAICM supports a goal agreed at the 2002 Johannesburg World Summit on Sustainable Development that, by 2020, all chemicals are to be produced and used in a way that minimises significant impacts on the environment and human health.

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PART II

Selected issues

PART II

Chapter 4

Water

Water scarcity is a major concern in Israel, a country subject to arid and semi-arid climatic conditions. Water consumption exceeds the natural rate of replenishment and pollution loads intensify pressure on water resources. To respond to these challenges, Israel has implemented an advanced water pricing policy and has encouraged innovation in water-related technologies. As the water crisis has deepened, following several consecutive years of drought, more emphasis has been placed on increasing supply through an extensive programme of seawater desalination. This chapter assesses the effectiveness and efficiency of such components of Israel's water policy, as well as of water quality management.

Assessment and recommendations

Israel's limited water resources are under severe pressure due to the country's geo-climatic location, rapidly expanding population, growing economy, and water pollution loads. Responding to these threats and opportunities, Israel has introduced some ambitious water policies and has been at the forefront of developing efficient water technologies.

Pressures on water resources have intensified in recent years, as Israel has faced the worst water crisis in its history. From 2003/04 to 2010/11, the country experienced almost seven consecutive years of drought. Water consumption exceeds the natural rate of replenishment, while the intensity of freshwater use is extremely high by OECD standards. Groundwater is being used unsustainably and a potentially serious pollution problem (including salinity and nitrates) is developing, particularly in the Coastal Aquifer. Climate change is further intensifying pressures on water resources.

Israel has pioneered water-efficient technologies such as drip irrigation, soil aquifer treatment for reuse of treated wastewater, brackish and seawater desalination, and large-scale filtration of lake water. Recently, there has been increasing reliance on economic incentives and other instruments to reduce demand for scarce water resources. Practically all water consumption is metered. Use of "smart metering" is growing. Water prices have significantly increased, and rising block tariffs provide incentives to conserve water resources. However, further steps could be taken to reduce household consumption in line with good international practices. A 40% increase in domestic water prices, introduced in January 2010, was a bold step which will help to address this issue. A marine pollution tax for direct discharges of effluent to seawater is currently under discussion.

Overall, Israel has achieved full recovery of the costs of supplying water services and this is an established policy principle, including for the agricultural sector. However, about 35% of agricultural uses of potable and reused water are still cross-subsidised by the household sector and receive a relatively large share of public support. The 2006 Farmers' Agreement contains a commitment to achieve an agreed target price in the direction of full cost recovery by 2017.

As the water crisis has deepened, more emphasis has been placed on increasing supply. Israel has embarked on an ambitious policy of seawater desalination, with the aim of supplying 750 million cubic metres (about half the expected potable water needs of the urban, industrial, and agricultural sectors) by 2020. Its desalination plants are among the most energy- and cost-efficient in the world. However, a planned substantial increase in the production of desalinated water is based on a number of key assumptions. First, it is assumed that the agricultural sector can absorb steep increases in the cost of water as full cost recovery of supply is introduced. Second, no major change in the cost of producing desalinated water is foreseen in Israel's water supply outlook. This may be optimistic, as the price of desalinated water is linked to energy costs, which are important for both production and long-distance transport. Increasing energy prices could put the economic balance, and/or the political will to ensure full cost recovery, to the test. Although some

studies have been carried out, the environmental and health effects of seawater desalination (*e.g.* impacts on coastal biodiversity, health effects of desalinated water's low magnesium content) require further assessment.

Water governance has improved since 2007 with the creation of the Water Authority. It is responsible for the regulation of the entire supply-recovery cycle of water and oversees the national water grid, by means of which water may be transported almost anywhere in Israel (upstream and downstream). This situation is unique. In 2010, 60 million cubic metres of water (potable water and treated wastewater) were allocated for environmental purposes. Nonetheless, centralised management of water resources has not given sufficient weight to environmental considerations. River basin management authorities have been established, although their performance remains uneven. Environmental quality objectives have not been established for rivers. Major rivers, which once supported rich aquatic and wetland ecosystems, became seriously depleted and polluted. However, restoration and rehabilitation programmes have resulted in steady water quality improvements over the past five years. The reuse of treated domestic wastewater for irrigation means that most of this water is lost to evaporation and plant transpiration, leaving virtually none for river flows and aquifer recharge. However, addressing this issue would require greater use of potable water.

Recommendations

- Gradually increase the agricultural and industrial sectors' share in financing the full costs of water infrastructure, taking account of the positive externalities associated with water supply; establish targets for domestic water consumption in line with best practices in western European countries.
- Continue to carefully assess the economic assumptions and the environmental and health impacts of producing and using desalinated water; internalise environmental costs in the price of desalinated water.
- Consider broadening the use of economic instruments for water management, including: expanding the scope of the proposed marine pollution tax to effluent discharges in freshwater and aquifers; ensuring that extraction tax rates reflect water scarcity; introducing a pesticide tax with rates reflecting pesticide toxicity; and trading water quotas among different agricultural producers and, in the medium term, with other water users.
- Consider how local ecological conditions and minimum river flows could be better reflected in decisions on water allocation among sectors and to nature.
- Define water quality objectives for all stretches of rivers, and issue discharge and abstraction permits accordingly.

1. Institutional and legal framework

Israel is characterised by national level water governance. All decision making on water supply is carried out at the national level. Water corporations within the municipalities serve as "consumer liaisons" which transport water to their constituents.

Under the Ministry of National Infrastructures (MoNI) and pursuant to the Water Law (first enacted in 1959), the Water Authority has overall responsibility for the water sector. This includes: preserving the country's water resources; regulating the production, supply

and use of water; designing and implementing water supply schemes; and, through its Water Commission, allocating water and setting water prices in each sector (domestic, agricultural and industrial). Since 2007, primary responsibility for decision making rests with the eight elected members of the Water Authority Council, which represent the Water Authority, five ministries (MoNI, Environmental Protection, Health, Finance, and Foreign Affairs) and two representatives of the general public (appointed by the Minister of National Infrastructures).

The Water Authority also supervises the establishment of wastewater treatment facilities. The Local Authorities Sewage Law (1962) requires local authorities or the water corporations to maintain these systems. The effluent quality and wastewater treatment regulations, issued by the Ministry of Environmental Protection (MoEP) and the Ministry of Health in 2010, include 36 parameters that may not be exceeded in effluent whose use in irrigation will be unrestricted or that will be discharged to rivers.

Established in 1937, *Mekorot*, the National Water Company, supplies 70% of total water consumption. Water supplied to agriculture is mainly provided by *Mekorot* directly or by Agricultural Water Associations. *Mekorot* treats about 40% of the country's wastewater.

The Water and Sewage Association Law (2001) provides for the increased efficiency of municipal water supply and sanitation. Water and wastewater services are gradually being transferred to newly created public service entities called Water and Sewerage Corporations to ensure that there will be a "closed loop financial system" whereby all income from water tariffs will be reinvested in water infrastructure.

The Water Law declares that all water resources are public property subject to the control of the state. There are no private water rights or resources in Israel. Water may only be used by permit holders. This requirement extends to the water drawn from a well under a farmer's property, even if intended solely for the owner's own use (OECD, 2010a). The law was amended in 1971 to regulate activities which directly or indirectly cause, or may cause, immediate or subsequent water pollution. In 2004, nature was added as a legitimate use of water under the law. A special judicial court, the Water Tribunal, handles disputes pertaining to the Water Law.

The MoEP is responsible for protecting water quality and preventing water pollution. Some of these activities are funded by the Water Authority and carried out by the Kinneret Drainage and River Authority and the Lake Kinneret management organisation. Created in 2008, the Kinneret Association of Towns ensures co-ordination of land use planning along the lake's perimeter. The Ministry of Health sets and oversees standards for drinking water and, with the MoEP, sets the standards for effluent to be reused in irrigation or that flows back into the environment.

Pursuant to the Streams and Springs Authorities Law (1965), river authorities have been created to protect the Yarkon and Kishon Rivers and prevent further pollution. There are also 11 drainage authorities in Israel that protect river basins. Most of Israel's rivers are dry during most of the year. A small number of rivers such as the Yarkon (Tel Aviv), Kishon (Haifa), Sorek (Jerusalem) and Jordan flow year-round due to rain, springs, or the inclusion of effluent (from wastewater treatment plants) in the baseflow. National statutory planning guidelines control national and urban development in such a way as to protect public open spaces and nature (including rivers).

Under the supervision of the Ministry of Agriculture and Rural Development, and pursuant to the Drainage and Flood Prevention Law (1957), the 11 drainage authorities are

primarily responsible for drainage of agricultural runoff, including through channelisation of rivers. They are given environmental responsibilities by the MoEP, in accordance with the Streams and Springs Authorities Law, and must protect the environment in their daily activities. They are also responsible for flood prevention. The Lower Jordan River drainage authority has drafted terms of reference for a land use master plan for the Lower Jordan.

With regard to water monitoring, the Water Authority (mainly the Hydrological Service) monitors water levels and quality in Israel's major aquifers (including in the Lake Kinneret watershed). The Israel Oceanographic and Limnological Research station monitors the quantity and quality of water along the coastline of the Mediterranean Sea. The Nature and Parks Authority (NPA) monitors water quality in rivers on behalf of the MoEP. *Mekorot* and local authorities monitor drinking water quality under the supervision of the Ministry of Health. The Ministry of Health monitors effluent quality prior to its use in the agricultural sector.

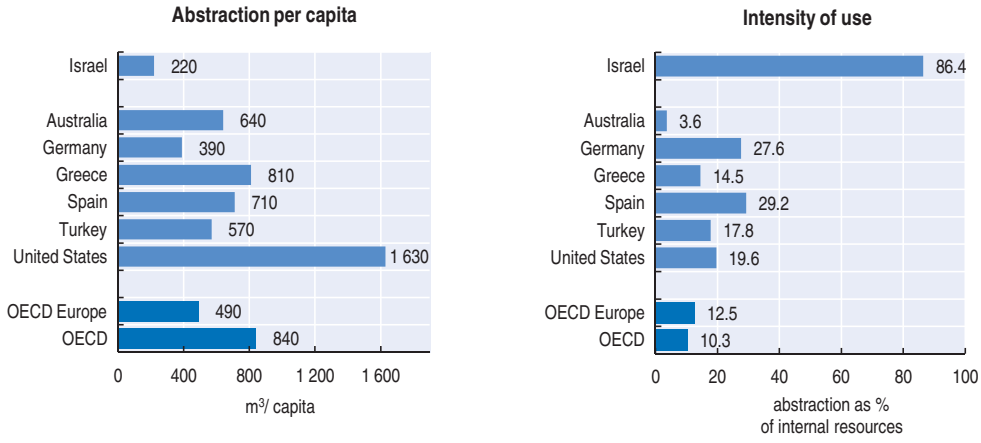
2. Pressures on water quantity

Israel is characterised by arid and semi-arid climatic conditions, and water scarcity is a major concern. The main natural water sources are the Mountain and Coastal Aquifers[1] and Lake Kinneret, Israel's largest natural freshwater lake (and its surrounding watershed), which provides one-third of the country's water requirements and a higher proportion of its drinking water requirements. The agricultural sector is the largest water consumer (for all water types), followed by the domestic sector and, to a much lesser extent, the industrial sector. Israel's National Water Carrier, inaugurated in 1964, transfers water from Lake Kinneret and the aquifers to the highly populated centre of the country and the arid south. With the introduction of seawater desalination plants, flow directions will change. Water from Lake Kinneret will be consumed mainly in the north (in the vicinity of the Lake Kinneret watershed), while water from both the coastline and natural groundwater sources will flow country-wide.

Intensity of freshwater use (abstraction as a per cent of internal natural potable water resources) is extremely high by OECD standards (Figure 4.1). Israel already consumes more water than its natural supply, which is essentially provided by rainfall. The annual deficit is currently 300 million m^3/year. In addition, there is a need to restore depleted natural aquifers. The problem of water scarcity has been exacerbated in recent years by several multi-year drought cycles and the consequent over-pumping of water to meet growing water demand. Annual rainfall has decreased by 9% on average since 1993 and could decrease by a further 10-15% between 2015 and 2035, according to climate change models (Chapter 6). No upstream Jordan River water now reaches the Dead Sea, which has lost one-third of its surface area since 1930.[2]

The 2050 outlook for water does not give any reason for optimism. Increasing population and agricultural growth are placing additional pressures on Israel's limited water resources, in terms of both quantity and quality. As a result, despite significant progress in reducing agricultural use of potable water (by more than 50% within a decade), consumption of potable water will increasingly exceed renewable resources (Figure 4.2). The main government response has been to reduce demand by promoting drip irrigation and the reuse of treated domestic wastewater (effluent) in agriculture, and to increase potable water supply for the urban sector mainly through the construction of large-scale desalination facilities (Box 4.1). The goal is to increase effluent and desalinated water use

Figure 4.1. **Freshwater use, 2009**[a]



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

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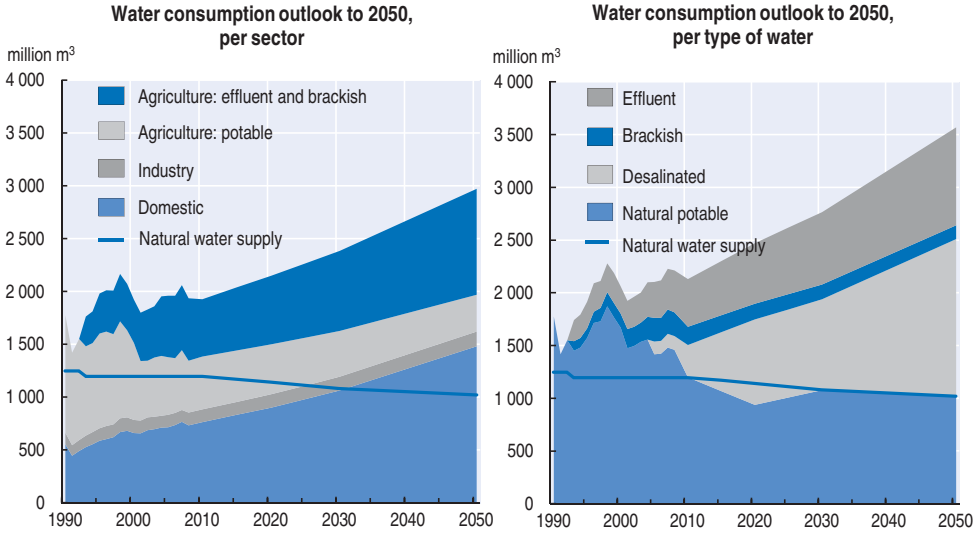
Figure 4.2. **Water consumption outlook to 2050**



Source: Water Authority, Planning Department.

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in order to prevent increased demand on natural potable water resources up to 2050. Efforts are also being made to foster the role of economic instruments: significant increases in water tariffs have taken place or are planned in all sectors. Agricultural water quotas have been made more stringent. By law, all water supply must be metered.

Box 4.1. **Innovation in the water sector**

Reuse of treated domestic wastewater (effluent)

The reuse of effluent in agriculture is high on Israel's water policy priority list. This reflects a combination of factors, including severe water shortage, contamination of water resources, densely populated urban areas and highly intensive irrigated agriculture. To ensure that high-quality effluent is applied to irrigated crops, soil aquifer treatment (SAT) has been used at the Dan wastewater treatment and reclamation plant in the Tel Aviv metropolitan area (130 million m^3/year or about 25% of total wastewater treated). Effluent is discharged to sand infiltration fields, where it is treated by physical, biological and chemical processes before reaching the aquifer. The long retention time which is part of these processes produces a high-quality effluent suitable for all agricultural crops, with no restrictions and no risk to public health.

Large-scale desalination of seawater

The long-term construction programme for large-scale reverse osmosis seawater desalination began to contribute potable water to Israel's national water grid in 2005 when the Ashkelon plant, at the southern end of the country's Mediterranean coast, began operation. Three large-scale desalination facilities currently provide 320 million m^3 of potable water to all sectors, the equivalent of approximately 42% of current domestic water requirements. By 2015, 2025 and 2050, respectively, new desalination facilities along this coast are expected to cover 62.5%, 70% and 100% of domestic water demand. Any supplementary desalinated water available in these years will be used to narrow the gap between replenishment of Israel's natural water systems and increasing water demand.

In tenders for the construction of large-scale desalination plants, energy efficiency is maximised through a bidding system that promotes energy conservation in different ways, including giving preference to natural gas (rather than use of coal) and to efficient technological energy recovery systems. Israel's desalinated water production is therefore among the most energy-efficient (3.5 kWh/m^3) and cost-efficient (USD 0.54/m^3) in the world (Figure 4.3).

Most of the country's desalination plants have been, or will be, privately financed as build-operate-transfer (BOT) projects. In 2010, the cost of operating Israel's three large seawater desalination facilities was USD 260 million, including USD 20 million to transport desalinated water to users. The three facilities were built at a cost of USD 750 million. Construction of additional desalination facilities between 2010 and 2020 will cost approximately USD 1 billion, including USD 750 million to transport the water throughout Israel.

While large-scale desalination significantly increases water availability, it has potentially adverse environmental impacts in the form of greater energy consumption and subsequent increases in greenhouse gas emissions. Brine discharges to the sea can lead to substantial increases in salinity and temperature, and to the accumulation of metals (*e.g.* iron), hydrocarbons and toxic anti-fouling compounds in receiving waters (Roberts *et al.*, 2010). When discharges are released to poorly flushed environments, they can result in widespread alterations to community structure in seagrass, coral reef and soft-sediment ecosystems. Occurrence of the American Comb Jelly along the Mediterranean coast seems to coincide with the operation of a desalination plant (Galil *et al.*, 2009). The spread of this invasive species is of great concern because of its harmful impact on fisheries. Other concerns include the impacts of desalinated water use in agriculture, as desalination removes ions (*e.g.* calcium and magnesium) that are essential to plant growth. Carbonates (more than 80 mg/litre) are reintroduced into the desalinated water after completion of the desalination process. There is currently a debate regarding the addition of magnesium for health reasons.

Box 4.1. **Innovation in the water sector** *(cont.)*

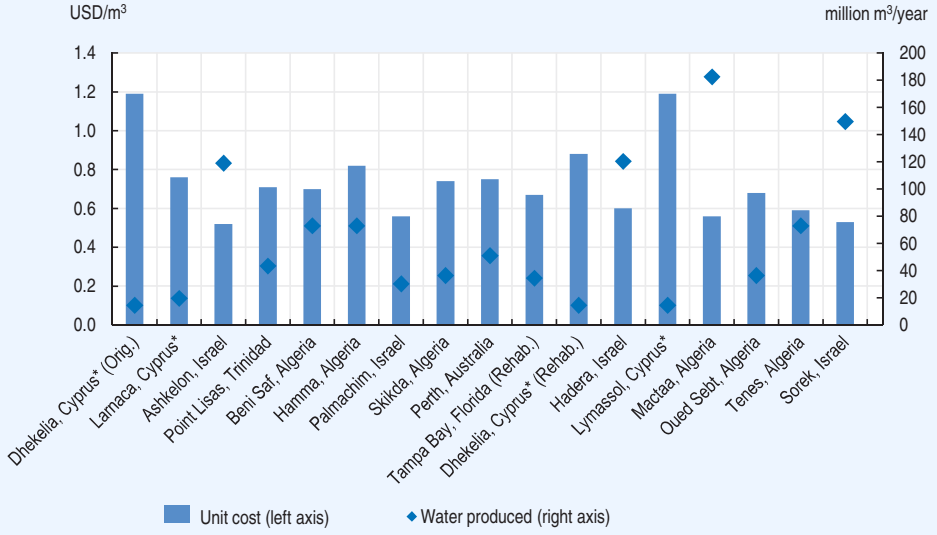
Drip irrigation

First developed in the 1960s, drip irrigation technology was refined in the 1980s to include innovations such as computerisation, fertigation (direct application of fertilisers to plant roots), and pressurised drippers which enable even water distribution. Recently developed sub-surface drip irrigation systems cover 5-10% of the country's irrigated area. These systems are positioned in the soil to conserve water, control weeds, minimise runoff and evaporation, increase the longevity of piping and emitters, facilitate the use of heavy equipment, and prevent human contact with low-quality water. They allow better control of environmental variables, including nutrients, salinity, oxygen and temperature. Over half of Israel's irrigated area is under drip irrigation, significantly improving water use efficiency. Drip irrigation technology also makes up a significant part of the country's water technology exports, which totalled USD 1.4 billion in 2008 (double the amount in 2005).

Large-scale filtration of water from Lake Kinneret

In 2007, after years of delay, *Mekorot* completed construction of a state-of-the-art Central Filtration Plant at Eshkol to improve water quality and reduce the turbidity of water from Lake Kinneret transported through the National Water Carrier. With an annual filtering capacity of more than 500 million m^3, the filtration plant is one of the largest such facilities in the world. The decision to go ahead with the project was taken following a cost-benefit analysis, which estimated that savings in the form of avoided damage to health would be much higher than the USD 134 million spent to build the filtration plant.

Figure 4.3. **Production costs of desalinated water in large-scale seawater reverse osmosis desalination plants**[a]



a) The plants are ordered from left to right by operation launch date (between 1997 and 2010).
Source: Water Authority.

**Footnote by Turkey:* The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of United Nations, Turkey shall preserve its position concerning the "Cyprus issue".
Footnote by all the European Union Member States of the OECD and the European Commission: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

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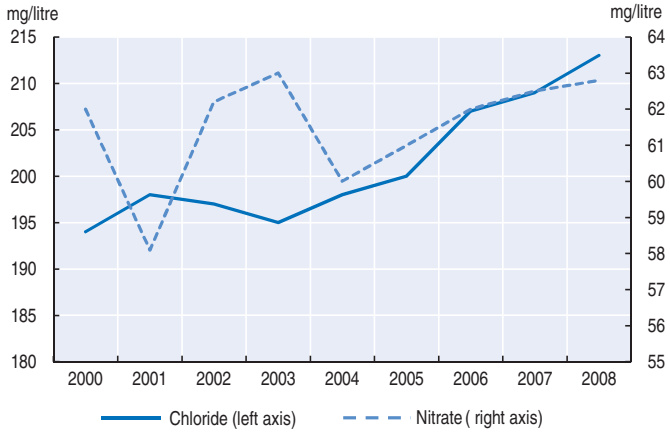
3. Quality of ground and surface water

Groundwater

In the Coastal Aquifer, located in Israel's densely populated region, saline and nitrate concentrations have increased considerably since 2000 (Figure 4.4). Nitrate concentrations have increased from 30 to more than 60 mg/litre[3] in the last 60 years, mostly due to agricultural activity and the lack of tertiary treatment of increased urban wastewater. The salinity of the aquifer now exceeds 210 mg/litre[4] on average, due to excess groundwater pumping that generates a fall in water levels, intrusion of saline water from the sea and saline aquifers from the east (especially in the southern coastal aquifer), and high concentrations of chloride in effluent used for irrigation. In addition, 6% of the aquifer is polluted because of industrial activity occurring on top of it.

Figure 4.4. **Chloride and nitrate concentrations in the Coastal Aquifer, 2000-08**



Source: Water Authority.

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Because of the deterioration in both quantity and quality of water in the Coastal Aquifer, the Yarkon-Taninim Aquifer, a sub-basin of the Mountain Aquifer, is becoming a main supplier of drinking water in Israel.[5] The Yarkon-Taninim Aquifer is the only natural groundwater source whose water quality has remained acceptable. Nitrate concentrations are generally low (5-25 mg/litre); salinity ranges from 50 to 300 mg/litre, but in most (75%) pumped water it is well below 200 mg/litre.

Lake Kinneret

Pumping of water from Lake Kinneret is regulated. It may be carried out sparingly between 209 and 213 metres below sea level (MBSL), but is prohibited below 213 MBSL for fear it could cause irreparable damage to the lake's ecosystem and water quality.[6] In general, the lake has demonstrated remarkable resilience to increasing pressures in the past 30 years, as development in its catchment area has boomed. Acceptable limits have been developed based on observed variability in various chemical and biological parameters during a 25-year period (Hambright *et al.*, 2000). Nevertheless, recent events (*e.g.* the collapse of the Kinneret bleak fishery) indicate that the lake's natural "buffering capacity" may have been exceeded. For example, between 2000 and 2009 cyanobacteria (or

blue-green algae) often exceeded acceptable limits, particularly during the summer-autumn season (Table 4.1). The Kinneret Drainage and River Authority implemented stringent measures to reduce phosphorus discharges, the main source of the blue-green algae, particularly from the livestock sector.[7] Efforts have also been made to reduce the historically high salinity of Lake Kinneret (400 mg/litre), in particular through the capture and diversion of saline springs. However, salinity increased to 270-285 mg/litre in 2009-10 following several years of drought.

Table 4.1. **Water quality in Lake Kinneret, 2000-09**[a]

Parameter	Winter-spring season (January-June)		Summer-autumn season (July-December)	
	Acceptable limit	Number of months beyond the acceptable limit[b]	Acceptable limit	Number of months beyond the acceptable limit[b]
Chloride	243 mg/l	29	245 mg/l	30
Cyanobacteria	7% of total	15	13% of total	34
Chlorophyll[c]	38 µg/l	7	10.2 µg/l	12
Faecal coliforms	100/l	5	60/l	1

a) Years 2000, 2002, and all years beween 2004 and 2009 included.
b) Out of 48 months.
c) Indicator of phytoplankton blooms.
Source: MoEP.

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Rivers

Israel has 16 main rivers flowing to the Mediterranean Sea, and 15 that flow to the Jordan River and Lake Kinneret. These rivers have been seriously depleted and polluted, although they once supported rich aquatic and wetland ecosystems. River water has been diverted for public water supply and irrigation, while untreated wastewater has been discharged to rivers. The southern Jordan River has become a relatively small stream along most of its length.

Since 2000, pollutant discharges to rivers have been reduced by 20% (total nitrogen), 40% (organic matter) and 70% (total phosphorus), largely due to the construction of new wastewater treatment plants and increasing reuse of treated domestic wastewater (effluent) in agriculture. However, despite improvements, water quality in Israel's rivers (except the still unpolluted Taninim and Zippori Rivers) needs further improvement. Rehabilitation plans have been developed for most rivers, supported by statutory planning. Water allocation plans for rivers have begun to be approved recently, with a view to ensuring adequate allocation of water for ecosystems (in terms of quality and quantity). Together with the 2010 Public Health Regulations (Effluent Quality Standards), the goal is to achieve considerable environmental improvement of rivers within five to ten years.

Drinking water

There has been a substantial improvement in the microbiological quality of drinking water during the past two decades, with the rate of non-compliance falling from 6.5% in 1991 to 0.2% in 2008.[8] However, deteriorating water quality (concentrations of nitrates, chloride, micro-organisms and pesticides) has led the Ministry of Health to close 10% of the country's 2 200 drinking water wells in the last ten years. Drinking water is routinely checked for chemical (including heavy metals), physical and radiological quality.

Coastal water

Overall, the level of pollution of Israel's coastal waters has stabilised since 2005 following a decrease in 2000-05 (Herut *et al.*, 2009). Pollution is not high with respect to international guidelines[9] except in Haifa Bay and at some other locations. At polluted locations, excess heavy metals, organic matter and nutrients originate from both point sources (marine outfalls and coastal rivers) and non-point ones (runoff water and atmospheric deposition).

Since 2003, the Eilat Interuniversity Institute for Marine Sciences has monitored water quality in the Gulf of Eilat/Aqaba on behalf of the MoEP. The coral reefs seem stable (*i.e.* with regard to species diversity and community structure) while concentrations of most nutrients in the water column are decreasing (Shaked and Genin, 2010). Monitoring of heavy metals started in 2009.

Large-scale desalination generates pollutant discharges to coastal waters. The MoEP has published a policy paper on the environmental impacts of desalination facilities (MoEP, 2002). The government's aim is to reduce discharges at sea of solids, suspended solids and phosphorus, and to ban those of organic material. The policy paper establishes requirements for the construction of outfall pipes, in order to reduce impacts on the marine environment, and sets parameters for marine outfalls of concentrated desalination brine. It also imposes monitoring and control of pollutants discharged at sea in concentrated brine, which should be an integral part of a desalination plant's planning and operation.

4. National policy objectives and international commitments

National policy objectives

Israel has a national goal of supplying water to all consumers sustainably, based on approved requirements for quality, quantity, efficiency and economic feasibility. To this end, it has set specific targets for gradually reducing reliance on natural potable water during the coming decades, primarily to ensure security of supply, in the context of the increase in water demand (Tables 4.2 and 4.3, Figure 4.2).[10] These targets are designed to:

- decrease consumption by investing in technical, economic and educational means;
- increase reliability of supply (*e.g.* through increased reliance on desalinated seawater);

Table 4.2. **Water consumption indicative targets, by sector**

	Total consumption (all sectors)		Domestic consumption	Agricultural consumption	
	Alternative water sources[a]	Desalinated water (brackish and seawater desalination plants)	Per capita water consumption[b]	Alternative water sources[c]	Treated domestic wastewater (effluent)
	%	Million m^3	m^3/person/year	%	Million m^3
2010	44	307	90	55	400
2015	51	558	100[d]	55	464
2020	57	809[e]	99	58	528
2025	59	835	98	61	587
2050	71	1 491	95	74	900

a) Water other than natural potable water: includes desalinated, brackish and effluent.
b) Maximum desirable rate. Per capita consumption in 2010 was 90 m^3/person/year.
c) Water other than potable water (both natural and desalinated): includes brackish and effluent.
d) The assumption is that per capita water consumption can increase when water sector provisions improve. The reduction to 2050 will occur in response to increasing water efficiency.
e) Of which 750 million m^3 of desalinated seawater supply.
Source: Water Authority Master Plan (2010).

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Table 4.3. **Water consumption indicative targets, by type of water**

	Natural potable water (%)	Desalinated water (%)	Treated domestic wastewater (effluent) (%)	Natural brackish water[a] (%)	Total (%)
2010	56	15	21	8	100
2015	47	24	22	7	100
2020	38	33	23	6	100
2025	39	32	24	5	100
2050	28	42	26	4	100

a) Water that has more salinity than freshwater, but not as much as seawater. It may result from the mixing of seawater with fresh water, as in estuaries, or may occur in brackish fossil aquifers.

Source: Water Authority.

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- decrease reliance on potable water for agriculture by 150 million m^3 until 2050, and concomitantly increase use of treated domestic wastewater (effluent);
- upgrade all secondary wastewater treatment facilities to tertiary level by 2015;[11]
- increase the efficiency of water conveyance (*i.e.* reduce losses from leaking pipes) in all sectors, and improve the efficiency of monitoring of water consumption with automated meters.

Major international commitments

Under the Treaty of Peace with Jordan (1994), Israel agreed to transfer to Jordan 55 million m^3/year of potable water from the northern part of the country while Jordan agreed to transfer 20 million m^3/year to Israel from the Yarmouk River. Thus, Israel is committed to a net supply of 35 million m^3/year of potable water to Jordan (Chapter 3).

Israel notes that it has also made 88 million m^3/year of water available to the Palestinians, both through direct transfers from the Israeli water system and through permits for the drilling of wells in the western Mountain Aquifer. Infrastructure projects are authorised by the Joint Water Committee established under the 1995 Israeli-Palestinian Interim Agreement on the West Bank and the Gaza Strip (the Oslo II Agreement) (Chapter 3).

5. Towards more efficient water use

Strong pricing signals have been introduced to encourage reduced consumption and recycling of water. However, there are different rates for the agricultural, industrial and domestic sectors (OECD, 2010b).

Domestic sector

Measures have been taken to decrease domestic per capita water consumption from 108 m^3/person/year to the current 90 m^3/person/year (2010). In 2010, Israeli per capita consumption was 156 litres/head/day (lhd) for households, in the middle range of OECD countries, and 247 lhd when considering households and all other urban uses.

The main measures taken to reduce water consumption have been water-saving campaigns, increases in water tariffs, and, for 55% of households, repair of water-saving devices. Efforts have also been made to reduce pipe (conveyance) losses. Approximately 10-20% of water transported by national and urban pipelines is lost due to pipe leakages, theft and faulty metering equipment. This level of water loss compares well with good practice in other OECD countries. Israel recently decided to gradually replace most of its

manually read water meters with automated meter reading (AMR). Losses greater than 8% of the total volume of water transported must now be paid for by the Water and Sewerage Corporations. This creates an incentive for efficiency. The Corporations may also reduce water pressure in order to minimise leaks, provided they do not supply water below the minimum pressure required.[12]

In January 2010, tariffs for the domestic sector were raised by 40%, mainly to recover the cost of the recently built large-scale seawater desalination facilities, and as a result of the closed budget system following the establishment of the Water and Sewerage Corporations. Domestic users pay according to an increasing two-block tariff system, or progressive pricing, which encourages water conservation. Below 3.5 m^3/person/month, the rate is USD 2.5/m^3 and, as of March 2011, USD 4/m^3 above this level.[13] In the event of exacerbated drought conditions, the addition of a third block with a much higher tariff was considered (USD 6.95/m^3). It would apply to large consumers in the event of exacerbated drought conditions (this third block is known as the "drought tax"). The drought tax was initially applied in the summer 2009 as a surcharge on water prices for consumption in excess of household allocations. In response to social protest, however, this tax was frozen in early 2010 and never reintroduced.

Multimedia (television, radio, newspaper and internet) water-saving campaigns by the Water Authority have become increasingly effective, contributing to a 10% (76 million m^3) reduction in domestic consumption in 2009-10 (compared to 6% in 2000-01). Greater public awareness can be attributed to several years of drought before 2009 and widespread attention to the severe depletion of Israel's water resources (the "water crisis") stimulated by these media campaigns.[14]

Since 2009, municipal parks or gardens must be equipped with water meters and municipalities are allocated a water quota for this use of water. In 2009, the quota allocated to municipal parks or gardens (20 million m^3) was less than half of estimated consumption for that purpose in previous years (45 million m^3).

The agricultural sector

Growth in agricultural production (20% between 2000 and 2009) has largely been achieved through improving the productivity of fixed and variable inputs, including water.[15] The combined effect of reducing agricultural support and tightening water quotas has been the creation of incentives to improve water use efficiency in agriculture. Demand management policies in the agricultural sector seek to accomplish two key objectives: to irrigate with non-potable water (effluent or natural brackish water) wherever possible; and to maximise efficiency in the use of irrigation water.

Three economic incentives exist to encourage farmers to switch from the use of potable water to that of alternative water sources. First, there is a price incentive: for irrigation the price of treated domestic wastewater (USD 0.34/m^3) is one-third that of potable water (about USD 1/m^3). There is also a quota incentive: if farmers exchange part of their annual potable water quota for reused or brackish water, an extra 20% in volume is provided free of charge. Finally, 60% of the effluent pipe infrastructure is subsidised.

Lower prices for effluent and brackish water have encouraged their use for irrigation (Table 4.4). Effluent now accounts for 40% of irrigation water against 20% in 2000, in line with the targets that had been set (Table 4.5). To meet the 2050 target of 60%, the effluent pipe grid would have to expand to cope with the increasing volume of effluent coupled with population

Table 4.4. **Water prices, January 2010**

USD/m^3

% quota allocation	Potable water		Effluent	Brackish water
	Agriculture	Industry		
Up to 50	0.496	1.180	0.226	0.300
50-80	0.571			
80-100	0.724			
100-108	0.887	1.475	0.282	0.375
Above 108	1.049	1.770	0.338	0.450

Source: Water Authority (in Rosenthal and Katz, 2010).

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Table 4.5. **Water consumption indicative targets in agriculture, by type of water**

	Total potable water (%)	Treated domestic wastewater (effluent) (%)	Natural brackish water (%)	Total	
				%	Million m^3
2000	67	24	9	100	1 089
2010	48	38	14	100	1 045
2015	45	43	12	100	1 083
2020	42	47	11	100	1 121
2025	39	51	10	100	1 156
2050	26	67	7	100	1 351

Source: Water Authority.

StatLink http://dx.doi.org/10.1787/888932495836

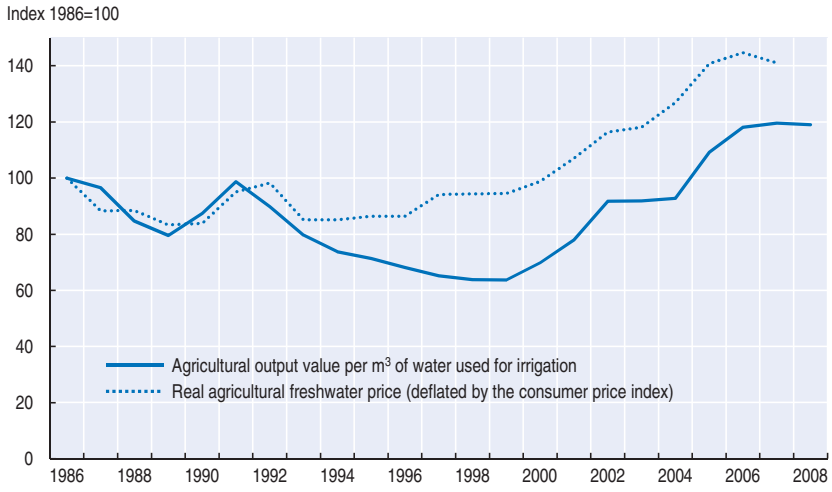
growth.[16] Approximately 85% of effluent is currently reused in agriculture, compared with 70% in 2000. The remaining 15% is lost through evaporation or discharged at sea.

A quota of potable water is allocated to the agricultural sector each year to create incentives for efficient water use. In 2001, following a severe drought, the quota was reduced by 23% (to 563 million m^3) compared with the 2000 level. The quota has changed little since then, but it is expected to decrease to 487 and 350 million m^3 by 2015 and 2050, respectively (from the current 500 million m^3). Quota reductions since 1999 have been compensated by income support payments.

Following a decrease in the 1990s, the value of output per unit of water used for irrigation significantly improved in the 2000s (Figure 4.5). During the last decade, water use declined from 7 megalitres (ML)[17] per hectare per year to about 5 ML/ha/year. This is largely due to technological improvements (*i.e.* the introduction of new irrigation technologies and irrigation management practices, increased cultivation of crops requiring less water) and water policy reform (*e.g.* increases in average real agricultural water prices). Compared with Israel's current rate of water use in irrigated agriculture of around 5 ML/ha, the OECD 2002-04 average was 7.5 ML/ha (OECD, 2010c).

While water pricing in the domestic sector was established by the Water Authority to cover the cost of production (USD 2/m^3), water use in the agricultural sector is still heavily subsidised (above the quota price of around USD 1/m^3). The government's objective is to gradually charge farmers for the social costs or "true resource value" of water (by 2015). The calculation of such external costs is not a simple task and is a major challenge in Israel's efforts to achieve the integrated management of its water resources (Kedmi, 2005). The pace of the price increase will take account of the agricultural sector's capacity to further increase its already high water use efficiency. By 2050, the volumes of domestic water

Figure 4.5. **Economic efficiency of agricultural water use, 1986-2008**



Source: OECD (2010), *OECD Review of Agricultural Policies: Israel, 2010* .

StatLink http://dx.doi.org/10.1787/888932495285

consumption and agricultural water consumption (all water types combined) are expected to be approximately equal (agricultural water consumption is currently 50% higher in volume) (Figure 4.2). The 2006 Farmers' Agreement commits the agricultural sector to an increase in the price of water to recover the costs of production by 2015.

Support to agriculture, expressed as a percentage of gross farm receipts,[18] decreased from 24% in 1995-97 to 17% in 2006-08, below the OECD average of 23% (OECD, 2010a). However, the most distorting forms of support (based on commodity output and variable input use) still dominate (96% of PSE in 2006-08). Budgetary expenditure on agri-environmental measures (USD 9 million in 2008)[19] is just over 2% of total agricultural budgetary expenditure.

Industry

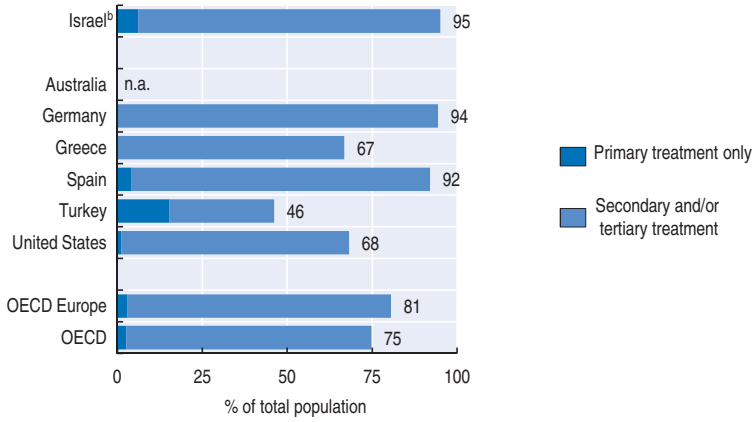
As in the case of agriculture, price incentives are provided to industry to use alternatives to potable water (Table 4.4). These incentives have not been as effective as in the agricultural sector: about 25% of water consumed in the industrial sector (30 million m^3) was brackish in 2010. A new policy is being sought to increase the use of effluent by industry, which could take the form of grants to invest in on-site wastewater treatment plants.

As in the agricultural sector, efficiency of water use in the industrial sector is controlled by a quota system. Water use by industrial users is also subsidised, although much less than in the agricultural sector (above the quota price of USD 1.8/m^3). The government's objective is again gradually to charge industry for the cost of supplying water by 2050.

6. Towards more efficient water quality management

Most (93%) of Israel's population is connected to public wastewater treatment plants, a very high rate by OECD standards (Figure 4.6). The ultimate goal is to treat almost 100% of wastewater to a level enabling its unrestricted use in irrigation (*i.e.* without risk of over-nutrification to soil and water sources). To achieve this, Israel plans to upgrade all existing

Figure 4.6. **Population connected to public wastewater treatment plants, 2009**[a]



a) Or latest available year.
b) Includes population served by other wastewater treatment (1.7%) and population whose wastewater is transported by truck from independent storage to wastewater treatment plants (0.2%).
Source: OECD, Environment Directorate.

StatLink http://dx.doi.org/10.1787/888932495304

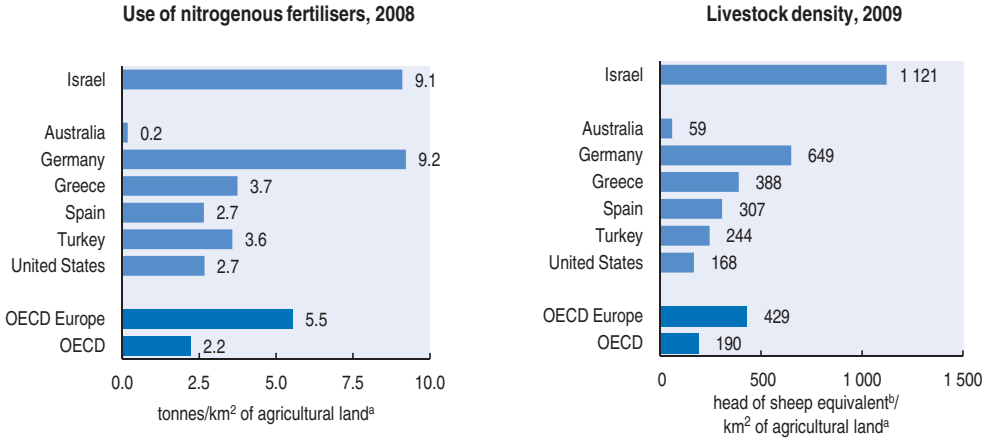
secondary-level treatment facilities to at least tertiary level between 2010 and 2015, and to reuse as much effluent as possible for irrigation.

Most treatment plants now provide intensive treatment (*i.e.* they treat flows above 1 400 m^3/day) and generate high-quality effluents. In 2009, 92% of effluents complied with national standards.[20] From 2010, new standards require effluent quality to comply with 36 parameters, including chloride concentrations. High chloride concentrations (salt concentrations) in effluent used for irrigation have been responsible for soil and groundwater contamination, especially in the Jezreel Valley and on the coastal plain. The widespread introduction of desalination will improve effluent quality by reducing saline concentrations, thereby reducing pressure on aquifers from effluent used for irrigation. This is already evident in the south of the country, following the introduction of large-scale desalination plants at Ashkelon, Palmachim and Hadera. However, the increase in desalinated seawater, together with the development of the water transport infrastructure, represents an expansion in the use of energy-intensive forms of water supply.

Effluent discharge to rivers is prohibited under the Water Law, although permits may be granted on a case-by-case basis by an advisory committee grouping the Water Authority, the MoEP and the Ministry of Health. The permits must comply with the 2010 Public Health Regulations (Effluent Quality Standards). The list of discharge permits was made publicly accessible as of 2009, including the name of the permit holder, date of issuance, expiry date, and date of denial if the permit was not granted.

Concerning the impact of agriculture on water quality, it is not clear whether the national nitrogen and phosphorus balances have evolved over the last decade, during which the number of livestock increased while inorganic fertiliser use decreased (OECD, 2010a). Israel's livestock density is high by OECD standards (Figure 4.7), as is the intensity of its use of nitrogen fertilisers (Figure 4.7). Fertiliser use has decreased due to more efficient application methods (*e.g.* fertigation) and greater use of effluent (which contains plant nutrients).

Figure 4.7. **Agricultural inputs and livestock density**



a) Arable area, permanent crop land and permanent grassland.
b) Based on equivalent coefficients in terms of manure: 1 horse = 4.8 sheep; 1 pig = 1 goat = 1 sheep; 1 hen = 0.1 sheep; 1 cow = 6 sheep.
Source: FAO (2010), *FAOSTAT Database*.

StatLink http://dx.doi.org/10.1787/888932495323

The only currently available information on national agricultural pesticide use dates to 1998,[21] when average intensity of use was 0.01 tonnes/km^2 of agricultural land. This is low by OECD standards. Pesticide concentrations in the Kinneret watershed are low. In northern Israel, however, intensity of pesticide use (0.07 tonnes/km^2) is more in line with the OECD average. In 2007-08, one or more pesticides were detected at around 35% of the Water Authority's monitoring sites in coastal aquifers, although none had pesticide concentrations exceeding Israeli drinking water standards. There is some evidence that pesticide use has begun to decline in response to wider adoption of Integrated Pest Management (IPM)[22] and the need to meet the pesticide residue standards of the European Union, a key export market for Israel's horticultural products. Organic agriculture has increased, but it still accounts for less than 2% of agricultural land. A national biological pest control project was initiated in 2007, using barn owls and kestrels.

7. Water and nature management

Since 1993, the MoEP's River Restoration Administration (RRA), together with the Keren Kayemeth LeIsrael-Jewish National Fund and other bodies, has administered the rehabilitation of Israel's rivers. This requires complex planning and co-ordination between different stakeholders (*e.g.* government ministries, local authorities, the private sector and NGOs).

River rehabilitation plans address ecological, hydrological and recreational aspects. This includes restoration of natural ecosystems alongside rivers, preservation of aquatic biodiversity, pollution prevention (*e.g.* enforcing the ban on effluent discharges to rivers), water resource management (*e.g.* restoration of flow paths), enhancing the ability of rivers to serve as drainage channels for flood control (*e.g.* cleanup of riverbeds), and promotion of the use of rivers for leisure activities and tourism.

The river rehabilitation plans are based on a river basin management approach. They are implemented on different levels, from specific sections of rivers to entire drainage basins. The RRA serves as a catalyst for implementation of these plans, particularly through funding the 30 regional river administrations, which group local authorities, drainage authorities, regional organisations and NGOs as well as an RRA representative.

Studies have been carried out on the economic feasibility of river rehabilitation projects. Cost-benefit analyses conducted for numerous rivers have demonstrated that rehabilitated rivers and adjacent parks contribute to the economic growth of localities by attracting private investment and increasing real estate values (MoEP, 2010).

In 2000, the government decided that some 50 million m^3 per year of water should be allocated to nature as part of its overall water allocation policy. As of 2010, the allocation of water provisions to nature has been raised to 60 million m^3 per year, including 10 million m^3 of potable water and 50 million m^3 of treated effluent. This allocation is targeted to increase to 95 million m^3 per year by 2020. In 2003, the NPA assessed the water requirements of nature and the landscape in Israel. This policy document called for a change in Israel's approach to water management, with a view to preserving existing nature and landscape values and rehabilitating those which have disappeared (MoEP, 2003). Article 6 of the Water Law was amended in 2004 to introduce the "right of nature to water". This article now refers to the need to provide "water for the conservation and rehabilitation of natural assets and landscapes, including rivers, springs and wetlands". As part of the master plan developed by the Water Authority, the MoEP and the NPA, water for nature values will be defined. The MoEP is currently promoting mapping and the preparation of detailed plans for rivers, in accordance with their specific ecological systems' requirements.

8. Expenditure on and financing of water management

Public expenditure

In 2010, Israel spent nearly USD 580 million on sewerage and wastewater treatment, including both investments and operation and maintenance (Table 4.6). Expenditure is expected to increase to some USD 1 billion/year between 2011 and 2020, in order to finance the upgrade of all wastewater treatment facilities to at least tertiary level as well as the construction of new and expanded wastewater treatment facilities.

Table 4.6. **Public expenditure on wastewater treatment,[a] 2010-20**

USD million/year

	2010	2011-15	2016-20	USD/m^3
Sewerage	215	223	244	0.45
Sewage treatment	356	424	452	0.71
Upgrade to tertiary level[b]		26		0.06
New sewerage		202	202	3.37
New sewage treatment		219	92	3.11
Sludge treatment	6	6	6	236.00
Sub-total	*577*	*1 100*	*996*	
Effluent pipe grid	113	135	144	0.23
Total	690	1 235	1 140	

a) Cost estimates are based on 2010 market prices and do not include any potential future innovations for improved efficiency. These reported costs are approximations. The true costs vary within and between municipalities, according to differences in fees incurred per project in the tender-bidding process.
b) Completion is planned for 2015.
Source: MoEP, Water Authority.

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In addition, in 2010 around USD 110 million was spent on expanding the effluent pipe grid to increase the proportion of effluent that can be reused in irrigation. This expenditure is expected to increase to USD 140 million/year by 2020 in order to bring the increasing

volume of effluent coupled with population growth to the irrigation pipe grid (Table 4.6). Support to effluent pipe infrastructure began in the 1980s, first for the construction of reservoirs to collect storm water and later to bring more effluent to farmland.

In addition to the support to the effluent pipe grid, budgetary support to water management in agriculture is also provided for on-farm irrigation; water price support has been provided by *Mekorot*; and, between 1999 and 2004, there was compensation for cuts in water quota allocation (Table 4.7). Support to on-farm irrigation consists mainly in investment grants for installing drip irrigation and other water-efficient technologies. The government also covers part of the costs (both operational and maintenance and fixed capital) of *Mekorot*'s supply of freshwater to agriculture. Further reduction of the quota will be compensated if farmers can present evidence that they have invested in water-saving technologies.

Table 4.7. **Government support to water management in agriculture, 1995-2010**

USD million

	1995	2000	2005	2010
Water price support	164	50	7	19
Compensation for water quota cut[a]	–	4	–	–
Farmers' Agreement[b]	–	–	–	27
Water extraction levy concession[c]	–	29	24	13
Investment in water projects (on-farm)	2	2	12	71
Total	166	85	42	130

a) Implemented in the period 1999-2004.
b) Since 2006.
c) Since 2000.
Source: OECD, *PSE/CSE Database*.

StatLink http://dx.doi.org/10.1787/888932495874

In 2005-10, the MoEP allocated USD 5 million per year to the rehabilitation of polluted rivers.[23] This is much less than provisions in the 15-year national plan for river rehabilitation (2005-20), which estimated the cost of the ecological and landscape rehabilitation of rivers at USD 35 million/year (and the total cost of river rehabilitation at USD 67 million/year). River rehabilitation is mostly funded by the MoEP, with matching funds from the Keren Kayemeth LeIsrael-Jewish National Fund (KKL-JNF). Monitoring of aquifers and of Lake Kinneret is financed by the Water Authority, while the MoEP finances monitoring of rivers and marine waters.

Around USD 3 million/year is spent on monitoring water quantity and quality, of which 55% on aquifers, 20% on the Lake Kinneret watershed, and 25% on rivers and marine waters.

Financing through tariffs

The Water Authority is responsible for designing tariff levels and their structure to recover supply costs and reflect scarcity. Charges for all water in Israel are determined according to the volume metered. Prices for consumers are the same in all regions. Municipalities are subject to fines if unbilled water quantities exceed 12% of the water consumed by the local authority.

Israel has achieved full recovery of the costs of supplying water services. However, about 35% of agricultural uses of potable and reused water are still cross-subsidised by the household sector and receive a relatively large share of public support. Following a 2006 agreement between the government and farmers, it is expected that by 2017 the

agricultural sector will pay the average cost of water production (operation and maintenance and fixed capital costs). The agreement to move towards charging farmers the average cost of water production implies a gradual elimination of water price support by *Mekerot* and the end of urban/industrial cross-subsidisation of water for agriculture. Water price support by *Mekerot* will only be provided during this period on condition that farmers invest in water-saving technologies and infrastructure, so that they can adjust to the increase in water charges by 2015 (OECD, 2010a).

Wastewater tariffs based on water consumption are charged by local authorities and included in the water bill (*i.e.* a combined water bill). They are planned so as to recover the cost of producing effluent to a quality level enabling unrestricted irrigation, or investment and maintenance related to the effluent pipe grid. To finance investments in wastewater treatment, municipalities receive grants and soft loans through various funds including the National Sewage Fund.

Green taxation of water

A water extraction levy is imposed on domestic, industrial and agricultural consumers. It partly reflects the scarcity value of water resources, with a higher rate charged for the extraction of groundwater than for that of surface water (OECD, 2010a). However, farmers benefit from concessions (Table 4.7). Extending the levy to water producers is envisaged, in order to fully reflect the environmental cost of water and prevent depletion of aquifers. The levy on water producers would be differentiated according to natural resource conditions and water quality, water quantity, and location of the catchment. A marine pollution levy has also been proposed, which would apply to discharges of sewage and other waste streams to seawater, but not to discharges to rivers. The marine pollution levy (not in force yet) is awaiting approval by the Knesset.

Notes

1. The Coastal Aquifer is a phreatic aquifer extending some 120 km along Israel's Mediterranean coastline.
2. The water that flows downstream is only saline water and effluent. Occasionally, water flows from Lake Kinneret.
3. Water with a nitrate concentration higher than 50 mg/litre is not potable.
4. There is no limit on the salinity of potable water. Chlorides are essential to the human organism, as they play an important role with regard to the cell structure. However, according to the WHO, chloride concentrations above 250 ppm could affect the taste of drinking water.
5. Like the Coastal Aquifer, it supplies a quarter of national drinking water requirements.
6. Water levels in the lake, fluctuating in accordance with its use in the national water system and the amount of precipitation and inflow, have varied between 213 and 209 metres below sea level for several decades.
7. For example, manure from local cattle is collected, transported and treated in a sewage treatment facility. All cowsheds must be covered in the winter (rainy) season, so that rain does not wash the manure into the lake. Food and water for cattle are located away from streams in all watershed pastures.
8. Bacteriological standards, tightened in 1989, state that water is unfit for drinking if it contains more than three coliform microbes and/or one faecal coliform per 100 millilitres (ml). This is less stringent than the EU standard of zero *Escherichia coli* per 100 ml.
9. Guidelines of the MED POL Programme, the marine pollution assessment and control component of the UNEP Mediterranean Action Plan for the Barcelona Convention, to which Israel is a contracting party.

10. According to the Master Plan for Water Sector Development in the period 2010-50.
11. Secondary treatment removes biological matter, employing micro-organisms, while more advanced (tertiary) treatment involves chemical processes to remove non-biodegradable toxic organic pollutants, nitrogen and phosphate.
12. Reduction of water pressure was initiated in 2009 in many municipalities, where it is expected to reduce municipal water consumption by about 5%.
13. In March 2011, following a public outcry about increases in the prices of many items across the economy, the first block was increased from 2.5 to 3.5 m^3/person/month.
14. The extremely low water level in Lake Kinneret was used as a prominent symbol of the water crisis.
15. Some 60% of Israel's agricultural land is irrigated.
16. Some wastewater treatment plants are not yet connected to the irrigation pipe infrastructure.
17. One megalitre is 1 million litres.
18. As measured by the Producer Support Estimate (PSE).
19. Including USD 3 million/year to encourage the adoption of Integrated Pest Management (IPM).
20. Until 2010, regulations called for (secondary) treatment of wastewater to a minimum baseline level of 20 mg/litre biological oxygen demand (BOD) and 30 mg/litre suspended solids in every settlement with a population exceeding 10 000 people.
21. Survey carried out jointly by the MoEP and the Central Bureau of Statistics.
22. IPM is used to eradicate the Mediterranean fruit fly. Its use has become widespread in the production of strawberries (on 90% of the crop area), avocado and mango (80%), citrus crops (65%) and peppers (50%).
23. This is in addition to expenditure on wastewater treatment, including reuse of effluent in irrigation, which also contributes to the improvement of river quality by reducing sewage discharges to rivers.

Selected sources

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PART II

Chapter 5

Biodiversity conservation and sustainable use

Israel's biodiversity, while exceptionally rich, is subject to serious pressures from a range of sources. Although a relatively large share of the total area is protected, natural reserves and parks do not adequately represent the country's diversity of habitats. Relatively large shares of fauna and flora species are threatened. This chapter reviews Israel's biodiversity policy and institutional framework, along with the priorities, principles and actions outlined in the National Biodiversity Strategy. It discusses the policy mix for biodiversity conservation and sustainable use, including the increasing, albeit still limited, use of economic instruments. The degree of biodiversity mainstreaming into other sectors such as agriculture, fishery and forestry is also addressed.

Assessment and recommendations

Despite its relatively small size, Israel has an exceptionally high degree of biological diversity. This is largely due to its location at the interface of Africa, Asia and Europe. It is also important for migratory birds and marine species. Its biodiversity policies therefore affect ecosystems in other countries, as has been recognised by Israeli policy makers.

One of the country's unique features is that its land is publicly owned. How land may be used is determined by national land use planning policy. Within this framework, a relatively large share of the total land area is protected. About 20% of land area is currently classified as nature reserves (primarily for nature conservation) and 1% as national parks (primarily for conservation of heritage and archaeology). Although the number and extent of protected areas are increasing, they do not adequately represent the country's diversity of habitats. None of the protected areas is large enough to preserve entire ecosystems. Their small surface area and lack of buffer zones leave them vulnerable to human activity. Biosphere reserves are being identified to help reduce habitat fragmentation.

The current status of biodiversity presents a mixed picture. Israel's biodiversity is subject to serious pressures from several sources: habitat fragmentation, the introduction of invasive species, over-exploitation of natural resources, and pollution. Demographic changes, economic development and climate change are the main drivers of these pressures. In response, Israel has made progress in reducing pressures on aquatic ecosystems from river pollution and in enhancing habitat protection through an impressive afforestation programme. On the other hand, the condition of coral reef habitats has deteriorated and the size of coastal ecosystems has decreased. The number of threatened mammal species is relatively high compared to that in other OECD countries, while the status of other species is more favourable.

The National Biodiversity Strategy (NBS) adopted in 2010 provides a comprehensive framework for monitoring, conservation and sustainable use of biodiversity. The NBS recognises that economic development and biodiversity conservation objectives are not incompatible. This represents an important shift from the traditional conservation approach followed in Israel and many other countries for a number of years. The need to mainstream biodiversity in all policy domains and economic sectors is explicitly recognised. The NBS also signals a clear shift from previous biodiversity policy, in that it aims at the conservation of ecosystems and the promotion of biosphere reserves and ecological corridors rather than focusing on single species.

The NBS has established guidelines and objectives. Targets will be developed in the future. Taking account of such targets in legislation or government decisions would support effective implementation. The existing information system and indicators provide a sufficient basis for management purposes. However, they would be more effective if the information base were more comprehensive and were expanded to include the economic aspects of biodiversity conservation. A more systematic analysis of future trends would also strengthen the basis for biodiversity policy development, including the development of targets.

The NBS recognises the role that economic instruments can play both in internalising environmental costs in economic activities and in providing incentives for sustainable use of biodiversity resources. Greater use should be made of such approaches to help mainstream biodiversity in economic and sectoral policies (*e.g.* in agri-environmental schemes, by creating markets for biodiversity conservation and sustainable use, introducing tradable fishing quotas, and establishing levies for coastal and marine protection). Policy and institutional co-ordination remains a key challenge. Co-ordination with climate change mitigation and adaptation policies, including possible trade-offs, is of growing importance. Israel has a range of useful educational and public awareness programmes, which should be continued and strengthened.

Recommendations

- Undertake a comprehensive national assessment of Israel's ecosystems and biodiversity, including their economic value; analyse how the main pressures on biodiversity are likely to evolve and how they could be mitigated by alternative policies.
- Establish measurable biodiversity targets; consolidate the national biodiversity monitoring system to measure progress in achieving these targets and to support future policy development.
- Strengthen and broaden biodiversity conservation in and around nature reserves, *e.g.* by establishing buffer zones, ecological corridors and biosphere reserves.
- Identify specific measures to reduce the introduction of invasive alien species from all sources.
- Expand the use of market-based instruments such as fees, charges and payments for ecosystem services in key economic sectors, such as housing, infrastructure development, agriculture, fishing and forestry; examine ways to create new market opportunities to further involve the private sector in biodiversity protection, *e.g.* in the tourism sector.
- Assess how trade-offs between biodiversity and other key policy areas, notably climate change, should be addressed in implementing the National Biodiversity Strategy and the national plan for adaptation to climate change.

1. Key trends and projections

Despite Israel's relatively small size, it is characterised by an exceptionally high degree of diversity at all biological levels or scales: genetic, species and ecosystem. This high degree of biological diversity is attributed to the country's location, connecting Africa and Eurasia, and its varied climatic zones (from mountain to Mediterranean and arid and semi-arid environments). It is estimated that Israel hosts some 3.5% of globally known species. Biodiversity is richer in the Mediterranean region than in the arid and semi-arid zones (MoEP, 2002, 2010c).

1.1. *Drivers of Israel's biodiversity loss*

Despite past, current and ongoing efforts to protect biodiversity in Israel, several threats persist. These are both direct (mostly related to land conversion or alteration) and indirect (mostly linked to pollution loads, which are expected to triple by 2050) (MoEP, 2009). Further, most of the drivers are internal (*e.g.* stemming from internal population

pressure or the agricultural sector) although others are external (*e.g.* threats from climate change or invasive species). While some threats, such as pollution and over-use of natural resources, have been addressed to a certain extent, other pressures from further habitat fragmentation, as well as from climate change, represent serious challenges that could lead to downward trends in Israel's biodiversity. The nature of the pressures on biodiversity have changed over the years, reflecting changes in geopolitical conditions, an evolving policy agenda within and outside Israel, changes in societal preferences, changing demographics, and climate change.

The main pressures on Israel's biodiversity are (MoEP, 2002, 2009, 2010a, 2010c):

- Destruction, alteration and fragmentation of habitats. While large-scale land conversion for agriculture or urban development no longer takes place, fragmentation is associated with other serious pressures. It results from enhanced economic activity and population pressures within a relatively small country (Box 5.1). In addition, wildfires due to negligence or arson have caused widespread damage to forests and woodland and are a major cause of habitat degradation. They usually occur in the Mediterranean region (central and northern Israel). Burned areas also increase risks of invasive plant species, proliferation of pyrophytic species, soil loss, and depleted seedbank and regeneration potential. Although the extent of open landscape affected by wildfires has declined in the past decade (Figure 5.1), the number of fires per year has recently shown a notable increase. This trend warrants further monitoring, especially in light of increasing temperatures and drier winters due to climate change.
- An increase in the introduction of invasive species (non-indigenous plants, terrestrial vertebrates, fish, insects and gastropods). This is primarily attributed to the agricultural, tourism and marine transport sectors.
- Over-exploitation of natural resources in the form of hunting, fishing, over-grazing and the unregulated collection of fauna and flora for commercial purposes. While some of these activities have been unsustainable and have exceeded the rate of species regeneration, their impacts have been moderated in recent years through better management. Changing demographics and economic conditions, technological advances in the fishing and agricultural sectors, and continued severe pressure on water resources may increase the pressures on natural resources in the future.
- Pollution of aquatic and terrestrial ecosystems by activities associated with production (*e.g.* soil and water pollution from fertilisers used in agriculture, pollution from industry) and consumption (*e.g.* domestic solid waste, untreated sewage) (Chapter 4). While about 95% of the population is served by adequate sewage treatment facilities, lack of treatment facilities in areas with high natural value and high biodiversity is a significant threat. In previous decades the main source of pollution that threatened biodiversity in Israel was agriculture. Although structural changes in the agricultural sector during the past decade have brought about a reduction in the use of highly toxic chemicals, this remains an important threat. For example, about 40% of all recorded poisoning of mammals and birds is attributed to agriculture (MoEP, 2009, 2010a).
- The projected impacts of climate change on biodiversity, which will mostly stem from rising sea levels (*e.g.* increased aquifer salinity), the increase in winter dry spells (leading to desertification) and the proliferation of aquatic invasive species (mainly through the impact of rising sea temperatures) (MoEP, 2010b). The potential trade-off between

biodiversity management objectives and the development of renewable energy sources in Israel's climate mitigation strategy should also be considered (Section 4.6).

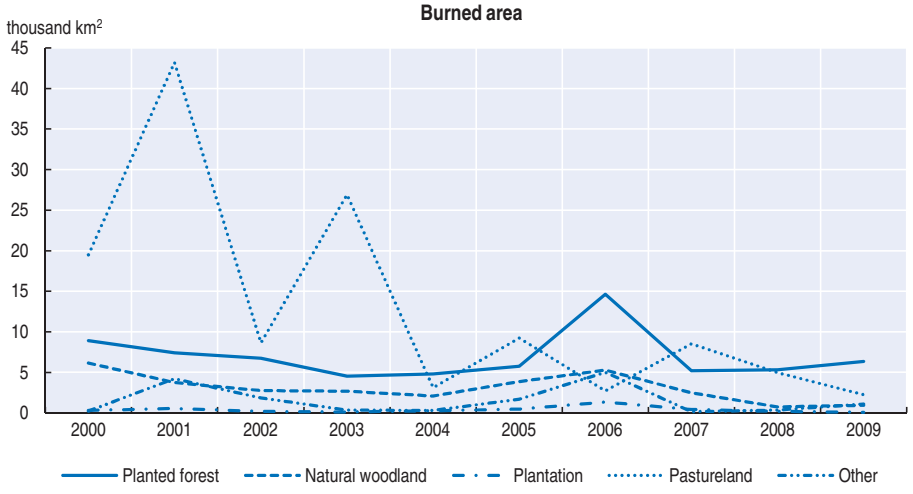
Box 5.1. **Reasons for habitat fragmentation in Israel**

Habitat fragmentation is mainly attributable to construction, infrastructure development and agricultural activities. Israel's population is projected to increase by 1.8% annually and to triple by 2050. Demographic changes are leading to increased demand for new dwellings and for more floor space. Taken together, these effects are increasing demand for new construction. Most of this construction is likely to take place in the non-desert areas which host higher amounts of Israel's biodiversity.

The rate of expansion of built-up areas since the year 2000 has been considerably lower than in previous decades due to a planning policy favouring urban concentration. This policy achieves various economies of scale (*e.g.* for infrastructure) as well as better land use. Strict planning regulations will need to be maintained in the face of increasing population pressures if threats to biodiversity are to be held in check. Rural low-density development also affects biodiversity. Although it is small-scale, this type of development has disproportionate effects on habitat fragmentation due to the need for infrastructure (*e.g.* road access, electricity lines, water supply). Several new villages have been located in areas with high landscape and natural value. The amount of land they use and their ecological impacts are relatively high compared with the number of dwelling units.

Source: MoEP (2009, 2010a).

Figure 5.1. **Forest fires**



Source: Forestry Department, JNF.

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1.2. Current status and trends of Israel's biodiversity

Information on the current status of Israel's biodiversity (at the ecosystem and species level) provides a sufficient basis for management, but evidence concerning future trends under business-as-usual or other scenarios is lacking. Progress in achieving Israel's biodiversity policy objectives presents a mixed picture (Section 2). In some cases, such as

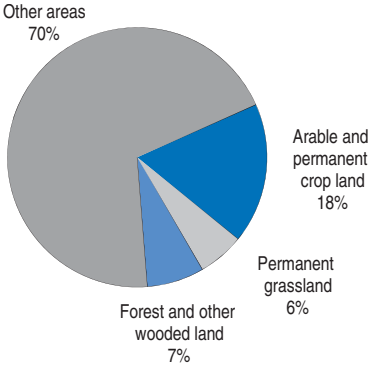
the reduction of river pollution and the increase in forest coverage, there are signs of progress, while in others, such as the status and trends in invertebrates and bird species, the evidence is less conclusive.

1.3. Status and trends in ecosystem types

Forest ecosystems

Forests and woodlands are the largest ecosystem types in Israel after desert ecosystems. According to the Food and Agriculture Organization (FAO, 2010), about 7% of land area is forested (Figure 5.2). There are 88 000 hectares of planted forest. Between 1990 and 2010, Israel gained an average of 1 100 ha or 0.83% of forest per year. In total, between 1990 and 2010 it gained 16.7% of its forest cover or around 22 000 ha. This is due to its renowned afforestation programme (Section 4.3). Israel's forests host several terrestrial endemic species, while they contain 5 million metric tonnes of carbon in living forest biomass.

Figure 5.2. **Land use, 2008**



Source: FAO (2010), *FAOSTAT Database.*

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Coastal, inland and freshwater ecosystems

An indication of biodiversity quality status and trends in coastal, inland and freshwater ecosystems can be obtained by observing trends in pollution levels. Available data suggest favourable or stable trends in pollution discharges to costal, inland lake and river ecosystems. This has resulted from the construction of new wastewater treatment plants, the development of effluent reservoirs, and effluent reuse in agriculture. Nonetheless, most rivers remain seriously depleted and polluted (Chapter 4).

One type of aquatic ecosystem that is of great concern is coral reefs. Monitoring of the Red Sea over seven years shows a continuous stressful condition of the coral reef, and continuous pollution and eutrophication, although with some slight improvements in recent years (Shaked and Genin, 2009). The Red Sea reef corals continuously show bleaching due to the loss of symbiotic algae that are sensitive to high temperatures, leading to coral death. Both the coverage and abundance of corals are much lower than 20 years ago, with a low replenishment rate. However, no change has been found in species diversity since 2004. In 1993, Israel and Jordan (which share the shoreline around the

northern Gulf of Eilat/Aqaba) established the Red Sea Marine Peace Park to protect the fragile reef ecosystem (Chapter 3). Slow and unclear recent improvement seems to be occurring as aquaculture facilities, which were largely responsible for the deteriorating conditions, were removed from the Red Sea Bay in 2008.

Although wetland pollution trends are improving or stable, there is an alarming negative trend with regard to the size and number of coastal sand areas, wetlands, swamps and rain pools. Only 8.5 km^2 out of the 280 km^2 of inland wetlands which once existed in Israel remain today, a mere 3%. Population pressures, continued construction activities and climate change will likely contribute to the continuation of this trend unless policy action is taken. Moreover, the connectivity of water bodies has been lost and their isolation has been increased. The situation is even more serious due to the fragmentation impact of roads and built-up areas. Highways and buildings are absolute barriers to amphibian movements.

1.4. Status and trends in fauna and flora

Fauna

According to Israel's first International Union for Conservation of Nature (IUCN) Red List of Threatened Species, on average around 33% of the country's vertebrate species are endangered. Higher than average shares of endangered species are recorded for amphibians and mammals (Table 5.1 and Figure 5.3). More than half of the 34 vertebrates listed as extinct are wetland dependent species. This is directly related to the use of all the country's water sources (springs, streams and swamps) since the beginning of the 20th century to provide drinking and irrigation water. Furthermore, Israel is located on two major migratory routes, avian and marine (Box 5.2). The temporary presence of an even larger number of species, and the co-existence of local and migratory species, adds functional biodiversity. Although the Red List provides a good understanding of the current state of threatened invertebrate species, it does not assess trends in invertebrate species over the previous decades.

Table 5.1. **IUCN Red List summary of endangered species**

	Documented species	Endangered species[a]	% of endangered species	Example of endangered species
Mammals	105	59	56	Leopard
Amphibians	7	5	71	Fire salamander
Reptiles	105	35	33	Green turtle
Stream and lake fish	32	6	19	Yarkon bleak (*Acanthobrama telavivensis*)
Nesting birds	210	39	19	Lesser kestrel

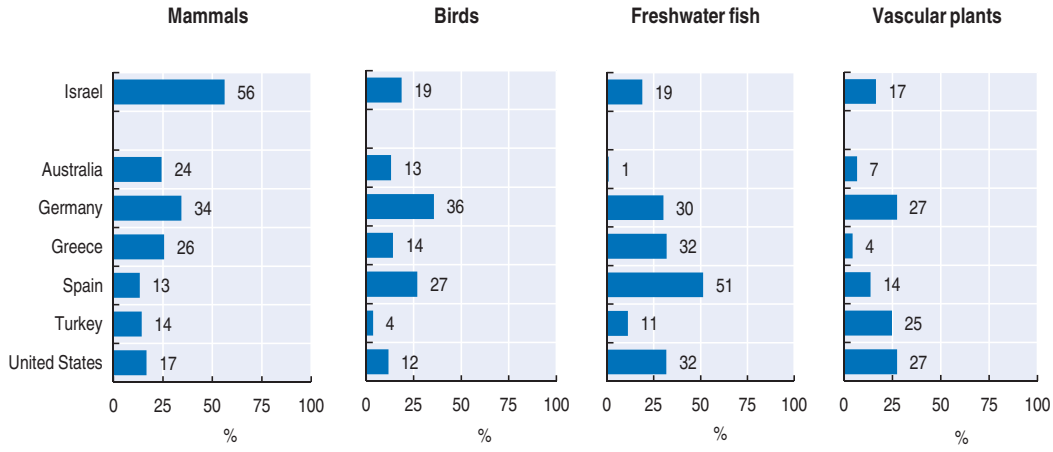
a) Includes critically endangered, endangered and vulnerable species.
Source: MoEP.

StatLink http://dx.doi.org/10.1787/888932495893

Flora

There are nearly 2 500 species of flora in Israel, about a quarter of which are concentrated in the desert and the rest in the Mediterranean zone. Israel is one of the world's richest areas in terms of progenitors and relatives of major agricultural crops (with many local varieties) and of domesticated species. Its Red Book of Flora (following IUCN standards) has been compiled. This Red Book identifies biodiversity hotspots. Approximately 370 red species have been identified in four types of habitats: wetlands and salt swamps (33.9%); heavy soils and fields (33.8%); sandy soils (20.2%); and cliffs and rocks (19.6%). The

Figure 5.3. **Cross-country comparison of threatened species**



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

StatLink http://dx.doi.org/10.1787/888932495380

Box 5.2. **Migratory birds**

Israel is located on the migration route between Africa, Asia and Europe. About 270 species are native to Israel, but an additional 230 pass through every year. About 25% of the world's migrating birds fly over Israel. A number of innovative initiatives have been taken to monitor and protect these birds' migratory patterns and to promote public awareness and co-operation with other countries in this regard.

Israel has ten main bird sanctuaries. Keeping them in good condition facilitates the migration of different bird species and contributes to protecting the ecology of other countries. The Jerusalem Bird Observatory is the national ringing centre. In spring and autumn, volunteers assist in capturing birds so that they can be weighed, measured and ringed. This enables the migration of selected birds and their condition to be monitored internationally. The Jerusalem Bird Observatory is the only such centre in the world where the public can view the ringing process.

For more than 20 years, the Society for the Protection of Nature in Israel and the International Center for the Study of Bird Migration in Latrun have actively promoted the protection of bird migration. One feature of this work has been co-operation with the Israeli air force. Since 1972, the air force has lost nine fighter aircraft and sustained serious damage to another 30 planes due to collisions with birds. Some 6 600 birds have been killed in collisions with aircraft. Bird movements have been mapped to avoid such collisions. As a result, two aircraft were lost in 1984-2004 compared with seven in the previous 15 years and the number of collisions has been reduced by 76%. The air force estimates that it has saved USD 690 million in avoided damage cost since 1984. Through its work, the Center fosters co-operation with countries along the Great Rift Valley, one of the world's main bird migration routes, which extends from Mozambique to Turkey.

Source: Cairncross (2006), MoEP (2009, 2010a).

endangered species list also includes 293 peripheral species, some of which are found at only one or two sites. Since 1965, the distribution of some 104 red species has diminished. If this trend continues, more red species will be added to the list of extinct species.

More generally, 17.3% of documented plant species are endangered, of which 39 have already become extinct. Most of the damage had occurred by the mid-1960s and most of the extinct species (56%) are wetland and salt marsh species. Their disappearance may be traced to the drainage and pollution of Israel's water bodies. Only 67 of the endangered plant species are among Israel's 268 protected plant species; 66 of the protected plant species are endemic native plants, and 203 of them are species whose habitat is highly threatened (MoEP, 2009, 2010b).

2. Israel's biodiversity policy and institutional framework

2.1. The National Biodiversity Strategy

Israel has ratified several international conventions on nature conservation and sustainable use, including the Convention on Biological Diversity (CBD) (Chapter 3) (Box 5.3). As part of its legal obligation under the CBD, Israel prepared its National Biodiversity Strategy and Action Plan (or, more simply, National Biodiversity Strategy or NBS). The NBS was developed during the past decade and completed in 2010 (Frankenberg, 2005; MoEP, 2009, 2010a).

Box 5.3. **Israel's international commitments on biodiversity conservation and sustainable use**

- Convention on Biological Diversity: Israel ratified this convention in August 1995.
- Convention to Combat Desertification: In 1996, Israel was one of the first countries to sign and ratify this convention. It has established the International Center for Combating Desertification in Sede Boqer in the Negev desert.
- Convention for the Protection of the World Cultural and Natural Heritage: Israel ratified this convention in 1999. Thus far, five Israeli sites have been included on the World Heritage List.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES): Israel ratified this convention in 1980. Enforcement of the CITES provisions is highly efficient in Israel due to its comprehensive nature protection legislation.
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention): Israel ratified this convention in 1996. Two Israeli sites have been designated as Wetlands of International Importance on the Ramsar List: the Hula Nature Reserve and the En Afeq Reserve.
- Convention on the Conservation of Migratory Species of Wild Animals, ratified by Israel in 1983. Three of the agreements concluded under the auspices of the Convention are relevant to Israel: Populations of European Bats (*EUROBATS*), Cetaceans of the Mediterranean Sea, Black Sea and Contiguous Atlantic Area (*ACCOBAMS*), and African-Eurasian Migratory Waterbirds (*AEWA*).
- Barcelona Convention for the Protection of the Mediterranean Sea Against Pollution. Israel ratified the Convention in 1978, and is a signatory to the Protocol on Specially Protected Areas and Biological Diversity.

The National Biodiversity Strategy (NBS) provides a comprehensive framework that establishes the main biodiversity priorities, principles and objectives, as well as guidelines for biodiversity management at both the local and national planning scale. It only sets

objectives and guidelines and has not set specified biodiversity targets. These targets are to be developed in the future as part of the NBS roadmap. Incorporating such targets or commitments in legislation or government decisions would give them more weight.

The NBS also highlights the need to adopt economic incentives and advance research, as well as promoting education and provision of information, encouraging legislation and its enforcement, and actively engaging in the international biodiversity conservation arena. It identifies the institutional and legal instruments required for its enforcement, as well as gaps in the research required for appropriate biodiversity and ecosystem management.

The NBS explicitly acknowledges that biodiversity should be viewed as a component of (or input to) the provision of ecosystem services that are essential to human welfare. Therefore, the main aim of biodiversity policy would no longer be merely to conserve the maximum possible level of biodiversity, but would instead be to provide the sustained and optimal amount of ecosystem services for human welfare. This strong "functionalist" approach to biodiversity management entails its sustainable utilisation to promote social welfare. In this respect, the NBS adopts a pro-active policy approach which accepts that economic development and biodiversity conservation objectives are not incompatible. This approach represents an important shift from the traditional conservation approach followed in many countries for a number of years. The need to mainstream biodiversity conservation in all policy areas and economic sectors is explicitly recognised. The NBS also signals a clear shift from previous biodiversity policy, in that it aims at the conservation of ecosystems and the promotion of biosphere reserves and ecological corridors rather than just focusing on specific sites and/or single species.

This shift in its biodiversity policy outlook is part of Israel's new overarching sustainability principles, which were adopted in 2003 to guide the formulation of sustainable development strategies by each ministry. These include the "polluter pays", "eco-efficiency" and "integrated resource management" principles which have been influential in shaping Israel's current biodiversity policy outlook.

The biodiversity policy objectives of the NBS are operationalised and implemented through: a multi-layered institutional framework (discussed below); a series of policies specifically directed towards biodiversity conservation and sustainable use (Section 3); and broader policies that are either part of Israel's national land use planning framework or concern specific economic sectors (Section 4).

2.2. Implementing institutions

Israel has established institutions to implement its biodiversity policy framework (MoEP, 2008). Responsibility for nature conservation lies with the Nature and Parks Authority (NPA), while the Ministry of Environmental Protection (MoEP) is responsible for biodiversity policy design. A wide range of institutions are involved in implementing and enforcing Israel's biodiversity policy framework, with various levels of commitment and awareness. They include other ministries and public authorities (*e.g.* the Ministry of Agriculture and Rural Development, the Water Authority, and the Israeli Land Administration), local municipal and regional authorities, and non-governmental (private or charitable) organisations such as the Jewish National Fund (JNF) and the Society for the Protection of Nature in Israel (SPNI). Several policies are the responsibility of more than one institution. The degree of overlap and conflicts among institutions creates bureaucratic obstacles to efficient implementation and enforcement.

Recognising this challenge, the NBS recommends that the distribution of responsibilities among implementing authorities be clarified (MoEP, 2010a). Designation of the MoEP as the central body responsible for the co-ordination of biodiversity policy was a step in this direction. Co-ordination is to be achieved through a committee established to prepare the NBS, which includes representatives of relevant ministries, the NPA, academia and NGOs. Another important supplementary co-ordinating institution is the National Planning and Building Board (NPBB), which co-ordinates policy for areas outside declared protected zones.[1] Within the NPBB, an informal mechanism exists for co-ordination between representatives of the MoEP, the NPA, the JNF and the SPNI.

3. Israel's policy mix for conservation and sustainable use of biodiversity

Israel has endorsed a series of specific policy instruments to achieve the policy priorities and objectives set out in the NBS for the conservation and sustainable use of biodiversity. These include pure regulatory instruments (*i.e.* command and control), economic instruments, and a series of other information and monitoring instruments. Some of these policy instruments have already been adopted, others are at pilot stages, and still others are under review and consultation. The current policy tool kit is in accord with those observed in other OECD countries and endorsed in the OECD's *Green Growth and Biodiversity* report (OECD, 2011).

3.1. Regulation

There is no consolidated law in Israel concerning biodiversity conservation. This is not necessarily a limitation, as biodiversity conservation and sustainable use inevitably cut across different sectors and cannot be adequately covered by a single piece of legislation. However, the NBS provides a platform for co-ordinating different legal instruments.

There are over 15 main legal instruments (including laws, regulations, master plans, orders and directives) protecting species, habitats, natural resources and natural assets. Many were designed for nature protection and/or other purposes before the concept of biodiversity was introduced in Israel. Although all of these instruments do not specifically refer to biodiversity and ecosystem services, they can be used to address related issues. Moreover, indirect protection of habitats is provided by legislative tools addressing land and water use. Two key biodiversity-related laws are:

- The 1963 National Parks, Nature Reserves, National Sites and Memorial Sites Law (revised in 1998 and last amended in 2010) is the fundamental statute regarding protection of nature and biodiversity. It sets out systems for the establishment of nature reserves and national parks and for listing protected natural assets (MoEP, 2008).
- The 1955 Wildlife Protection Law defines protected wildlife as any animal that has not been designated as a "pest" or "game". It requires a license for game hunting or for the extermination of pests, and prohibits hunting of protected species except by special permit and for specific purposes as listed in the law. The Wildlife Protection Law is also Israel's implementation tool for the Convention on International Trade in Endangered Species (CITES), and thus prohibits trading, possessing or transporting protected species without a permit (MoEP, 2008).

Other legal instruments related to biodiversity conservation are integrated into a wide variety of laws dealing with land, forests, water sources, and the marine and coastal environment. The most relevant of these are: the 1926 Forests Ordinance for the protection of

forests and other tree species; the 1956 Plant Protection Law regulating the use of pesticides and fertilisers in order to prevent plant-threatening pests; the 1965 Streams and Springs Authority Law that mandates the protection of the landscape and biological diversity within streams and springs; the 1937 Fishing Ordinance (Section 4.4); the marine pollution prevention legislation prohibiting pollution of the marine environment, inclusive of its biological diversity, by oil, waste dumping and discharge of pollutants from land-based sources (Chapter 3); and the 2004 Protection of the Coastal Environment Law that aims to protect the coastal environment and its natural and heritage values and to manage, develop and use the coastal environment in a sustainable manner. In addition, the 1959 Water Law establishes the framework for the control and protection of Israel's water resources. A 2004 amendment to this law allows the allocation of water explicitly for nature and landscape assets. A government decision in 2000 allocated 50 million m^3 per year of water to nature, raised in 2010 to 60 million m^3 per year (including 10 million m^3 of potable water) (Chapter 4).

Biodiversity legislation suffers from two main limitations. First, the National Parks and Nature Reserves Law and the Wildlife Protection Law aim at "nature protection", which is similar but not identical to "biodiversity conservation and management". Hence, these laws provide solutions for individual species rather than for biodiversity and ecosystems under threat. Similarly, other relevant legal instruments do not explicitly address biodiversity, but are directed at physical components such as land and water for human use, which are usually not associated with the functionality of biodiversity in the provision of human needs.

The second limitation is that existing legislation imposes restrictions and bans on actions that constitute "threats" to biodiversity rather than obligating authorities to initiate actions. Such actions could include government programmes for protecting ecosystems and their biodiversity, or mechanisms for granting "endangered" legal status to threatened species, ecosystems and their services, all within the framework of a consolidated and comprehensive national biodiversity policy (MoEP, 2008, 2009, 2010a). The decade-long efforts to develop the NBS were largely concerned with acknowledging these limitations and developing a new policy framework so that they could be addressed.

3.2. Protected areas and forests

Protected areas (nature reserves, national parks and forests) have traditionally played a central part in Israel's biodiversity policy. The national parks legislation created mechanisms for the establishment of both nature reserves and national parks and for listing protected natural assets. While nature reserves are predominantly concerned with the conservation of nature, national parks are primarily dedicated to the conservation of heritage and archaeology. However, national parks play an important role in protecting the country's natural landscapes from rapidly encroaching urbanisation. In 2008, Israel had 218 officially declared nature reserves covering about 20% of total area and 74 national parks, accounting for nearly 1% of total area (Table 5.2). The remainder, out of a total of 464 nature reserves and 147 national parks, are in various stages of planning.

The number of protected areas is constantly increasing, as is their extent (around 31% of the country's total area). Although they do not adequately represent Israel's diversity of habitats (most of them protect desert habitats), the representation of ecosystems is expanding. Currently, none of Israel's nature reserves is large enough to preserve entire ecosystems. The small surface area of most nature reserves and the lack of buffer zones around them leave them vulnerable to human activity. Efforts are being made to address this form of fragmentation through the declaration of Biosphere Reserves.[2]

Table 5.2. **Nature reserves and national parks in Israel, 2008**

Status	Number	Total area (km^2)	% of total area (22 070 km^2)
Nature reserves			
Declared	218	4 280	19.4
Under statutory process	81	966	4.4
Proposed	178	1 724	7.8
Total	464	6 582	29.8
National parks			
Declared	74	201	0.9
Under statutory process	34	33	0.1
Proposed	44	68	0.3
Total	147	286	1.3
Grand total	611	6 867	31.1

Source: MoEP.

StatLink http://dx.doi.org/10.1787/888932495912

Forests are another category of protected area, with around 530 km^2 protected by the 1926 Forestry Ordinance. The 1995 National Master Plan for Forests and Afforestation (TMA 22) protects about 1 620 km^2 of forests and open spaces designated as such (Section 4.3).

3.3. Protection and management of species

Israel has implemented several programmes for the reintroduction and reinforcement of endangered species, including raptors and sea turtles. A special programme for the conservation of rare and endangered plant species on a national scale is currently being prepared by a professional team led by the National Parks Authority (NPA).

Ex situ management of species is carried out by the Israel Gene Bank (IGB). The IGB is a national body responsible for the collection, preservation and evaluation of indigenous plant species, with the aim of preserving plant genetic resources and the endangered genetic variability of Israel's flora. A few additional small, targeted *ex situ* collections are located in other research institutes. Efforts are being made to conserve both natural and agricultural biodiversity, applying conservation not only to species related to agriculture but also to other endangered or rare wild native species. In parallel, country-wide collections of the most important wild relatives of crop plants are being made, irrespective of any immediate danger they may face. This is necessary for an adequate representation of these species in the seedbank (MoEP, 2008, 2010a).

There are several botanic gardens countrywide. The largest and most active are at the Hebrew University of Jerusalem and Tel Aviv University. They serve as refuges and produce seeds and seedlings for specific reintroductions or reinforcements, as well as for storage in the IGB. The purpose of the 2006 botanic gardens law is to support and strengthen these gardens, and to allocate financial resources for their activities. About 15 botanic gardens currently qualify for this support.

Israel's zoological gardens and special wildlife centres help promote wildlife conservation by aiding *ex situ* breeding and reintroduction programmes, treating injured wild animals and releasing them back to nature, and promoting public awareness. Important zoological and wildlife centres include the zoological garden at Tel Aviv University and the Israeli Center for Wildlife Rehabilitation at the Zoological Center of

Ramat-Gan. In 2007, the Center treated 1 169 injured terrestrial vertebrates, mainly birds (88%) (MoEP, 2008, 2010a).

The MoEP and the NPA are setting up a national-level mechanism and protocol to handle invasive species that threaten biodiversity. Cases also involving hazards to human health and well-being require more co-ordinated efforts and are treated by the MoEP in co-operation with the NPA and other ministries, including the Ministry of Agriculture and Rural Development and the Ministry of Health. Efforts to limit several outbreaks have included monitoring, awareness-raising initiatives, and targeted treatment and eradication of invasive species.

3.4. Economic instruments

Economic principles for the conservation and sustainable use of biodiversity have been endorsed and accepted in Israel's biodiversity policy framework. They are reflected in Israel's guiding principles for sustainable development and are an important part of the National Biodiversity Strategy (NBS). The latter contains an entire chapter dedicated to the economic aspects of biodiversity conservation and acknowledges the economic perspective that biodiversity is an input for the production of ecosystem services (Section 2). Further, the NBS acknowledges the importance of cost-benefit analysis as a means to prioritise biodiversity policies as well as to assess the relative net benefits of alternative biodiversity policies. The NBS accepts the validity and usefulness of non-market valuation techniques, as it also acknowledges that biodiversity has a public good dimension and hence cannot be valued by market prices alone.

The NBS fully endorses the need to use economic instruments, both as a means to control environmental externalities and as a vehicle to provide incentives for the sustainable utilisation of biodiversity resources. Support for economic instruments (*e.g.* taxes, charges, fees and tradable quotas) in the NBS is mostly based on the potential cost-efficiency gains of internalising externalities (as compared to command and control regulation). Additional arguments could be used to justify the use of economic instruments, related to their dynamic long-term benefits (OECD, 2011).[3]

The NBS guidelines for using economic instruments are broadly in line with those described for other OECD countries in their Environmental Performance Reviews (OECD, 2009), with other national biodiversity strategy documents (Emerton, 2001), and with the OECD's *Green Growth and Biodiversity* report (OECD, 2011). While Israel has started to implement economic incentives in order to achieve environmental goals, *e.g.* in the water, waste, energy and transport sectors (Chapters 4, 6 and 7), the application of such approaches to biodiversity policy is lagging. Israel has a two-year timeframe (ending in 2011) to implement the OECD Recommendation on the Use of Economic Instruments in Promoting the Conservation and Sustainable Use of Biodiversity.

A major review and assessment of economic instruments and economic assessment tools will be part of the NBS's implementation (MoEP, 2009, 2010a). A policy aim of the NBS is to develop economic tools specifically for biodiversity conservation and sustainable use. In particular, biodiversity-related economic policy measures being contemplated include:

- The use of agri-environmental schemes that will pay farmers to change their agricultural practices in order to provide specific biodiversity-related ecosystem services. Various options for allocating such contracts are under consideration, including auctioning (Section 4).

- The development of markets for biodiversity conservation and sustainable use. Some of these, such as ecotourism, have already been developed while others are being considered (*e.g.* markets for certified biodiversity-friendly agricultural products).
- Levies, fees and fines. For example, the introduction of coastal and marine protection charges is being considered. The proposed levy for the protection of the coastal environment would be imposed on owners or operators of coastal facilities which damage this environment. The proposed marine charge would be paid by marine installations that have adverse effects on sediment transport along the shore. A fund for the protection of the natural landscape was established in 2010 and will be managed by the Israel Land Authority. Changes in land zoning will be subject to a fee to be paid to that fund. The fund will finance, among others, the protection of biodiversity and ecological systems.

There is further scope to apply economic instruments for biodiversity conservation. This should be complemented by systematic evaluations of the relative impacts of these policies on biodiversity. Moreover, the use of biodiversity offset market schemes (either for species or habitat restoration) could also be explored. Such schemes can be implemented through regulation or voluntary initiatives. They require developers that damage a habitat or ecosystem to buy a conservation or restoration "credit" that compensates for or offsets that loss elsewhere. Such schemes are being applied more widely in other OECD countries in contexts where there are strong economic development-biodiversity trade-offs. Regulatory approaches include wetland and conservation banking in the United States, the "no net loss of fisheries habitat" scheme in Canada, and the "green offsets" programme in New South Wales, Australia (Ten Kate *et al.*, 2004). The Business and Biodiversity Offsets Programme is a good example of a voluntary initiative (BBOP, 2009).

3.5. Public expenditure on biodiversity

Public expenditure on the protection and rehabilitation of space and habitats, and the protection of natural and semi-natural landscapes, dwarfs expenditure on other areas of environmental protection, at around 80% of public sector expenditure (excluding public service producers) (Chapter 1). This figure has remained roughly constant throughout the past decade.

Fiscal and monetary policy instruments endorsed by the NBS include public procurement and green national accounting. Work is being carried out on the greening of national accounting, although this is still in its early stages. Since 2009 environmental criteria have been included in the public procurement of several products and services (Chapter 1). There is scope to use public procurement for government agencies, hospitals, schools and the military as a vehicle for biodiversity conservation by introducing criteria, in tenders, concerning the degree to which the goods procured are consistent with biodiversity conservation objectives (*e.g.* biodiversity-friendly paper or food).

3.6. Monitoring, evaluation and information

Israel has made significant progress during the last two decades in establishing monitoring mechanisms, as well as information tools and mechanisms. It has set up more narrowly focused monitoring systems and developed more integrated and overarching biodiversity monitoring mechanisms.

In particular, the Israeli Long Term Ecological Research Network (LTER) has been established under the auspices of the Israel Academy of Sciences. The purpose of this consortium is to co-ordinate and promote long-term monitoring of the state of ecosystems and their biodiversity, and to link scientific knowledge and ecosystem management. A national monitoring programme for biodiversity in Israel (MARAG) was also completed in 2010. The Red Book of vertebrates has been published and updated periodically, and the Red Book of flora has been compiled with data collected from a 12-year monitoring field survey of Israel's botanic heritage. The survey was conducted by the Rotem Israel Plant Information Center, which developed an ecological database of Israel's flora including some 600 000 records concerning the distribution and phenology of native plants. The Hebrew University of Jerusalem is currently developing BioGIS, an effort to create a spatially referenced, comprehensive, internet-based biodiversity information system for Israel's fauna and flora. The MoEP has produced an online system of open space sensitivity maps that classify and characterise open spaces according to sensitivity and value criteria. The criteria include vulnerability, continuity and functionality. During the last few years, Israel has also participated in several important EU-led multinational projects for mapping and monitoring habitats, such as the EBONE project, whose main objective is to establish a pan-European biodiversity monitoring mechanism.[4]

These monitoring efforts and initiatives should be continued and further supported, so that biodiversity knowledge gaps can be addressed. The NBS has identified additional indicators that need to be developed in order to better support policy making, such as those for "functional biodiversity" (*e.g.* indicators of soil diversity).

A considerable number of research studies have been conducted on the benefits of ecosystem services in Israel, especially in the areas of countryside recreation, valuation of landscapes and charismatic species, and the valuation of irreparable damage to biodiversity. Yet it is unclear how or whether these studies (and estimates of the benefits of biodiversity) have been used to formulate and evaluate policies. Steps need to be taken to evaluate biodiversity resources, so as to integrate biodiversity considerations into decision making processes. This could be accomplished as part of Israel's National Ecosystem Assessment exercise (NEA), which is currently in the early planning stages. The NEA, similarly to the National Ecosystem Assessment (NEA) in the United Kingdom,[5] aims to provide a more coherent and unified baseline indication of the status and value of Israel's biodiversity. Israel's NEA will also provide projections of biodiversity trends based on various scenarios (*e.g.* business-as-usual, a "green growth" scenario) which are currently unavailable.

3.7. Educational initiatives

Educational and public-awareness programmes on the importance of biodiversity are largely promoted by the Nature and Parks Authority (NPA) and NGOs, foremost among which is the Society for the Protection of Nature in Israel (SPNI). Through its educational trips, courses, training programmes, public campaigns and publications, the SPNI reaches hundreds of thousands of children, young people and adults. The MoEP website also performs important educational work by providing geographical information and interactive maps showing the locations of nature reserves, national parks, blooming plant sites and endangered species (vertebrates) as well as comprehensive information on invasive species and biodiversity in general. Other notable educational initiatives include the "Nature Campus", an online portal established by Tel Aviv University to promote education on biodiversity, and plans to establish a unified national museum containing

both botanic and zoological taxonomic collections, which would bring together collections dispersed in different universities in Israel.

4. Mainstreaming biodiversity into other sectors/policy areas

Mainstreaming or integrating biodiversity into other policy areas is one of the pillars of the NBS. It is to be achieved primarily through the national land use planning framework, and secondarily by means of interventions in key sectors such as agriculture, forestry and fishing. Sectoral interventions include pro-active measures promoting biodiversity conservation (*e.g.* sustainable agriculture, ecotourism), as well as corrective measures that eliminate perverse incentives that are detrimental to biodiversity (*e.g.* removal of certain agricultural support programmes). Mainstreaming biodiversity into other policy sectors also requires looking into synergies and possible trade-offs (*e.g.* between biodiversity and food production, or biodiversity and climate change policies), as well as integrating biodiversity policy with equity objectives.

4.1. *Israel's national planning framework and biodiversity*

One of Israel's unique features is that land is publicly owned. How it may be used is determined by the national land use planning policy. Within this framework, a relatively high share of the total land area has been designated as protected. In addition, extensive areas that are used for military training remain virtually unexploited, thereby contributing to the conservation of natural habitats. To address the conflicts between the need for development on the one hand, and the need to preserve landscapes and ecosystems on the other, a series of new land use planning initiatives was devised in the 1990s and integrated into a non-statutory strategic master plan complemented by sectoral National Master Plans. The Comprehensive National Master Plan for Building, Development and Conservation, an overarching outline plan affecting biodiversity conservation, was approved in 2005. It establishes guidelines for the development of conservation worthy areas, including coastal areas. It also gives protection to landscape ensembles and to coastal, river and landscape strips (MoEP, 2008, 2010a) (Box 2.4). Key sectoral national plans include: the National Master Plan for Forests and Afforestation; the National Master Plan for National Parks, Nature Reserves and Landscape Reserves; the National Master Plan for Coastal Areas; and the National Master Plan for Rivers and Drainage.

In addition, recently updated guidelines for landscape and environmental planning, published by the Israeli National Road Company, are aimed at addressing fragmentation and barriers caused by infrastructure.[6]

Israel now requires environmental impact assessments (EIAs) to be carried out for all major development projects and investments, with the explicit requirement to account for the impact of development plans on biodiversity (Chapter 2). Revised EIA regulations, which came into effect in 2003, expand the possibility to require EIAs for proposed development in environmentally sensitive areas such as coasts, riverbanks and stream corridors (MoEP, 2008). Most EIAs consider species and habitat diversity, endangered species, and connectivity issues (*i.e.* with regard to ecological corridors). However, the terms of reference (ToRs) of EIAs only occasionally consider impacts on biodiversity directly, and EIAs seldom incorporate estimates of new development projects' biodiversity costs and benefits.

4.2. Mainstreaming biodiversity into agriculture

Agricultural practices in Israel are more environment-friendly than in the past, but there is as yet no integrated policy for farmland's biodiversity conservation and sustainable use. In 2002, the Ministry of Agriculture and Rural Development prepared a plan for sustainable agricultural development (PSAD). In addition to measures concerning the use of treated wastewater in agriculture and reforms with regard to livestock, it included others concerning the maintenance of open landscape for sustainable grazing.

Israel is developing a number of agri-enviromental schemes aimed at providing farmers with incentives to deliver biodiversity-related ecosystem sevices. For example, a two-year pilot project under way pays farmers through an auction system to maintain farmland for biodiversity conservation. A similar scheme related to grazing is mainly implemented in areas for which there is no alternative agricultural use. From 2004, this scheme provides a per-hectare grazing payment, taking into account livestock density relative to land vegetation cover, with the regions of Israel divided into four categories according to pasture richness. Herd owners must follow appropriate production practices and environmental criteria. The area covered by this scheme amounted to about 60% of total agricultural land area in 2008. Preliminary research suggests that such managed grazing regimes have helped support floral diversity (OECD, 2010).

The reform of the livestock sector, and integrated pest management (IPM) programmes, have also reduced environmental pressures from excess applications of nutrients and pesticides (OECD, 2010). Considerable attention has been given to biological pest management, for example in a project started in 2007 that uses barn owls and kestrels as biological pest control agents (OECD, 2010).

There are programmes to support farmers who have suffered losses of yields in fish ponds impacted by migratory birds. Agriculture is also subject to other forms of damage and losses from wildlife, such as damage to irrigation equipment by mammals and birds and losses to field crops and orchards due to small rodents and birds. In addition to support for some losses, farm advisory, bio-control, IPM and other approaches are used to address these wildlife-agriculture conflicts (OECD, 2010).

4.3. Mainstreaming biodiversity into forestry

The 1926 Forestry Ordinance remains the basis for current formal afforestation policy in Israel. Although the act is still in force, afforestation policy is largely implemented under the guidelines included in the 1995 National Master Plan for Forests and Afforestation (TMA 22), under which about 1 620 km^2 of forest and open spaces is protected (Table 5.3).

Forest management in Israel is carried out by the Jewish National Fund (JNF), an NGO that currently manages about 1 000 km^2, largely in areas with a semi-arid climate and rocky, hilly terrain unsuitable for agriculture where there is a high risk of land degradation. Afforested areas are used for tourism, pastureland and wood supply, as well as providing other general ecosystem services and contributing to the water budget and stream restoration. Israel is one of the few countries in the world that has more trees today than it did 100 years ago (MoEP, 2010a). Figure 5.2 shows trends in new and regeneration planting areas during the last 11 years.

Early afforestation efforts in Israel have been criticised for not creating functional ecosystems that support endemic species and conserve biodiversity. Yet Israel's afforestation programme has gradually changed its orientation towards increased

Table 5.3. **Existing and proposed forest area under the National Master Plan for Forests and Afforestation**

	Type	Area (km^2)
Existing forest area		
	Existing planted forests	536
	Recommended planted forests	142
	Existing forest parks	75
Proposed forest area		
	Recommended forest parks	181
	Fostering natural woodlands	176
	Natural woodlands for preservation	428
	Coastal forest parks	44
	Riverside/dry stream plantings	39
Total		1 621

Source: MoEP.

StatLink http://dx.doi.org/10.1787/888932495931

consideration of biodiversity. In the past decade there has been a shift in the direction of ecologically oriented forest management, with a growing emphasis on fostering woodland biodiversity. Conifer-dominated forestry has changed to mixed woodland management, allowing the regeneration of wild tree and shrub species, their penetration into carefully managed areas, and increasing biodiversity in these areas. About 55% of afforestation areas are to remain as open space, with natural woodlands contributing to soil fertility and in many cases serving as sanctuaries for protected wildlife.

4.4. *Mainstreaming biodiversity into fishing*

Israel's marine fish catch comes principally from the Mediterranean Sea. Total production from the marine environment is small and steadily declining, partly due to the relative impoverishment of fish stocks in the eastern Mediterranean. The bulk of Israel's fish production comes from aquaculture and mariculture (Chapter 3). The 1937 Fishing Ordinance regulates the use of fisheries, so that it is sustainable, fish stocks are not depleted, and the wider aquatic environment is protected against fishing-related externalities (*e.g.* pollution and the death of sea turtles). Fishing is overseen by the Ministry of Agriculture and Rural Development.

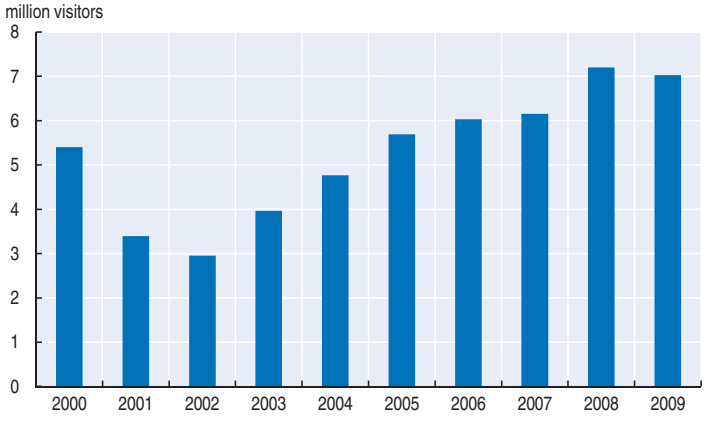
During the past two decades, measures have been taken to protect fish stocks and aquatic biodiversity in the Red Sea. In 2008, all fish cages in the Gulf of Eilat/Aqaba were dismantled and mariculture in the Red Sea ceased due to concern about impacts on the vulnerable reef complex, a major tourism attraction (Chapter 3). However, few effective protective measures have been taken with regard to the Mediterranean or Lake Kinneret. In 2000, the Ministry of Agriculture and Rural Development concluded that the capture fishing industry in the Mediterranean had reached exploitation limits for most species. More recently, some important initiatives have been taken. They include: a cap on the size of the fishing fleet; mesh size restrictions; gear modifications; prohibition of scuba diving; relocation of inshore fishing efforts to deep sea areas; seasonal fishing restrictions or temporary outright fishing bans (*e.g.* a ban on fishing in Lake Kinneret in the period 2010-12); doubling the minimum depth allowed for fishing with trawlers; and online monitoring of trawlers. Evidence suggests that the implementation of these policy measures is still

unsatisfactory in practice. Some members of Israel's scientific and environmental communities, and of the general public, have raised concerns that fishing off the country's coasts is endangering other living marine resources, including marine mammals (Chapter 3). Most of these initiatives constitute command and control approaches. The use of economic instruments (notably schemes for tradable fishing permits) has not been pursued but deserves further consideration.

4.5. *Mainstreaming biodiversity into tourism*

Tourism is one of the most important sectors of the Israeli economy, with 45 million tourist arrivals in 2010. There is significant potential to utilise Israel's natural resources for ecotourism, both as a source of growth and a means of sustainably managing ecosystems. The main destinations for developing this niche tourism market are nature reserves and other protected areas. Tourism activities in protected areas are overseen by the Society for the Protection of Nature in Israel (SPNI). The number of visitors to NPA nature reserves showed an increasing and stable trend over the decade, with over 7 million visitors in 2009 (Figure 5.4).

Figure 5.4. **Visitors to NPA nature reserves, 2000-09**



Source: NPA.

StatLink http://dx.doi.org/10.1787/888932495399

A challenge that must be addressed with regard to nature reserve ecotourism is how to optimally price the entry to reserves and other related services. This, in turn, rests on determining the optimal carrying capacity of each reserve so that profits can be maximised while biodiversity is protected. An assessment of the carrying capacity levels in Israel's protected areas should be prepared (Box 5.4).

Beyond protected areas, planted forests, overseen by the Jewish National Fund (JNF), have gradually become a main local tourism attraction. They include hiking trails, camping areas, and areas for sports and recreation activities. Forests adjacent to nature reserves attract visitors and consequently help lower visitor pressure on nature reserves.

The development of ecotourism will require mobilising and promoting the use of private resources. Some notable private initiatives exist, such as Eco and Sustainable Tourism Israel, a non-profit organisation established in 2006 to promote sustainability and ecotourism awareness and implementation. It is part of the international Global Sustainable Tourism Criteria (GSTC) initiative.

Box 5.4. **Ecotourism and carrying capacity in Israel**

The Hula Agmon pond, located in the Rift Valley, is a critical migratory stopover and wintering site for more than 500 million birds belonging to over 390 species, including 21 globally threatened species and 16 nationally threatened ones. The nature area, opened in 2004, has witnessed a sharp increase in the number of visitors, from 78 000 in 2004 to 240 000 in 2008.

Several studies have been conducted to monitor and assess the impacts of tourism on bird populations. They have examined the impact of tourist demand, tourism development trends and management on birds, and how management policies can alleviate negative tourist-bird impacts and enhance real ecotourism. One finding was that for every 20 visitors, birds tend to retreat by 27 metres. This led to the development of sustainability guidelines concerning visitor load regulation, fencing, appropriate signposting and the positioning of telescopes. Further research could help establish visitor volumes that are consistent with maintaining optimal numbers of various species.

Source: MoEP (2009, 2010a).

4.6. Mainstreaming biodiversity into climate change mitigation and adaptation

There is considerable scope for mainstreaming biodiversity concerns into climate change mitigation and adaptation measures. One of the pillars of Israel's mitigation efforts is the development of new renewable energy sources. There is potential for conflict with solar parks and wind farms, in that the land they occupy could contribute to habitat fragmentation. This problem might be mitigated by producing these types of energy off-shore or by using existing structures (*e.g.* for the installation of solar panels).

Afforestation efforts in Israel, led by the Jewish National Fund, entail considerable synergies with climate change mitigation and adaptation. The JNF is examining ways to plant trees that are resistant to dry conditions and to introduce genetic improvements of plant species so that they can cope with high temperatures and water stress. Such actions could help respond to the potential northward expansion of the desert (MoEP, 2010b).

Israel has taken steps to develop its National Climate Adaptation Plan. Several adaptation actions being contemplated for sectors affected by climate change could have either positive or negative impacts on biodiversity. For example, in the case of agriculture the suggested actions of expanding the crop varieties used, developing substitutes for grains in animal feed, and better water management would all benefit biodiversity directly or indirectly. However, other suggested actions (*e.g.* increased use of treated effluents and the introduction of genetic improvements to crops and farm animals) could erode biodiversity. Likewise, adaptation actions taken in relation to coastal zone defence, such as specific forms of coastal infrastructure and the use of sea protection and sand nourishment techniques, could negatively impact biodiversity. Such trade-offs and concerns should be reflected in the final National Adaptation Plan.

4.7. Distributional issues

Biodiversity considerations are not generally integrated into poverty reduction strategies, as the issue of the economic dependence of low-income sectors on biodiversity is generally irrelevant in the case of Israel. Most poverty reduction efforts are targeted at urban populations and are not necessarily related to agriculture or to natural resources. Yet

biodiversity considerations are linked to equity issues, as part of the discussion on resource availability (mainly related to drinking water availability, access to marine and inland coasts, and the availability and accessibility of natural areas to socially deprived sectors for recreation) (MoEP, 2009). More progress needs to be made in including participatory and institutional approaches that address equity issues in the National Biodiversity Strategy framework.

Notes

1. The NPBB is made up of 32 representatives, one-third of whom represent the government, one-third local government and the other third academia and NGOs.
2. For example, Mount Carmel was declared a Biosphere Reserve in April 1996, within the framework of UNESCO's Man and the Biosphere Programme. Other areas considered appropriate to be declared biosphere reserves include Mount Meron in northern Israel and the Judean Hills area in the transition zone between the Mediterranean Sea and the desert biome.
3. These include the double dividend benefits that can be derived from instruments such as green taxes, and the benefits emerging from the added innovation and entrepreneurship that economic instruments stimulate (*e.g.* providing growth and employment opportunities, as well as improving international competitiveness through first-mover advantages).
4. European Biodiversity Observation Network (EBONE) (*www.ebone.wur.nl/uk*).
5. The National Ecosystem Assessment (NEA) is a systematic attempt to assess the value of ecosystem services that stem from biodiversity over a 100-year period (1950-2050) (*http://uknea.unep-wcmc.org*).
6. For example, by requiring the construction of animal passages below and above roads, and through the implementation of ecological considerations in planning, rehabilitation and management of road verges and other areas affected by road construction (*www.ecotourism.org.il*).

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PART II

Chapter 6

Climate change and air quality

Rapid demographic and economic growth, and the resulting increase in energy and transport demands, are the main factors underlying an increase in greenhouse gas (GHG) emissions. While emissions of air pollutants have declined, air pollution hotspots remain at industrial sites and in major urban areas. The adoption of the Clean Air Law and of a national plan for reducing GHG emissions by 20% by 2020 represent major steps towards addressing these challenges. This chapter reviews these policy initiatives, the institutional framework and the mechanisms in place to monitor implementation. The energy and transport sectors are the major sources of emissions of GHG and air pollutants. The chapter assesses the policy measures implemented in these sectors, including those to promote renewables, energy efficiency and transport modes other than road transport. The opportunity of introducing economy-wide policy instruments such as a carbon tax is also discussed.

Assessment and recommendations

Between 2000 and 2008, Israel's greenhouse gas (GHG) emissions grew by about 5%, mainly due to rapid population and economic growth and the associated increase in energy demand, particularly that of electricity. However, the emission and energy intensities of the economy are close to the OECD average, while the energy supply remains more carbon-intensive than in most OECD countries. This is largely because electricity is generated entirely within Israel, using almost exclusively fossil fuels. Historically, coal and oil have dominated this mix. The discovery of off-shore gas and its progressive use for electricity generation since the mid-2000s have helped mitigate the increase in GHG emissions and contributed to a decrease in emissions of some air pollutants. GHG emissions are expected to continue increasing as a result of rapid economic growth. Some estimates suggest that, under business-as-usual assumptions, they will double by 2030 compared to the 2005 level.

Since it is not a party to Annex I of the United Nations Framework Convention on Climate Change, Israel is not committed to a binding GHG emissions reduction target under the Kyoto Protocol for the period 2008-12. Perhaps as a result, it has made a relatively late start in formulating a climate change mitigation policy. For much of the 2000s its approach was piecemeal. However, in 2009 it set the target of reducing GHG emissions by 20% by 2020 compared with a business-as-usual scenario. This was a positive step forward, although reaching the goal will entail a further increase in GHG emissions. While a national action plan for reducing GHG emissions was prepared, some uncertainty remains concerning the definition of both the target and the strategy to meet it, which may compromise their effectiveness in guiding and motivating implementation. Not only is the target defined against a business-as-usual scenario rather than in absolute terms, but it is not anchored in legislation. While the contribution of the electricity sector to the achievement of the target is reasonably clear, this is not the case for other sectors. An inter-ministerial committee, chaired by the Ministry of Finance, was established to oversee the implementation of the action plan and identify additional measures needed to achieve the GHG emissions reduction target. However, a more open and independent oversight mechanism could provide a broader basis for discussing the policy adjustments that may be needed to achieve this target. There is also room for improving data collection and reporting of GHG emissions trends to support decision making.

The main GHG emissions reduction measures are being developed at the sector level. According to the authorities' current plans, mitigation measures in the electricity sector will account for most of the targeted emissions reductions. As regards energy efficiency, there have been few effective initiatives over the review period. Hence, the National Energy Efficiency Programme, adopted in 2010, marks an important step; it aims to achieve a 20% reduction in projected electricity consumption by 2020. The main implementation instrument, the Energy Efficiency Fund, will need to be carefully designed to meet this objective. Opportunities exist to improve the energy performance of buildings through better performance standards and provision of information to households.

For many years, Israel has promoted solar water heating, which now accounts for 80% of all water heating requirements. However, renewable energy sources account for only a minor share of electricity production, well below Israel's objectives. The implementation of feed-in tariffs and production quotas has improved performance considerably. A number of obstacles need to be addressed if the goal of supplying 10% of electricity with renewable energy by 2020 is to be achieved. In particular, a variety of financial incentives are being used to support the use of renewables (with potential overlaps), while land use re-zoning and permitting procedures are complex and time-consuming.

Transport demand and private car ownership increased considerably in the 2000s. As in many other OECD countries, transport is a major source of GHG and air pollutant emissions. A number of measures have been introduced to reduce emissions from transport. Among them are the adoption of European standards for imported vehicles, fuel quality and vehicle tests. In 2009, the vehicle purchase tax, which has long been an important source of tax revenue, was restructured and is now linked to emissions of CO_2 and local air pollutants. As a result, the average emission performance of new vehicles has improved, especially with regard to emissions of local air pollutants such as nitrogen oxides (NO_X) and particulates. Nevertheless, the carbon efficiency of new cars is still well below the EU average. The introduction of an electronic toll system on the main highway to Tel Aviv is a positive step. If successful in reducing congestion and emissions, it provides a basis for considering the extension of road pricing to other congested motorway stretches and to metropolitan areas. Nevertheless, there is scope to improve the economic incentives to car use. Further efforts are also needed to integrate transport and land use planning and to improve alternatives to private car use.

Many measures to reduce GHG emissions would also help reduce emissions of the main air pollutants, and *vice versa*. Although emission intensities of sulphur and nitrogen oxides (SO_X and NO_X) have decreased since 2000, mostly due to the switch to natural gas and improved fuel quality, they remain above the respective OECD averages. Overall emissions of major air pollutants tended to decrease or stabilise during the 2000s, but there are still air pollution hotspots at industrial sites. Ambient air concentrations of NO_X, PM_{10} and ozone continue to exceed limit values in major metropolitan areas, mainly due to heavy transport pressures. The implementation of the Clean Air Law from 2011 represents a major step towards consolidating the regulatory framework for air pollution from both stationary and mobile sources. In addition, the Law creates a legal basis for imposing air emissions levies on large industrial facilities requiring an emission permit. The air quality monitoring network is among the densest in the world and data are made widely available to the public. However, lack of uniformity in data control among the different monitoring bodies may hinder data reliability.

Recommendations

- Consider expressing the target for reducing GHG emissions by 2020 in absolute terms and making it legally binding; fully integrate climate, environmental and health considerations into the government's long-term energy and transport policies.
- Set up a system to monitor the implementation of GHG emissions reduction measures; provide an annual assessment to the *Knesset* on progress in achieving targets, preferably by an independent body, and periodically (*e.g.* every three years) propose recommendations to adjust policy measures.
- Consider introducing an economy-wide carbon tax, or adjusted excise duties on fossil fuels, to reflect an appropriate carbon price.
- Rationalise the financial incentives for renewable energy projects, taking account of the full range of costs and benefits of renewables; provide consistent guidelines on the types of land used for, and the conditions that apply to, such projects; streamline the associated planning and permitting processes.
- Ensure that the Energy Efficiency Fund targets projects that are justified environmentally and economically by: establishing appropriate criteria for identifying eligible projects; applying instruments to provide targeted support and to leverage other resources; and establishing an independent mechanism to assess progress.
- Introduce mandatory minimum energy performance standards for buildings, and ensure that information on building energy performance is available to consumers.
- Better integrate transport and land use planning; further develop public transport networks; improve the integration of public transport services and networks.
- Extend the use of road tolls on congested motorway stretches and consider introducing congestion or pollution charges in major metropolitan areas.
- Using the legal basis provided by the Clean Air Law, introduce an air emissions levy targeting priority pollutants emitted by large and medium stationary sources.
- Building on the voluntary emissions reporting scheme, establish a mandatory Pollutant Release and Transfer Register that includes GHG emissions; strengthen data quality control across the various ambient air quality monitoring networks.

1. Introduction

Israel is a party to the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. However, as it is not a party to Annex I of the Protocol, it has no specific greenhouse gas (GHG) emissions reduction commitments in the period to 2012. Israel has increasingly taken on responsibilities commensurate with its status as a developed economy at international climate negotiations, as well as in its implementation of domestic climate policy. It is committed to reduce its GHG emissions by 20% compared to a business-as-usual (BAU) scenario in the period to 2020 (Section 3).

Israel is not a party to any regional or global conventions on transboundary air pollution, including the UNECE Convention on Long-range Transboundary Air Pollution and its eight protocols (Chapter 3). Therefore, unlike most OECD countries, it is not committed to any official national emissions targets for major air pollutants such as sulphur oxides (SO_X), nitrogen oxides (NO_X), particulate matter (PM) or volatile organic compounds (VOCs). Nonetheless, air quality has long been a priority in Israel's environmental policy. Several pieces of legislation have long regulated air emissions from

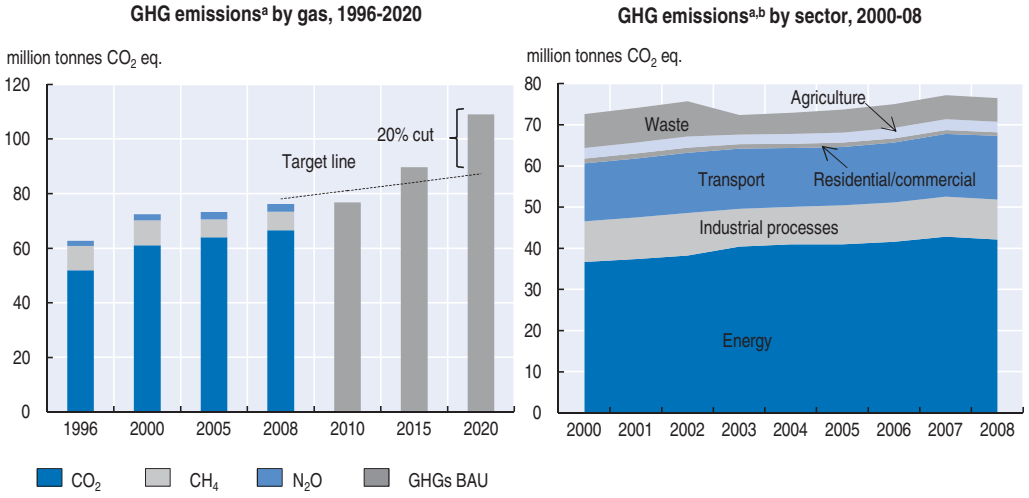
stationary and mobile sources, as well as establishing air quality standards. The approval of the Clean Air Law in 2008 is a major step forward: it is the first attempt to provide a comprehensive regulatory framework for air management policy, and can be used as a tool for future GHG emissions monitoring (Section 3).

2. Emissions performance and projections

2.1. Greenhouse gas emissions

Israel's GHG emissions have grown rapidly since the mid-1990s. Its emissions were 78 Mt CO_2 eq in 2008, including removals from land use, land use change and forestry (LULUCF) and emissions of "F gases", the latter accounting for 1.8 Mt CO_2 eq.[1] Carbon dioxide (CO_2) is the main greenhouse gas emitted, accounting for more than 85% of all emissions. Nearly 9% of emissions are methane (CH_4) and 3.6% are nitrous oxide (N_2O). "F gases" account for the remaining 2.3% (Figure 6.1).

Figure 6.1. **GHG emissions trends and projections**



a) Excluding F-gases.
b) Excluding emissions/removals of the land use, land use change and forestry sector.
Source: CBS (2011), *Statistical Abstract of Israel 2010*; MoEP (2010).

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Although GHG emissions (excluding removals from LULUCF and emissions of F gases) increased by nearly 16% between 1996 (the first year for which data are available) and 2000, a more moderate increase in emissions of about 5% was recorded between 2000 and 2008. Most of this increase in the 2000s occurred between 2003 and 2008, corresponding to an acceleration of growth in GDP. Rapid population and economic growth – and an associated increase in demand for energy, particularly electricity – are primarily responsible for the upward trend in emissions. Broken down by gas, CO_2 emissions increased by 9% in 2000-08 and N_2O emissions by nearly 26.5%, mostly due to emissions from agricultural soils, while CH_4 emissions fell by 26% due to increased collection of biogas from landfill and improved solid waste management.

According to Heifetz and Co. and DHV MED (2009), GHG emissions are projected to grow by 63% in the period 2000-25 under a business-as-usual scenario, reaching 118 Mt CO_2 eq

(MoEP, 2010). This projected increase would largely be due to increases in three major sub-sectors: energy industries (+49%), transport (+43%) and manufacturing and construction (+250%). According to McKinsey & Company (2009), if Israel's current GHG emissions growth trajectory continues, GHG emissions by 2030 will be twice as high as in 2005, reaching 142 Mt CO_2 eq in 2030. This growth exceeds that in other OECD countries, primarily due to Israel's large population and high level of economic growth.

CO_2 emission intensities

CO_2 emissions from fuel combustion per capita decreased only slightly during the review period. They were 8.6 t CO_2 eq in 2008, below the OECD average. CO_2 emissions per unit GDP (at purchasing power parity) have fallen consistently since 2000, albeit at a lower rate than in many other OECD countries. While the carbon intensity of Israel's economy is in line with the OECD average, it is still at the upper end of OECD countries (Figure 6.2). CO_2 emissions have increased less rapidly than total primary energy supply (TPES), mostly due to a change in the fuel mix in favour of natural gas. This has resulted in a decline in CO_2 emissions per unit of TPES. Nonetheless, Israel's energy supply remains more carbon intensive than that of most OECD countries, owing to its high dependence on oil and coal for electricity generation, the low share of renewables, and the absence of nuclear power (Section 5).

Emissions trends by sector

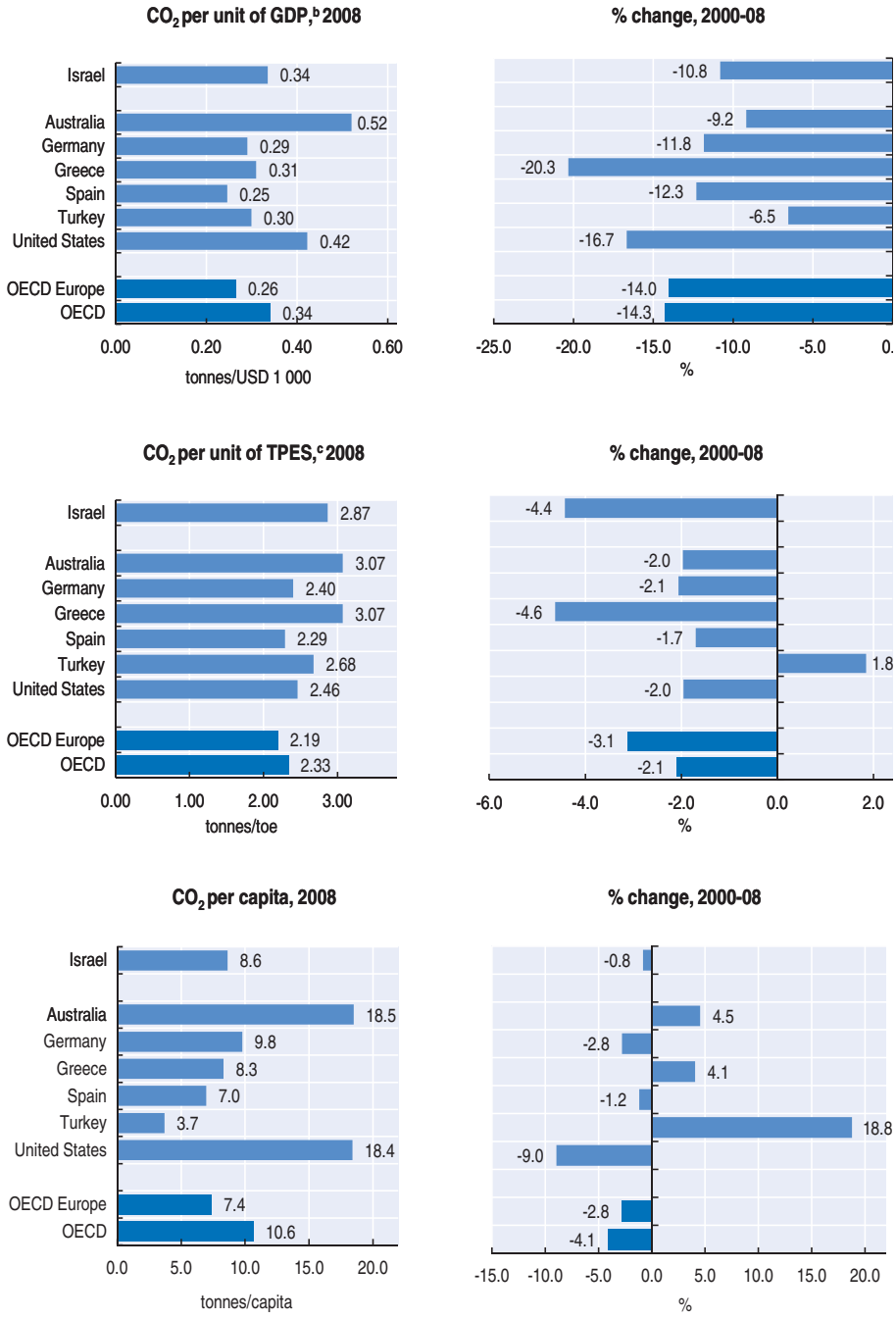
The energy industries (including both power generation and refining activities) are by far the largest sector from a GHG emissions perspective, accounting for more than 55% of Israel's total emissions.[2] Electricity production alone accounts for over half of GHG emissions. It increased dramatically between 2000 and 2008, by more than 30%. The upward trend in emissions from increased electricity generation has been offset to some degree by the integration of gas into the generation portfolio of the Israel Electric Corporation (IEC) (Section 5).

The transport sector, the second largest source of GHG emissions, was responsible for 15.5 Mt CO_2 eq of emissions in 2008, a 10% increase compared with 2000 levels and approximately 40% above 1996 levels.[3] Growth in transport sector emissions can be attributed to a significant increase in car ownership and in usage rates (Section 6).

Emissions from manufacturing industries, industrial processing and construction accounted for 9.74 Mt CO_2 eq in 2008, representing a slight decrease (2%) during the review period. An 11% decrease in direct emissions from fuel combustion (mostly of oil products) in manufacturing industries (including pharmaceuticals, electronics, agro-technology, telecommunications, fine chemicals and computers) between 2000 and 2008 was partly offset by a 6% increase in emissions from industrial processing, mostly arising from cement production. Cement production is the second largest source of CO_2 emissions after fuel combustion. On the other hand, electricity consumption by the industrial sector has increased, in parallel with the increase in industrial production. If indirect emissions arising from industrial electricity use and energy refining (both included in the energy industries) are included, emissions from the industry sector account for almost 30% of overall emissions.

Emissions from the residential and commercial sectors are relatively small, as electricity is the predominant energy source and emissions are therefore considered to

Figure 6.2. CO_2 emission intensities[a]



a) Includes CO_2 emissions from energy use only; excludes international marine and aviation bunkers; sectoral approach.
b) At 2005 prices and purchasing power parities.
c) Total primary energy supply.
Source: OECD-IEA (2010), *CO_2 Emissions from Fuel Combustion*; OECD (2010), *OECD Economic Outlook No. 88*; OECD-IEA (2010), *Energy Balances of OECD Countries Database*, OECD-IEA (2010), *Energy Balances of Non-OECD Countries Database.*

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come from the energy industries sector. This sector accounted for approximately 0.87 Mt CO_2 eq emissions in 2008, a fall of 29% during the review period.

Emissions from waste decreased by 30% between 2000 and 2008, a reduction in large part attributable to increased capture of methane from solid waste at landfills (Section 7). However, the contribution of waste to GHG emissions remains significant: it accounted 5.8 Mt CO_2 eq in 2008. This is due to high production of solid waste and to most waste being landfilled (Chapter 7).

Total emissions associated with agriculture were 2.6 Mt CO_2 eq in 2008. They remained broadly constant during the review period. N_2O is the dominant gas, arising mostly from agricultural soils, manure management and animal grazing. N_2O emissions have increased considerably since 2000, although this increase has been offset by a dramatic decrease in CO_2 emissions associated with agriculture.[4] In 2008, Israel's "Kyoto" forests sequestered 0.37 Mt CO_2 eq, an increase from 0.21 Mt CO_2 eq in 2000, owing to the continuous expansion of forested areas (Section 7).

Impacts of climate change

According to the findings of an inter-ministerial steering committee on Israel's vulnerability to climate change (Section 3.1), the average temperature is expected to rise by 1.5 °C by 2020 and by 3.5 to 5 °C in the years 2071-2100, compared with the years 1960-90. In addition, a 10% decrease in precipitation is expected by 2020, reaching a 20% decrease by 2050. This indicates a tendency towards a more arid climate, consistent with the 2010 Intergovernmental Panel on Climate Change (IPCC) forecasts (MoEP, 2010).

The impacts of climate change will also include: increased water demand (due to warming and increased evaporation); increased frequency of extreme events (heat or cold, floods); changes in crop yields; increases in agricultural pests, plant diseases and weeds; risk of damage to coastal infrastructures due to rising sea levels; morbidity and mortality due to heat waves, new disease vectors and increased risk of food-borne infectious diseases; increased energy demand arising from air conditioning and water desalination; changes in biodiversity, especially in the Mediterranean Sea; and an increased risk of forest fires.

2.2. Air emissions and air quality

As in many other countries, the main sources of air pollution in Israel are transport, electricity generation and industrial activities. Its high population density, the concentration of population and economic activities in coastal areas, and specific geographical and climate conditions tend to exacerbate the impacts of air pollution along the coast. While overall emissions of major air pollutants tended to decrease or stabilise during the 2000s, air pollution hotspots remain in Haifa Bay, the Ashdod area and Ramat Hovav.[5] Transport is the main source of pollution in the very densely populated centre of the country.

Sulphur dioxide

Power generation is the major source of emissions of sulphur oxides (SO_X) (Table 6.1). While GDP and fossil fuel supply grew considerably between 2000 and 2008, SO_X emissions decreased by about 35%. As a result, SO_X emission intensity also decreased considerably, although it remains well above the OECD average and is among the highest in the OECD (Figure 6.3). Major emission decreases occurred in power generation and in the industrial sector, mainly as a result of improvements in fuel quality (reduced sulphur content) and

Table 6.1. **Atmospheric emissions by source**

1 000 t

		SO_2	%	NO_X	%	NMVOCs	%	CO	%	SPM[a]	%
Power stations[b]	2000	209.1	*73.7*	110.7	*46.7*	2.1	*0.9*	7.6	*2.0*	11 404.7	*53.2*
	2008	126.0	*68.5*	119.5	*60.6*	2.6	*1.0*	9.9	*4.6*	7 788.8	*54.3*
Industrial combustion	2000	46.4	*16.3*	25.2	*10.6*	0.6	*0.3*	1.3	*0.3*	7 853.0	*36.6*
	2008	21.9	*11.9*	15.8	*8.0*	0.4	*0.2*	1.0	*0.4*	5 476.6	*38.2*
Non-industrial combustion	2000	4.2	*1.5*	2.3	*1.0*	0.1	–	0.5	*0.1*	64.4	*0.3*
	2008	0.7	*0.4*	1.5	*0.8*	0.1	–	0.5	*0.2*	46.5	*0.3*
Industrial processes	2000	19.0	*7.0*	4.9	*2.1*	83.5	*34.9*	–	–	. .	. .
	2008	33.0	*18.0*	1.2	*0.6*	74.4	*29.2*	–	–	. .	. .
Mobile sources	2000	4.8	*1.7*	94.1	*39.7*	152.8	*63.9*	366.5	*97.5*	2 120.6	*9.9*
	2008	2.2	*1.2*	59.1	*30.0*	177.2	*69.6*	202.7	*94.7*	1 043.2	*7.3*
Solvents	2000	–	–	–	–	. .	. .	–	–	. .	. .
	2008	–	–	–	–	. .	. .	–	–	. .	. .
Miscellaneous	2000	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
	2008	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
Total	2000	283.9	*100.0*	237.2	*100.0*	239.2	*100.0*	375.9	*100.0*	21 442.7	*100.0*
	2008	184.0	*100.0*	197.1	*100.0*	254.7	*100.0*	214.1	*100.0*	14 355.1	*100.0*
Change 2008/2000		–35.2		–16.9		6.5		–43.1		–33.1	

a) Suspended particulate matter.
b) Includes the refining sector.
Source: CBS.

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the conversion of some power plants from heavy oil to natural gas (Table 6.1). End-of-pipe emissions reduction technologies, such as scrubbers, have been installed at some power plants (*e.g.* in Ashkelon) and are set to be installed at other units in the future. Preliminary data for 2009 indicate a sharp decline in emissions from mobile sources due to the adoption of a stricter limit on sulphur content (10 parts per million) in transport fuels beginning in that year.

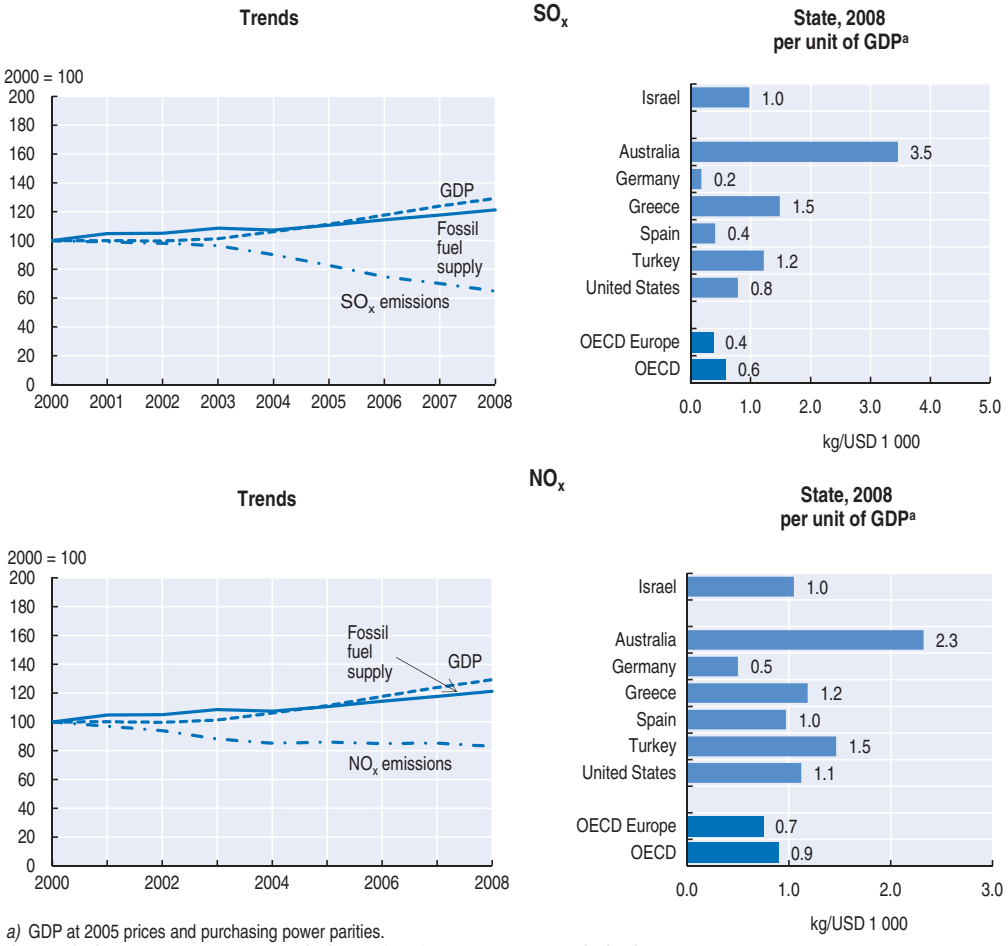
Reduced emissions have resulted in declining annual average sulphur dioxide (SO_2) concentrations throughout the country, including in major industrial areas (Haifa, Hadera, Ashdod, Ashkelon) and in Tel Aviv (Figure 6.4). Maximum annual concentrations remained below the annual standards at all monitoring stations. There was only one exceedance of the half-hour standard in 2008, in the area around Hadera and Haifa Bay.

Nitrogen oxides

Electricity generation and transport are the main sources of emissions of nitrogen oxides (NO_X) (Table 6.1). These emissions decreased by about 17% between 2000 and 2008, although they have tended to stabilise since 2004. This has resulted in their decoupling from GDP growth and fossil fuel supply and a decline in NO_X emission intensity. Nonetheless, NO_X emission intensity remains above that of most OECD countries and slightly above the OECD average (Figure 6.3). Despite the increase in road transport volumes, emissions from mobile sources have declined considerably owing to improved vehicle technology. This decline has been the major driver of NO_X emissions reductions (Table 6.1). While emissions from power generation have continued to increase, industrial emissions have decreased, resulting in lower concentrations of NO_X at major industrial sites.

Overall, annual average concentrations of NO_X have tended to decline slightly in Israel in the past decade. In the Tel Aviv metropolitan area this has been due, *inter alia*, to stricter vehicle emission standards, improved fuel quality, and more stringent vehicle inspections. However,

Figure 6.3. **Air pollutant emissions**



a) GDP at 2005 prices and purchasing power parities.
Source: OECD, Environment Directorate; OECD-IEA (2011), *Energy Balances of OECD Countries Database*; OECD (2010), *OECD Economic Outlook No. 88.*

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high annual average concentrations of NO_X continue to occur in the Tel Aviv and Jerusalem metropolitan areas due to heavy transport pressures while Israel's annual NO_2 concentrations exceed the recommendations of the World Health Organization (WHO) (Figure 6.4).

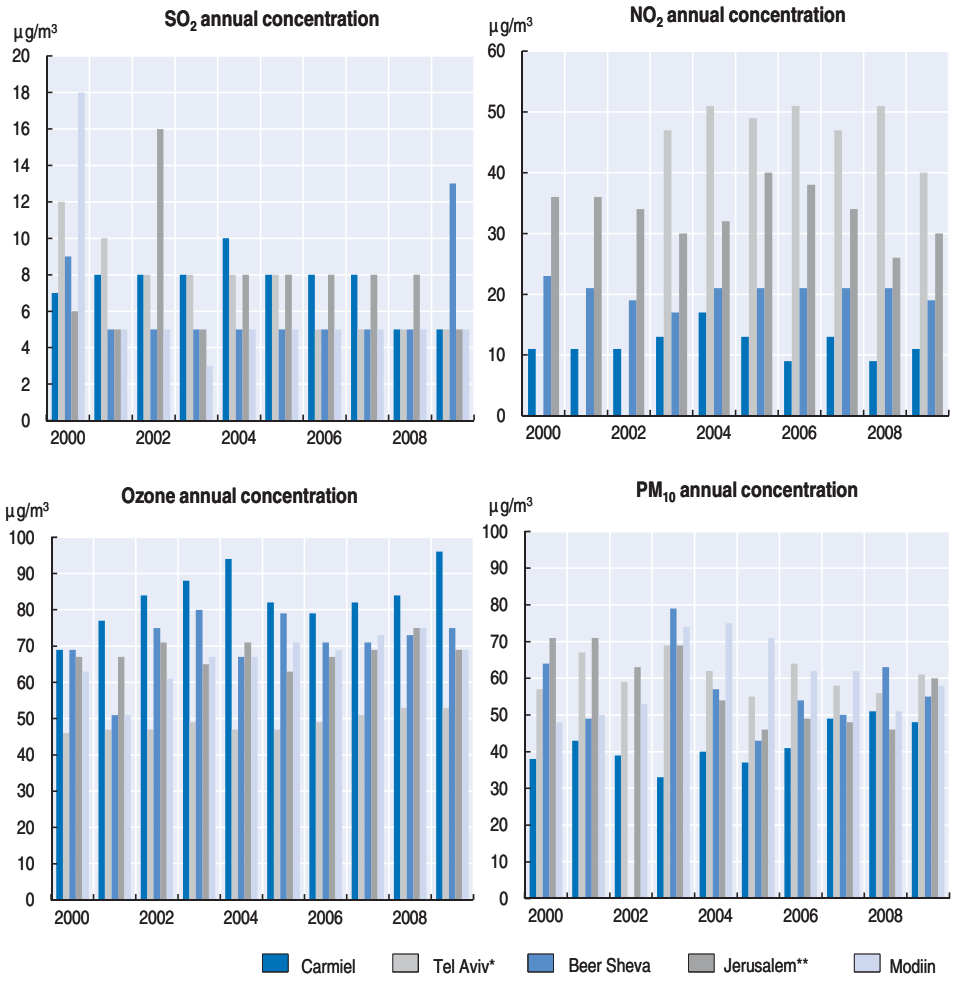
Non-methane volatile organic compounds and carbon oxide

Transport is also the major source of emissions of non-methane volatile organic compounds (NMVOCs) and carbon oxides (CO). Improvements in vehicle technology helped to reduce CO emissions by more than 40% between 2000 and 2008, whereas emissions of NMVOCs have continued to grow (Table 6.1).

Particulate matter

Electricity generation and industrial combustion are the main sources of suspended particulate matter (SPM) (Table 6.1). SPM emissions decreased by 33% between 2000 and 2008. Israel monitors both PM_{10} and $PM_{2.5}$. Annual average concentrations of PM_{10} are between 36 and 74 µg/m^3, depending on the location of the monitoring station. Israel has high background levels of PM, and concentrations tend to be higher at transport stations. In some areas, such as in Beer Sheva, there is a tendency for them to exceed the annual

Figure 6.4. **Air quality at selected locations**



*Tel Aviv monitoring sites: SO_2, NO_2, O_3 - central station; PM_{10} – Tahana Merkazit.
**Jerusalem monitoring sites: SO_2, O_3, PM_{10} - Safra; NO_2 - Efrata.
Source: MoEP.

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standard of 60 µg/m^3 (Figure 6.4). Annual concentrations of $PM_{2.5}$, which are very dangerous to public health, range between 17 and 29 µg/m^3 in some areas, above the European annual standard of 25 µg/m^3.

Ground-level ozone

Israel's ground-level ozone concentrations are high compared to WHO recommendations. Increasing annual average concentrations have been observed at most monitoring stations (Figure 6.4). Further, the WHO recommendation for an eight-hour value has been repeatedly and increasingly exceeded in recent years in many areas, including the largest urban areas of Tel Aviv, Jerusalem and Beer Sheva.

Ammonia

A national inventory of ammonia emissions was created only in 2011. Hence, no emission time series is available. It is likely that agriculture (livestock and use of fertilisers) is the major

source of ammonia emissions, as in most other OECD countries. It seems probable that ammonia emissions have increased due to the growth in livestock numbers, although emissions might have been partly offset by the decline in inorganic fertiliser use (OECD, 2010).

Impacts of air pollution

Epidemiological surveys were carried out in Israel in the 1980s and 1990s to assess the health impacts of air pollution near power plants and industrial sites. The most recent assessment, carried out in 2003, compared public health risks from air pollution in two Israeli metropolitan areas, Ashdod and Tel Aviv. Based on 1995-99 data, it confirmed that air pollution in these regions increases both mortality and morbidity.[6] However, this was a one-off study. Reviews of the impacts of air pollution on human health, as well as associated economic and social costs, are not systematically performed nor are their results used to inform decision making. The impact of air pollution on ecosystems has not been examined.

3. Policy framework

3.1. Climate change

Israel ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1996. It is thereby committed to: periodically updating, publishing and making available national inventories of anthropogenic emissions of greenhouse gases; formulating, implementing, publishing and regularly updating plans to mitigate climate change; and formulating, publishing and implementing measures to facilitate adequate adaptation to climate change.[7] In 2004, Israel also ratified the Kyoto Protocol, which imposed greenhouse gas (GHG) emissions reduction quotas on developed countries. Unlike the majority of OECD countries, Israel is not an Annex I country and is not committed to achieve a specific GHG emissions reduction in the period 2008-12.

Further to UNFCCC ratification, the Israeli government established an inter-ministerial committee under the Ministry of Environmental Protection (MoEP) to develop a comprehensive emissions reduction strategy. The Committee produced Israel's first communication to the UNFCCC in 2000. In the early 2000s the Committee commissioned a number of expert studies to identify the potential for cost-effective emissions reductions. It failed, however, to secure cross-government support for a comprehensive emissions reduction strategy. Climate policy was subsequently developed in a piecemeal manner during most of the 2000s.

Notwithstanding this late start in formulating a climate change mitigation policy, Israel took important steps forward in the late 2000s. It made a commitment to reduce GHG emissions by 20% compared to a business-as-usual scenario in the period to 2020[8] through its association with the Copenhagen Accord, taken note of by global leaders at the 15th Conference of the Parties (COP) to the UNFCCC in December 2009.[9] Israel intends to fulfil its commitment primarily by achieving a 10% share of renewable energy in electricity generation and a 20% reduction in electricity consumption from a business-as-usual baseline (Section 5). This target was established on the basis of the aforementioned feasibility studies undertaken by the consultancy firms Heifetz and Co. and DHV MED (2009) and McKinsey & Company (2009). Four working groups were established in the areas identified as having the highest emissions reduction potential: energy efficiency, green buildings, transport, and renewable energy (Box 6.1).

Box 6.1. **Israel's 2020 GHG emissions reduction target and mitigation potential**

The Heifetz and McKinsey studies estimated that, under "business-as-usual" (BAU) scenarios, Israel's GHG emissions would be between 107 and 109 Mt CO_2 eq in 2020. Using these scenarios as a basis for calculation, Israel's target of reducing GHG emissions by 20% compared to BAU emissions by 2020 results in about 87 Mt CO_2 eq in 2020 or a reduction of about 22 Mt CO_2 eq (Figure 6.1). This constitutes an 18.7% increase in emissions during the period to 2020 calculated on a 2005 baseline. The following table compares this commitment with the emissions reduction commitments envisaged in selected OECD countries, with countries ranked according to 2008 GDP per capita.*

Emissions reduction commitments and GDP per capita of selected OECD countries

	% reduction on 2005 emissions	GDP per capita (USD 2008)[a]
Israel	+18.7	27 679
United States	–17.0	46 901
Ireland	–20.0	42 644
Canada	–17.0	38 883
Germany	–14.0	37 171
Spain	–10.0	33 173
Greece	–4.0	30 077
Portugal	+1.0	24 957
Poland	+14.0	18 062

a) At current prices and purchasing power parities.
Source: EU Decision No. 406/2009/EC; *OECD National Accounts Database*.

The table suggests that emissions reduction commitments adopted by other OECD countries broadly correlate with GDP per capita. This was the sole criterion used within the EU to share the aggregate EU commitment among Member States. Within such a framework, Israel is an outlier in that its commitment would constitute a significant emissions increase on 2005 levels. At the same time, its target implies decreases in GHG emissions per capita and per unit of GDP comparable to those that would be achieved in other OECD countries (OECD, 2011). In addition, Israel is not an Annex I country, which means that it does not have recourse to international carbon markets to meet its commitment.

Israel's mitigation potential is restricted due to both its rapid projected population and economic growth, and the relatively limited scope for abatement which has been identified by expert studies. The Heifetz study estimated a mitigation potential of approximately 31.7 Mt CO_2 eq in the period to 2025. According to the study, the measures with the highest abatement potential are energy efficiency in the building sector, appliance efficiency and solar energy. Some 73% of the abatement potential may be achieved at negative costs (Figure 6.5). If all the mitigation potential were to be exploited, in 2025 GHG emissions would be 19% higher than in 2000, as opposed to a BAU increase of 63%.

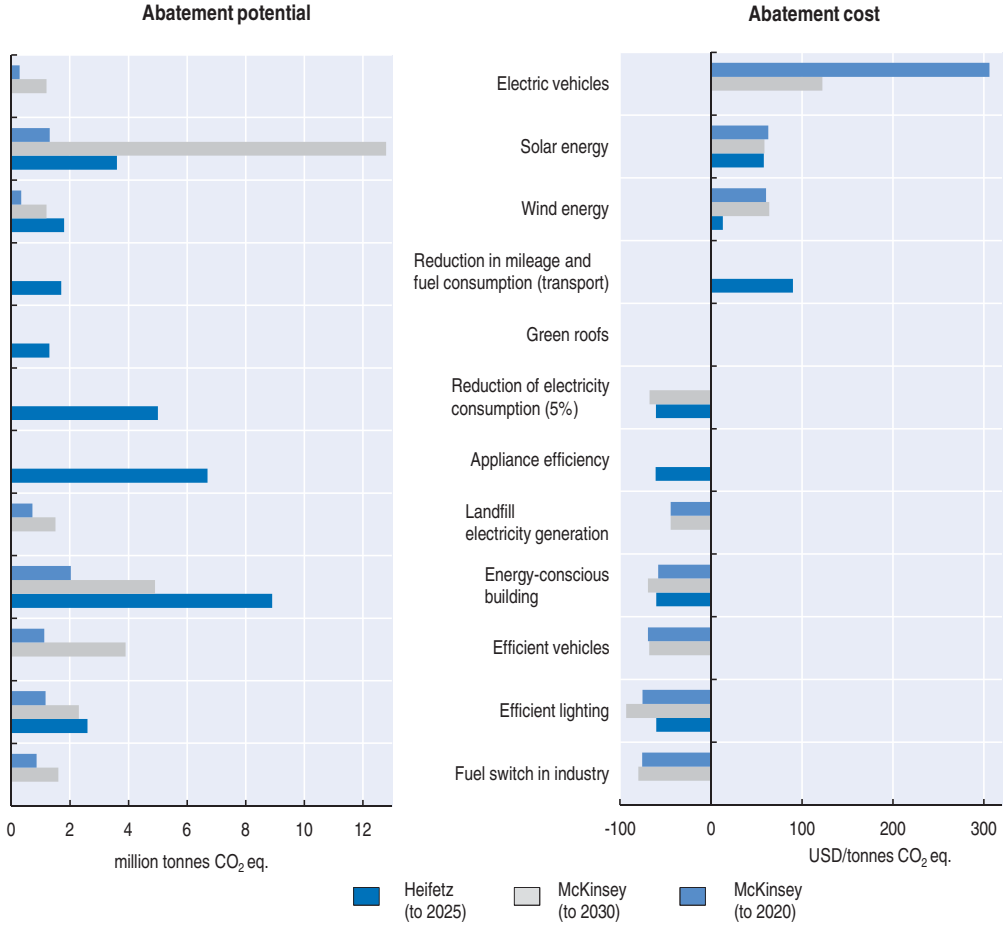
A subsequent analysis by McKinsey put Israel's abatement potential at approximately 45 Mt CO_2 eq in the period to 2030 (McKinsey & Company, 2009). Three broad measures would account for most of the abatement potential: higher energy efficiency in the building sector; the use of renewable sources for electricity generation; and improved vehicle efficiency, including the use of electric vehicles. Ten measures would account for 65% of total abatement potential to 2030, or 30 Mt CO_2 eq (Figure 6.5). The same measures would reduce

Box 6.1. **Israel's 2020 GHG emissions reduction target and mitigation potential** *(cont.)*

emissions by only an estimated 8 Mt CO_2 eq by 2020, and at a higher cost in view of the different level of technological maturity (Figure 6.5). As in the Heifetz study, many measures would have negative costs, or net benefits, for the economy. While the investment required to reach the full abatement potential is estimated at 1% of average GDP in 2011-30, this investment would be fully returned in the form of energy savings, implying that the total net cost of the abatement to the economy would be virtually zero. This analysis indicates lower abatement potential in Israel (32%) than in many other countries (where the average is around 50%) because of the low feasibility of many abatement measures, including hydroelectric power, biomass, and carbon capture and storage.

* Targets in the case of EU Member States relate to emissions not covered by the EU emissions trading scheme only. The aggregate EU target for emissions not covered by the ETS is –10%, (based on 2005 levels) by 2020. However, the aggregate emissions reduction envisaged under the emissions trading scheme across the EU is –21% (based on 2005 levels) by 2020. This is greater than the emissions reduction target envisaged by any Member State.

Figure 6.5. **GHG abatement potential and costs**



Source: MoEP (2010), Second national communication to UNFCCC; McKinsey & Company (2009); OECD (2010), *OECD Economic Outlook No.88*; OECD calculations.

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An inter-ministerial committee headed by the Director-General of the Ministry of Finance was established to identify the mitigation potential and economic impact of various measures, outline how measures would be implemented, and identify barriers to implementation. Following the Committee's recommendations, in November 2010 the government approved a resolution on the formulation of a comprehensive national plan for the reduction of GHG emissions. The government resolution allocates a budget of NIS 2.2 billion until 2020. NIS 540 million is allocated for the first biennium to specific broad emissions reduction measures, mostly reduction of household electricity consumption and an investment plan (subsidies for GHG emissions reduction projects) to be developed by the MoEP (Table 6.2). The government resolution also puts in place a follow-up and reporting mechanism. The MoEP is entrusted with the responsibility of overseeing implementation of the resolution, but implementation of each measure is assigned to identified ministries. The MoEP and the implementing ministries are required to report annually to the government. The inter-ministerial committee will continue to function for the purpose of monitoring implementation of the government resolution, as well as to evaluate the economic efficiency of the measures implemented until 2012 and recommend policy measures for the following period.

Table 6.2. **Budget allocations for GHG emissions reduction measures in 2011-12**

NIS million

Measures	Implementing ministries				
	National Infrastructures	Environmental Protection	Construction and Housing	Transport and Road Safety	Industry, Trade and Labour
Reducing electricity consumption in the domestic sector	269				
Support for investments in the reduction of GHG emissions, excluding the domestic sector		114			
Educational and information activities	30	11		5	
Support for initial installation of new technologies					40
Pilot project for new green building		16			
Survey of existing buildings		16			
Training for green building, including in academic frameworks		9			2
Support for energy surveys (including enforcement and follow-up)	8	5			
Pilot project for retrofit of existing buildings			7		
Standardisation for energy efficiency (including enforcement)	7				

Source: Government Resolution No. 2508/2010.

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While a robust institutional infrastructure is in place to propose measures and instruments, and work is based on high-quality research, the mechanisms adopted to ensure implementation and monitoring of these measures (and the benchmarking of progress towards the target) appear to be insufficient compared to best practices in other OECD countries, such as in the UK.[10] The 2010 government resolution does not specify the implied emissions in the "business-as-usual" scenario, and therefore the implied emissions reduction target, which leaves room for possible reinterpretations of the target. Establishing a national target in legislation (expressed in tonnes of CO_2 eq in 2020) and formulating the comprehensive national action plan foreseen by the government resolution (November 2010) would aid effective implementation. This plan should encompass other strategies and plans, such the 2010 National Energy Efficiency Programme (Section 5), and identify a trajectory for meeting the target. To increase accountability for implementation, a progress report should be presented to the *Knesset* on

an annual basis. Such a report should indicate progress in meeting the target, identify underlying sectoral drivers of emissions and obstacles to implementation, and evaluate the cost-effectiveness of emissions mitigation policy. Putting the inter-ministerial committee in charge of follow-up is a positive step. Opening the committee to independent experts and to parliamentary scrutiny would strengthen the review mechanism and provide a better basis for adjusting policy measures.

Adaptation to climate change

To address the challenges of climate change adaptation, the MoEP set up an inter-ministerial steering committee in 2006 headed by its Chief Scientist. The objective of the committee was to assess the potential impacts of climate change on Israel, and to recommend ways of preparing for and adapting to climate change as well as to promote the development of new concepts and technologies to address problems.

Adaptation measures are expected to be included in a national climate change adaptation plan. In line with best practices at international level, the national plan will consider the following issues: better integration of scientific considerations into decision making; methods and tools to assess adaptation actions; education, training and public awareness; technological development and effective use of resources and eco-innovation; promotion of local adaptation approaches; and proposals concerning legislation and standards that promote environment-friendly adaptation actions (MoEP, 2010). Table 6.3 shows the identified adaptation options. The ultimate goal is to integrate adaptation to climate change impacts in the sectoral, land use and environmental planning systems.

The MoEP has recently established an information and knowledge centre for adaptation to global climate change. This centre is expected to facilitate collection of information on adaptation to climate change in Israel, which will serve as a basis for the formulation of a national adaptation policy and a national action plan. It is also envisaged that establishing such a centre would facilitate the transfer of Israel's technology and know-how on climate change adaptation in fields such as water management (*e.g.* drip irrigation, leakage prevention), reuse of treated wastewater, seawater desalination, desert agriculture and afforestation.

3.2. Air emissions and quality

Israel's key air policy priorities are reducing air pollution from transport and at industrial hotspots. While it has not established official national emission ceilings for major air pollutants (Section 1), several pieces of legislation have long regulated air emissions from stationary and mobile sources, as well as establishing air quality standards.

The MoEP is responsible for the prevention of air pollution from stationary and mobile sources. The 1961 Abatement of Nuisances Law was the main legislative instrument for controlling air pollution until the Clean Air Law entered into force in 2011 (see below). Ambient air quality standards for 24 air pollutants, including SO_2, NO_X, CO, O_3, PM_{10}, heavy metals and chemicals, were set in 1992 and subsequently complemented by guidelines (not established in legislation) on alert procedures in case of high pollution. Most of these standards were less strict than those recommended by the WHO or adopted by the EU. Pollutant emissions from industrial and power plants were regulated by means of administrative orders,[11] specific air emission standards in business licenses, and pollution prevention plans for power plants. Several regulations have long been in place regulating vehicle emission standards, vehicle inspections and motor fuel quality, among others (Section 6).

Table 6.3. **Impacts of climate change and adaptation options**

Vulnerable sector	Possible impacts	Adaptation options
Water resources	• Reduction of water availability in aquifers and surface water bodies	• Expansion of desalination capacity
	• Deterioration of water quality	• Efficient water use and effective water economy management
	• Increased probability of flood events	• Improved modelling
		• Increased public awareness and change of consumption patterns
		• Enhanced water quality and quantity monitoring and modeling
		• Reassessment of water quality standards
		• Enhanced collaboration of authorities and institutions
		• Improved wastewater and drainage infrastructure
		• Enhanced management of the land-use interface in flood-sensitive areas
Agriculture	• Shortage of water supply for agriculture	• Increased use of treated effluents in agriculture
	• Damages to crop productivity due to water deficiency and extreme climate conditions	• Efficient use of water and better adjustment of crop location to water availability
	• Changes in crop growing seasons	• Better modelling and forecasts
	• Salination and erosion of soil	• Technological improvements in irrigation and cultivation methods and implementation of cultivation methods that prevent soil loss
	• Reduced productivity of farm animals	• Genetic improvements in crops and farm animals
	• Shortage of fresh animal feed	• Expansion and adjustment of crop varieties
	• Increased risks of pests and farm animal diseases	• Adjustment of planting and harvesting dates
		• Improvement of climate control systems in livestock farms
		• Development of substitutes for grains in animal feed
		• Selection of cattle species resistant to heat and pests and adaptation of animal husbandry methods
Coastal zone	• Coastal retreat	• Incorporation of climate change implications into land use planning
	• Sand removal	• Enhanced monitoring of sea level and coasts
	• Damage to coastal infrastructure and tourism	• Adaptation of coastal infrastructure
	• Salination of the coastal aquifer	• Use of sea protection and sand nourishment techniques
	• Damages to the coastal cliff	• Enhanced international trade control to prevent invasion of exotic marine species
	• Increased probability of invasion of marine alien species	• Prevention of sea pollution to reduce stress on coral reefs
	• Coral bleaching in the Red Sea	
Human health	• Increased incidence of parasitic and infectious diseases	• Enhanced control and monitoring of disease-carrying vectors and risk assessment
	• Increased thermal stress	• Training of health experts
	• Increased risk of damage from extreme weather events	• Improvement and adaptation of health systems to respond to climate change risks
		• Public education
		• Improved urban planning to reduce heat stress and air pollution
Ecosystems and biodiversity	• Loss of plant species in the semi-arid region due to desertification	• Incorporation of climate change implications in the management of conservation areas and the establishment of ecological corridors
	• Damage to local animal species populations	• Research, monitoring and mapping of species vulnerability to climate change impacts
	• Changes in species composition in Lake Kinneret	• Enhanced management of forest resources along with their human interface
	• Damage to nature reserves	• Forest thinning
	• Increased likelihood of forest fires	• Genetic improvements in forest tree species
		• Selection of resistant tree species for afforestation
Energy and infrastructure	• Increased energy demand due to greater heat stress, particularly during peak heat waves	• Use of renewable energy to meet increased energy demand
	• Damage to infrastructure in vulnerable areas	• Increased energy efficiency
		• Adaptation of building regulations to new climatic conditions
		• Identification and protection of vulnerable infrastructure and industries
		• Enhanced resource management
Economy	• Damage to public and private property	• Cost-benefit analysis of adaptation action vs. inaction in selected fields
	• Increased costs of goods and services	• Economic incentives that promote adaptation to anticipated climatic changes
	• Higher burden on the insurance industry	• Risk analysis for the insurance industry

Source: MoEP (2010).

Approval of the Clean Air Law in 2008 (entered into force in 2011) is a major step forward, as this law provides a comprehensive regulatory framework for air management. It establishes a framework for setting emission standards for mobile and stationary air pollution sources and for the revision of ambient air quality standards. Regulations on ambient air standards were adopted in 2011. They include target values based on WHO guidelines, and ambient and alert values based on European standards.

The Clean Air Law establishes emission permitting requirements for large industrial facilities based on best available techniques (BATs). It foresees public participation in the permitting process.[12] All air permits must be issued by 2015 (Chapter 2). The law also strengthens the MoEP's enforcement powers and the response to non-compliance, allowing for the possibility of both administrative and criminal sanctions. About 150 industrial facilities, accounting for 80% of national air emissions from stationary sources, will be covered by the air permits. Air emissions from other facilities will continue to be regulated through business licenses and sectoral binding rules or general regulatory standards, based on the German TA-Luft regulation.[13]

The Clean Air Law mandates the formulation of a 2010-20 national programme, led by the MoEP, to guide government-wide air pollution abatement actions. Based on current and projected air emission trends, this programme will include a detailed set of policy measures in all sectors of the economy, chosen according to a cost-benefit analysis. An annual budget of NIS 1 million was allocated for the programme in the first two-year period. It is important for this programme to be co-ordinated with the action plan to abate GHG emissions and the sectoral plans for the energy and transport sectors, in order to increase efficiency and harness potential co-benefits.

Under the Clean Air Law, the MoEP remains the main authority responsible for air pollution management and enforcement. Local authorities, which are responsible for managing air pollution at the local level, can issue local regulations for this purpose. In case of frequent exceedances of ambient air quality standards, local authorities (individually or jointly) are required to formulate an action plan for improving air quality. The majority of Israeli municipalities have started to co-operate on the development of climate change and air pollution abatement plans, independently of the new legislative requirements (Box 6.2).

The Clean Air Law allows for the introduction of an air emission levy on large industrial facilities that require a permit. Proceeds can be earmarked for rewarding installations that reduce their emissions beyond the level required by the permit. Experience in other OECD countries (such as Japan and Sweden) shows that air emission levies can be effective in reducing emissions from stationary sources and in promoting innovation, and that they can be effective in combination with emission standards (OECD, 2010). The levy should be paid per unit of pollutant emitted, irrespective of the emission limit set in the air permit. It should be introduced for a limited number of priority pollutants, so that it may be set at a sufficiently high rate without entailing excessive costs to installations. Since the emission limit for a large installation is tailored to the installation itself on the basis of BATs (which imply economically reasonable requirements), there could be limited scope for further abatement in the short term for average companies. However, it can be useful to implement such a levy for smaller installations, which remain subject to sectoral and less flexible standards. An emission levy, as opposed to financial incentives to go beyond the emission standard, would

Box 6.2. **The Israeli Forum of Self-Governing Cities**

The Israeli Forum of Self-Governing Cities (or Forum 15) brings together 15 major, financially independent municipalities. They account for about 40% of Israel's population, although more than 80% of the population lives or works in their metropolitan areas.

In February 2008, Forum 15 mayors and those of another three municipalities signed the Convention of the Forum 15 for Reducing Air Pollution and for Climate Protection. This is a local Israeli version of the Cities for Climate Protection (CCP) Campaign initiated by ICLEI – Local Governments for Sustainability. The convention calls for the development of municipal master plans for the reduction of air pollution and greenhouse gas (GHG) emissions, with a view to:

- establishing a basic inventory and outlook for key sources of cities' air pollution and GHG emissions;
- setting targets for the reduction of air pollution and GHG emissions (no less than 20% by 2020 compared with 2000);
- developing and adopting a local action plan to reduce air pollution and GHG emissions;
- implementing all measures and actions derived from local action plans;
- monitoring and controlling air pollution and GHG emissions, and reporting on actions and measures implemented within the framework of local action plans.

Most municipalities have completed their baseline emissions inventory and outlook and are now defining their annual GHG emissions reduction targets. This is accompanied by the development of local action plans to reduce air pollution and GHG emissions in four main areas: transport and fuels; energy efficiency and environment-friendly construction; waste and recycling; and green spaces.

In 2010, the MoEP, the Forum 15 and the Union of Local Authorities in Israel decided to launch a NIS 1 million project to promote a climate protection project in all of Israel's local authorities (of which there are about 200), based on their different needs and conditions. The programme will be accompanied by training and capacity-building and will concentrate on reducing GHG emissions in three areas: electricity consumption; waste disposal; and wastewater treatment.

generate revenue and be more cost-effective than subsidising abatement beyond the allowed emission level.[14]

3.3. Monitoring and reporting

GHG and air pollutant emissions inventories

Comprehensive and regularly updated greenhouse gas (GHG) and air pollutant inventories are a necessary building block for the delivery of effective air management and climate policies. During the review period, significant progress has been made in developing a comprehensive emissions dataset and in the regular publication and communication of this information.

GHG emissions inventories for the years 1996 and 2000 were prepared on an *ad hoc* basis. The Central Bureau of Statistics (CBS) began compiling annual inventories in 2003 for emissions of the three main GHGs (CO_2, CH_4 and N_2O) and of indirect GHGs. However, the CBS compiles GHG emissions inventories on the basis of a general mandate to collect and produce environmental data and not of a specific government regulation or directive. In

the EU, by comparison, the process of data monitoring, reporting and verification of emissions in Member States is prescribed by legislation (Directive 2003/87/EC). Data on emissions of the so-called "F gasses" were not collected in Israel until 2009.

An "air resources management system" tested in 2007 is expected to be fully operational in 2011. It includes the development and regular update of a National Emissions Inventory covering the major air pollutants (SO_X, NO_X, PM_{10}, NMVOCs and CO) and all emission sources throughout the country. It presents average maximum hourly emissions and the location of emission sources.

A voluntary GHG national reporting register was launched in July 2010. Companies and organisations may use it to report emissions. To reporting entities, the voluntary register will serve as a learning tool for quantifying GHG emissions, internalising and streamlining required procedures, managing business risks associated with GHG emissions, and identifying emissions reduction opportunities. The register could be a step towards establishing a mandatory register in the future. This would be consistent with Israel's commitment to implement the OECD Recommendation on implementing Pollutant Release and Transfer Registers (PRTRs) (Chapter 2).

Despite progress, current procedures for the collection and presentation of GHG and air emissions data could be strengthened. It remains illegal for the Central Bureau of Statistics to report and publish data which would identify specific installations. Data may therefore be published by the CBS only in aggregate form unless it obtains explicit consent from the surveyed installations. In the EU, by contrast, GHG and air emissions data from installations above a certain size are attributed to that installation. This transparency facilitates better understanding among policy makers and the public of the emissions performance and mitigation efforts of specific companies and installations. The Clean Air Law opens the door for GHG emissions from large stationary installations to be regulated and reported, and for emissions performance to be considered in the permitting process.[15] How this might work in practice remains unclear.

Procedures for reporting annual emissions inventories greatly improved during the review period, but they are not sufficiently detailed to form a basis for the development and implementation of comprehensive national plans to reduce GHG and air emissions. Nor would current reporting procedures enable effective ongoing monitoring of progress to meet commitments. This deficiency arises because annual reporting covers only trends for each GHG and air pollutant type and for macro-sectors; no sector-specific data are presented, and no analysis of the underlying drivers in each sector is undertaken or reported.[16] The publication of an annual report outlining key sectoral trends, and a brief analysis of the underlying drivers in each sector, would facilitate better understanding of climate and air policies, including their challenges and implications.[17]

Air quality monitoring network

With over 100 air quality monitoring stations, Israel's monitoring network is considered to be among the densest in the world. Air quality monitoring at specific sites dates back to the early 1970s. A national network was put in place in the late 1990s according to EU and US standards. The stations are operated by the MoEP (23 fixed stations and two mobile stations), municipal associations for the environment, the Israeli Electric Corporation and some industrial plants. Background or general stations measure SO_2, NO_X, O_3, CO and PM, while transport monitoring stations (located close to primary traffic nodes) measure

concentrations of NO_X, CO, PM and hydrocarbons. The MoEP's equipment is certified by the United States Environmental Protection Agency and the location of transport monitoring stations is in accordance with the EU standards. Air quality data are published in real time, and on an annual basis, on the MoEP's website. Information on air quality is usually made available on request free of charge.[18]

Differences in measurements between monitoring stations in the same area may result from lack of uniformity in data control among different monitoring bodies. This problem should be solved with the entry into force of the Clean Air Law, which requires the MoEP to develop guidelines and procedures for air quality monitoring. Efforts are currently being made to prepare a laboratory quality and accreditation system for the air monitoring network operated by the MoEP. The air resources management system is also expected to allow for air quality forecasts, including alerts for high pollution.

4. Cross-sectoral policy instruments

While Israel has comprehensive legislation on air pollution, there is no specific legislation on climate change and economy-wide tools such as a carbon tax or an emission cap-and-trade system are not currently used.

The 2010 Government Resolution on the "formulation of a national plan for the reduction of greenhouse gas emissions in Israel" mandates the Ministry of Finance to formulate recommendations on the use of direct and indirect taxation incentives to reduce GHG emissions by August 2011. Although an economy-wide carbon tax has not been proposed, it is one of the instruments under consideration. A Bank of Israel study found that a tax per tonne of CO_2 emissions would significantly reduce emissions with only a minor economic impact, even if the rate of taxation were set at a relatively high level (Palatnik and Mordechai, 2010). Evidence from European countries supports these findings and demonstrates that carbon taxation can have a positive impact on economic growth and competitiveness (Andersen and Ekins, 2009). For example, the introduction of carbon or energy taxes with revenue recycling in Denmark, Finland, Germany, the Netherlands and Sweden had a positive effect on GDP compared with the counterfactual reference case of no environmental tax reform (Andersen *et al.*, 2007).

In the absence of a carbon tax, excise duties already imposed on fossil fuels could be adjusted to reflect a carbon price component. While this would not replicate a universal carbon tax, it would cover a large share of Israel's GHG emissions. At the beginning of 2011, the excise duty on coal was raised considerably (to NIS 43.3/tonne from NIS 8.6/tonne) and it is now higher than the tax on oil and gas. This is consistent with the higher carbon content of coal compared to that of natural gas. Tax rates on primary fuels (natural gas, coal and oil for electricity generation and industrial use) remain below the price of carbon prevailing, for example, in the EU CO_2 emissions trading system (EUR 15 per tonne of CO_2). Calculations suggest that the excise duty on coal should increase to NIS 162 per tonne to internalise the social cost of CO_2 emissions alone, without considering other environmental impacts and additional reasons to impose such taxes (Table 6.4).

The Clean Development Mechanism (CDM) has been used to reduce emissions in several economic sectors.[19] In 2004, a Designated National Authority was created to authorise CDM projects in Israel. By the beginning of 2009, 54 projects had been submitted for approval in the areas of waste, agriculture, fuel switching, energy, and industrial efficiency. Sixteen projects had been registered with the United Nations, amounting to an

Table 6.4. **Excise duties on fuels and implied carbon prices**

Fuel	Excise duty (NIS/unit)	CO_2 emission factor (kg CO_2/unit)[a]	Implied carbon price of excise duty (NIS/t CO_2)	Implied carbon price of excise duty (EUR/t CO_2)[b]	Implied excise at EUR 15/t CO_2 (NIS/unit)
Premium unleaded petrol (1 000 litres)	2 890.00	2 301.8	1 255.5	261.6	165.7
Diesel (1 000 litres)	2 760.00	2 641.3	1 044.9	217.7	190.2
Heavy oil (tonne)	13.99	3 190.0	4.4	0.9	229.7
Natural gas (1 000 m^3)[c]	14.09	2 023.0	7.0	1.5	145.7
Coal (tonne)	43.30	2 251.2	19.2	4.0	162.1
Light fuel oil for households (1 000 litres)	2 195.00	2 529.9	867.6	180.8	182.1
Light fuel oil for industry (1 000 litres)	13.62	2 529.9	5.4	1.1	182.1

a) UK Department for Environment, Food and Rural Affairs.
b) Assuming an exchange rate of NIS 4.8/EUR.
c) Excise duty: NIS 15.53/107 kcal; average gross calorific value of natural gas: TJ 38/million m^3.
Source: OECD-IEA (2011), *Energy Prices and Taxes Database*; OECD calculations.

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annual emissions reduction of 1.6 Mt. Permits (certified emissions reductions) equivalent to 0.44 Mt CO_2 eq from four projects have been issued.

Access to international funding under the CDM is one of the advantages Israel enjoys as a non-Annex I country. A disadvantage is that the Israeli government does not have recourse to international carbon markets to meet future mitigation targets, which must therefore be achieved through domestic measures alone. The 2010 Government Resolution requires the MoEP, in co-operation with the Ministry of Finance and the National Economic Council, to examine the possibility of integrating the country into the international GHG emissions markets.

5. Policies and measures in the energy sector

The extent to which sustainability objectives are integrated into decision making frameworks for energy policy was the subject of some debate during the review period. The master plan for electricity production of the Ministry of National Infrastructures (MoNI) for the period 2007-30, published in 2007, stated that one of its strategic targets was the "long-term reduction of greenhouse gas emissions per person so that it would not rise above a level acceptable in developed countries". The State Comptroller's Office (2009), however, found that in relation to this commitment "the master plan does not lay a foundation for achieving its strategic target but only serves as a general statement".

Progress has been made in addressing this imbalance. Common pricing of the environmental externalities associated with electricity generation originally proposed by the MoEP were agreed by all government departments. Since the EU ETS permit price was used as the shadow price for CO_2 emissions, the real environmental impact of emissions may be underestimated.[20] However, these values are used only for determining the feed-in tariff for generation of electricity from renewable sources, whereas a common and consistent shadow price for carbon, and trajectory for future carbon prices, should be applied in all policy assessments.

The electricity sector is expected to contribute to most of the targeted 22 Mt CO_2 eq emissions reductions by 2020. The government set the target of reducing electricity consumption by 20% by 2020, which would translate into GHG emission savings of about 12 Mt CO_2 eq in that year. This target has been supplemented by the goal of generating 10% of electricity from renewable sources by 2020, which would provide about 5 Mt CO_2 eq in

additional GHG emission savings. It is not yet clear how the remaining emissions reductions are expected to be achieved, or what the relative role of the transport, waste and agricultural sectors will be. Promotion of renewable energy sources and of energy efficiency is expected to contribute considerably to the reduction of air pollution, although this contribution has not yet been quantified.

5.1. Fossil fuel supply

Israel's energy sector and electricity generation system stand out among those of OECD countries for a number of reasons. They include: geo-political limitations that do not permit Israel to connect to the electricity networks of neighbouring countries, thus requiring an autonomous electricity grid; limited land resources, which limit expansion of the electricity production system; and political obstacles to using nuclear power. Therefore, Israel's energy sector is isolated and heavily dependent on imported oil and coal. These factors underpin discussions on energy security. They are also relevant with regard to policies that seek to integrate intermittent electricity sources, such as some renewable sources, into the grid.

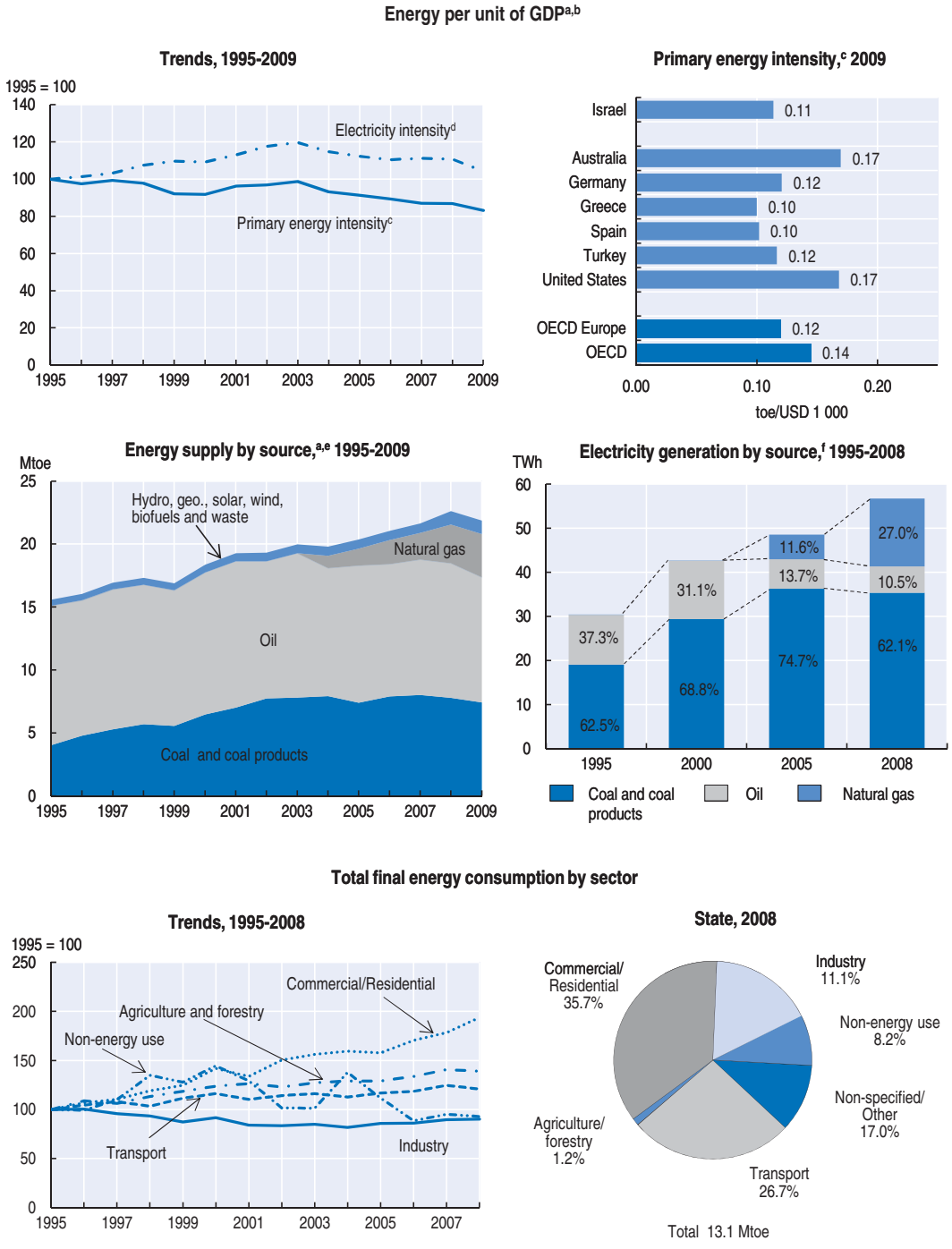
The discovery of about 33 billion m^3 (bcm) of natural gas at the Mari-B deposit off the Ashkelon coast in 2000 had a significant impact on Israel's generation portfolio during the review period. While coal still accounts for the greatest part of electric power generated, most of Israel's oil-based power generation has been displaced by gas since 2004. Use of natural gas to produce electricity increased from zero in 2003 to over 27% of power production in 2008 (Figure 6.6). As a result, between 2003 and 2008 the emission intensity of electricity production fell from 830 to 740 grams of CO_2 per kilowatt hour, partly mitigating the increase in emissions from this sector.

The fuel switch to natural gas has also contributed to a decrease in SO_X emissions, together with the use of low-sulphur oil and coal. Nonetheless, overall energy supply and electricity production increased considerably during the decade to meet demand from the growing economy and population (Figure 6.6). This has more than offset the impact of the fuel switch on GHG emissions and has been the main driver of increasing emissions. With more than 80% of its energy supply provided by coal and oil, Israel remains relatively dependent on these fuels compared with most OECD countries.

Further discoveries of off-shore reserves are expected to help Israel overcome its dependence on imported fuels and to reduce emissions.[21] The strategic implications of these gas discoveries, and the extent to which gas infrastructure might be developed to increase its potential share in the power generation portfolio, form part of an ongoing debate. Some government authorities argue that the share of natural gas could not rise beyond 50-55% by 2020 without compromising the security and flexibility of energy infrastructure and supply. Others believe this share could reach 70%. Within the context of this debate, construction of two additional 650 MW power plants in Ashkelon has been delayed several times due to differences of opinion among ministries concerning the trade-off between security/competitiveness of supply and environmental implications. A decision has finally been reached whereby a combined cycle gas-fired plant will be constructed with coal back-up.

The business-as-usual emissions scenarios in the Heifetz and McKinsey studies (used as a basis for defining the emissions reduction target) assume that natural gas accounts for about 45-50% of electricity generation. If recent gas discoveries enhance the medium-term

Figure 6.6. **Energy structure and trends**



a) Excludes international marine and aviation bunkers.
b) GDP at 2005 prices and purchasing power parities.
c) Total primary energy supply per unit of GDP.
d) Electricity consumption per unit of GDP.
e) Breakdown excludes electricity trade.
f) Including renewable energy sources (less than 0.5%).
Source: OECD-IEA (2011), *Energy Balances of OECD Countries Database*, OECD-IEA (2010), *Energy Balances of Non-OECD Countries Database*, OECD (2010), *OECD Economic Outlook No. 88.*

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potential of switching from coal to gas, the additional abatement potential should not be counted towards meeting Israel's target, as it could undermine the incentive to achieve the energy efficiency and renewable energy goals.

5.2. *Renewable energy sources*

Renewable energy sources hovered at around 3% of primary energy supply until 2007 (Figure 6.6). This is almost entirely due to the traditional widespread use of solar-thermal panels for water heating. Legal requirements for the installation of solar water heaters have been in force since 1980. Solar water heating accounts for 80% of all water heating requirements annually.

Government objectives to promote renewables in power generation have not been met. In 2002, the government established a goal of generating 2% of electricity from renewable energy sources by 2007, to be increased by 1% every three years so that 5% of total electricity would be produced from renewables by 2016. However, less than 0.1% of Israel's electricity was produced from renewable sources by 2007.

Implementation has been more successful since 2008. Overall, the renewable share of primary energy supply jumped to nearly 5% in 2008. The first feed-in tariff framework with production quotas was introduced for small-scale photovoltaic (PV) systems in that year. When quotas were exhausted, new quotas were introduced in 2010. Consequently, electricity generated from solar photovoltaic systems increased from 1 to 229 GWh in just one year and renewables reached 0.4% of electricity output in 2008, although still well below the 2007 target.

In 2009, the government established a goal of achieving 10% of total electricity supply from renewables by 2020, with an interim target of 5% to be achieved by 2014. This target was the result of a bottom-up analysis assessing the potential for renewable energy in Israel. The targets adopted for individual technologies and interim milestones are shown in Table 6.5. Technology-specific targets might limit investment decisions, thereby reducing efficiency. Large-scale solar and wind installations are expected to account for most additional renewable generation capacity. The renewables target is predicated on the achievement of the target for energy savings (Section 5.3). If the energy-saving target is not met, the total energy requirement will be higher. The renewables target would therefore not be met either.

Table 6.5. **Renewable energy and energy savings milestones by technology**

	2014/15	2016/17	2018/19	2020	% contribution to target
Energy savings goal %	7.0	12.0	17.0	20.0	
Consumption forecast (TWh)[a]	60.4	61.5	64.5	64.3	
Wind (MW)	250.0	400.0	600.0	800.0	29.0
Biomass and biogas	50.0	100.0	160.0	210.0	7.6
Large-scale solar (CSP and PV)	700.0	750.0	1 000.0	1 200.0	43.5
Medium-scale PV	350.0	350.0	350.0	350.0	12.7
Small-scale PV (up to 50 kW)	200.0	200.0	200.0	200.0	7.2
Total installed capacity (MW)	1 550.0	1 800.0	2 310.0	2 760.0	100.0
Renewable production %	5.3	6.5	8.3	10.2	

a) Assumes energy savings target is met.
Source: MoNI (2010).

StatLink http://dx.doi.org/10.1787/888932496007

The government has established a complex system of incentives to promote renewable energy with a view to achieving the 2020 target. Quota-limited feed-in tariffs have been set for several technologies. Further feed-in tariffs are anticipated in 2011 (Table 6.6). The premium payment is determined, *inter alia*, on the basis of saved external costs due to air and GHG emissions avoidance. The full feed-in tariff is available to developers for 20 years. The feed-in tariff for current quotas is set to be phased out by 2020.[22] The cost of the feed-in tariffs is fully passed on to consumers through electricity tariffs. Feed-in tariffs need to be frequently reviewed to take account of decreasing technology costs; this is particularly valid for household PV systems, whose cost is dropping rapidly. Government tenders are also used to promote renewable energy policy development where land is state-owned, as is the case of the majority of Israeli land. Two types of tenders have been used, based either on land rental cost or electricity price. Finally, an accelerated capital depreciation allowance of 25% is available for solar PV and solar thermal energy investments. However, while a large share of the available or intended quotas has been allocated for solar electricity generation, little progress has been made on wind and biomass production.

Table 6.6. **Feed-in tariffs for renewable energy projects**

	Feed-in tariff	Planned mechanisms	Projects under development
PV commercial	Set in 2008 and 2010	Feed-in tariff, quota based	50 MW in 2008. 120 MW in 2010.
PV Residential	Set in 2008	Feed-in tariff, quota based	Quota of 15 MW set in 2008, unlimited quota set for 2010.
PV medium	Set in 2010	Feed-in tariff, quota based	300 MW quota has been made available. Applications exceed 650 MW. The guaranteed price is about USD 0.04/kWh.
Thermo-solar or PV large-scale	Set in 2011	Mixture of tenders on land rental, electricity price and quota-limited feed-in tariffs	500 MW quota has been made available. Tenders on the price of electricity for three plants located in Ashelim (totalling 250 MW) were issued in 2007. A price equivalent to about USD 0.03/kWh has been guaranteed, but the project has been delayed. 60 MW tender for Timna planned 2011. A tender for a thermal solar plant of 280 MW has been launched.
Wind, small-scale residential and commercial	Set in 2009	Feed-in tariff, quota based	Quota of 30 MW announced.
Wind, medium- and large-scale	Announced in 2011	Mixture of tenders and quota-limited feed-in tariffs	155 MW project planned. Quota of 800 MW.
Biogas, biomass	Anticipated in 2011	Feed-in tariff, quota based	3-5 MW Abudis landfill in progress. Quota of 160 MW.

Source: Adapted from MoNI (2010) and Renewable Energy Association of Israel.

Complex, differentiated and technology-specific instruments may be required to promote renewables to the extent that such measures aim at long-term cost reductions rather than only short-term emissions abatement. They can also be justified in the context of Israel's complex land ownership patterns. However, use of overlapping instruments creates challenges. For example, failure to complete the Ashalim tender for a large-scale plant has had the knock-on effect of delaying the announcement of the feed-in tariff available for additional large-scale solar plants for fear it might interfere with the tendering process.[23]

Several obstacles must be overcome if policy implementation is to be effective in the coming period. The field of renewable energy is regulated by government decisions which are not legally binding, the division or responsibilities is unclear, and policy co-ordination among actors responsible for meeting targets is poor. While, for example, the Ministry of

National Infrastructures has instructed the energy regulator (the Public Utilities Authority – Electricity, PUA) to introduce feed-in tariffs for various renewable technologies, the legal basis under which the PUA might do so is not clearly established. In particular, cross-subsidisation of tariffs remains prohibited.

Furthermore, financial incentives to develop renewable energy projects are inconsistent and, to some degree, offset by charges associated with re-zoning of land. In the case of privately owned land, re-zoning which increases the value of land will result in a 50% tax on the increased land value, to be paid to the local zoning committee. If the land is publicly owned, lease tariffs are set by a property evaluator appointed by the Israel Land Authority on a case-by-case basis. Several methods may be employed to conduct the evaluation, resulting in varied and unpredictable outcomes.

The re-zoning process itself is complex and time-consuming. The majority of land suitable for large-scale renewable energy projects in Israel is used for agriculture, and there is an ongoing debate concerning the use of agricultural land. There are further differences of opinion among government agencies regarding the extent to which natural spaces should be preserved. The Ministry of the Interior has been tasked with developing a strategic plan which would identify suitable areas for renewable energy development, with the objective of streamlining the re-zoning process. As part of this process, a National Master Plan for Solar Installations was developed in 2010.

Although the land requirements associated with renewable energy development are not insignificant, at an estimated 33 km^2 in the period to 2020, this represents only a small fraction of the total land area of the Negev and Arava regions (which have a total area of 14 200 km^2). The extent to which land shortages *per se* are the central obstacle is therefore debatable. These areas have become increasingly drought prone, and the impacts of climate change are projected to become more pronounced in the future. The cost of keeping desert land in agricultural use requires careful re-evaluation to take account of this evolving context.

A final challenge surrounds upgrading the grid to facilitate the increased penetration of renewables. For example, the grid in the Southern Arava region (which has the highest potential for solar power in Israel) can accommodate only 100 MW of electricity. The Timna tender envisages 60 MW in the region, and several additional projects are at various stages of development. Grid upgrades are the responsibility of the Israel Electric Corporation (IEC), yet approval by the MoNI is required and lack of co-ordination can delay projects considerably. Formidable procedural obstacles put in place by the IEC also make securing connection to the grid challenging for renewable projects, even when the necessary grid upgrades have been delivered (Mor and Seroussi, 2007).

If these difficulties are to be overcome, a firm sense of direction will be required from central government, along with a more co-ordinated approach to implementation involving all stakeholders and government agencies. To achieve renewable targets, it is essential for the Ministry of the Interior's strategic plan to bring forward clear and binding guidelines, to be followed by the relevant zoning committees and government agencies. There are also opportunities to speed up and twin-track the application process for building permits, electricity production licenses and grid connection licenses.

5.3. *Energy efficiency in electricity consumption*

Energy consumption grew dramatically during the last decade, especially in the residential and commercial sectors, which account for more than 35% of final energy use (Figure 6.6). Electricity demand, in particular, grew considerably due to rapid population growth and wider use of electrical appliances, including air conditioning, coupled with higher incomes.

An Energy Master Plan, published in 2004, first identified cost-effective savings equivalent to 20% of energy use. A limited number of initiatives were subsequently introduced. Energy service companies were licensed to harness energy efficiency potential, particularly in the public sector, and voluntary standards were developed to enhance efficient energy use in the building sector,[24] although these are seldom applied in practice.

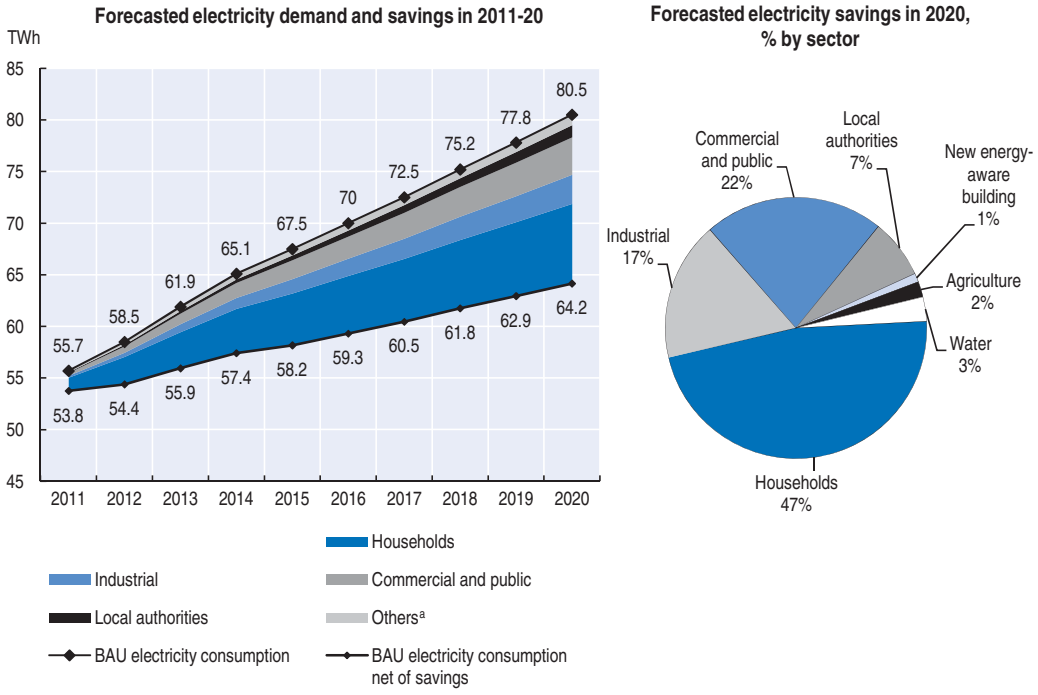
In 2008-09, several regulations and standards were published on energy efficiency and the energy labelling of electrical appliances (including refrigerators, air conditioners, dishwashers, washing machines, baking ovens and clothes dryers), in addition to regulations and standards published in previous years. An energy conservation campaign was also inaugurated by the MoNI, the MoEP and the IEC to raise awareness of energy efficiency among the general public. In 2009 and 2010, the MoNI published several tenders related to energy efficiency, including pilot projects for the distribution of energy efficient light bulbs, energy efficiency in hotels, energy efficiency in government buildings, and small-scale energy efficiency projects.

A new government target of achieving a 20% savings in anticipated electricity consumption by 2020 was adopted in September 2008. The 2010 National Energy Efficiency Programme (NEEP), prepared by the MoNI, is expected to achieve about 16 TWh of savings in electricity demand by 2020 (Figure 6.7). This would imply reducing average growth in electricity demand from 3.9% per year under a business-as-usual scenario (comparable to the estimated GDP growth) to 1.6% per year. This rate is comparable to estimated population growth and implies stabilising electricity consumption per capita during the next decade (OECD, 2011). The NEEP will then contribute to reducing GHG emissions by 12 Mt CO_2 eq by 2020.

The NEEP establishes savings targets by sector. Most of the savings are intended to be achieved in the household, commercial and public sectors (including local authorities) (Figure 6.7). The programme sets out several measures and an implementation schedule between 2011 and 2020 for each sector. Among these measures are: introducing regulatory changes, such as higher energy efficiency standards for electrical appliances, light bulbs and industrial equipment; subsidising the replacement of appliances for low-income households; a light bulb replacement programme; investments in the public sector;[25] tax incentives (*e.g.* an accelerated depreciation rate and tax benefits for investment in energy-efficient devices) for the business sector; and public information campaigns. The NEEP is expected to cost about NIS 200 million per year, mostly to cover the various subsidies and investment schemes, compared to overall estimated cost savings for the economy of USD 4.35 billion by 2020 (due to avoided additional electricity generation capacity). About 75% of the funds are allocated proportionally to the expected savings from implementation of each measure. The remainder is reserved for so-called "systemic" measures such as regulation, awareness campaigns and enforcement.

The market failures which prevent these negative-cost investments from being made have been well-documented (IEA, 2007).[26] To overcome these market failures, the action plan proposes the establishment of an energy efficiency fund financed by a surcharge on the unit price of electricity. This is expected to provide an additional incentive to reduce electricity consumption. The surcharge has been determined so that it is comparable to the

Figure 6.7. **National Energy Efficiency Programme**



a) Includes savings to be achieved in the building (new energy-aware buildings), agriculture and water sectors.
Source: MoNI (2010).

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electricity price increase that would be required to fund additional electricity generation if the energy savings were not made. It is estimated to yield about NIS 200-250 million per year, covering the programme's expected implementation costs. The establishment of an energy efficiency fund could be a positive development if interventions targeted measures with a positive net present value when environmental benefits are included. It is also important that market failures which prevent private sector investment are identified and targeted. On the other hand, a fund can lock in a spending commitment and therefore reduce government flexibility in responding to changing fiscal circumstances.

There is currently little data available on energy efficiency in the Israeli economy, and great uncertainty exists about the impact of the National Energy Efficiency Programme. For the programme to be effectively implemented, a clear standard for measuring savings will be required, as well as benchmarking of progress towards achieving objectives. For these reasons, any proposed fund should be subject to periodic performance reviews together with the planned annual evaluation of the programme.

Regulatory instruments are also important in the energy efficiency field, particularly for buildings and appliances. Buildings account for some 60% of total electric power consumption in Israel. Israeli buildings suffer from poor standards of thermal energy efficiency, the energy performance of buildings is poorly understood, and no tools are available with which homeowners can make informed rental and purchase choices in the absence of a building energy rating standard. The current voluntary green building standard is under revision, although it is unclear whether the revised standards will include a mandatory component. Requiring high standards of energy efficiency in new buildings is more cost-effective than attempting to retrofit at a later date.

6. Policies and measures in the transport sector

As in many other OECD countries, transport is a major source of emissions of GHGs and air pollutants (Section 2). Energy consumption from transport continued to increase during the 2000s, although at a lower rate than in the previous decade (Figure 6.8). It currently accounts for 27% of Israel's final energy consumption. Rapid population and economic growth has led to increased transport demand. Road transport is by far the dominant transport mode. The total number of vehicles in Israel (including passenger and heavy goods vehicles) grew by 34% between 2000 and 2009. Private car ownership also increased, although it remains well below the OECD average (Figure 6.8). The average distance travelled per car journey also increased significantly during the past decade, with the use of roads by cars, trucks and buses all recording increases. Increased vehicle usage was facilitated by a multi-billion dollar investment in national road infrastructure, which significantly outstripped investment in rail during the review period (Figure 6.8).

While there has been a major increase in the number of railway passengers, which reached 35 million in 2008, the share of bus journeys has decreased, mainly in favour of those by private car. Overall, public transport use declined during the review period (Figure 6.8). Private cars accounted for a relatively lower share of travel (in passenger km) than in the EU15, whereas buses accounted for over 20% of travel compared to less than 9% in the EU15 (where, however, railway transport is more developed and more widely used).

A government decision on the reduction of air pollution from transport sources was approved in September 2007. This decision resulted in the implementation of a number of measures, including the review of vehicle and fuel quality standards on the basis of the most recent European standards and the introduction of tax incentives (Section 6.2). Leaded petrol was phased out in 2004. The 2008 Clean Air Law mandates the MoEP to revise existing regulations. The 2007 government decision did not include GHG emissions from transport, and the contribution of the transport sector to Israel's climate mitigation strategy has not yet been clarified.

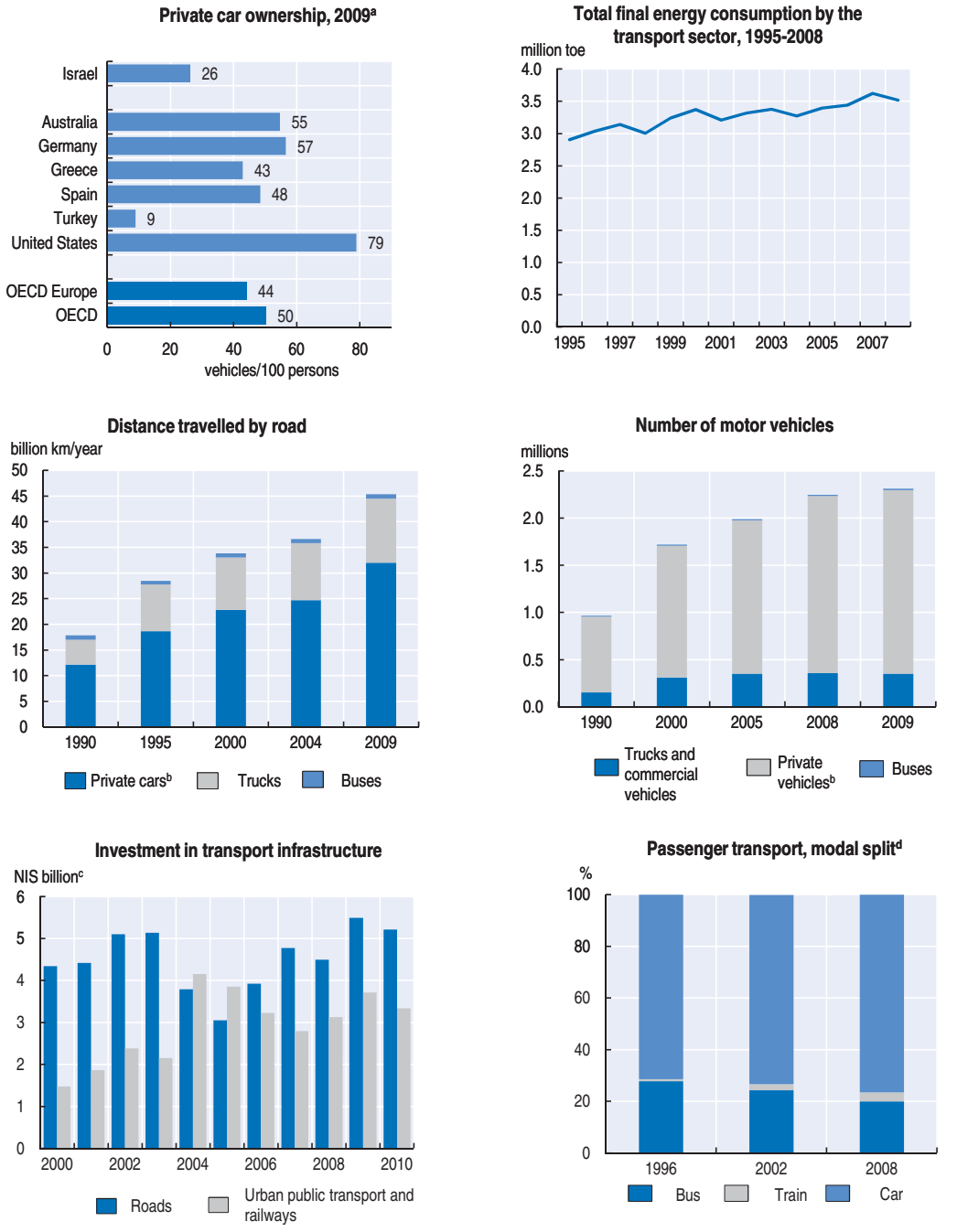
6.1. Investing in public transport

Public transport mostly consists of state-subsidised bus services. However, efforts are being directed towards encouraging a modal shift in the direction of more rail transport, although with slow progress. A development plan for railways for the period to 2017 has been published, calling for the prioritisation of investment in public transport over roads in the coming period. It envisages an investment of NIS 15 billion in the years 2010-17,[27] with a focus on connecting outlying regions with the centre. The most significant project is the fast train between Tel Aviv and Jerusalem, which is planned for completion in 2017. Light rail projects are well-advanced in Jerusalem, with full commercial operation of the light rail beginning in August 2011. These projects are still at an early stage in Tel Aviv.

To enhance the service offered by public transport, in 2008 the Ministry of Transport and Road Safety published a report calling for the establishment of a National Public Transport Authority. It would regulate the quality of services, improve the integration of routes, and provide better information to commuters on services provided. The report also proposed a Tel Aviv Regional Public Transport Authority to integrate services offered in the region, which are currently poorly co-ordinated.

An increasing emphasis was also placed during the review period on the link between land use and transport planning in policy making. Both the Green Taxation Committee and

Figure 6.8. **Key trends in the transport sector**



a) Or latest year available.
b) Excluding taxis and minibuses.
c) At 2009 constant prices.
d) Based on values expressed in passenger-km.
Source: CBS; MoEP (2010); Ministry of National Infrastructures; OECD, Environment Directorate; OECD-IEA (2010), *Energy Balances of Non-OE(Countries Database.*

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the MoEP have identified the role played by poor planning in locking in car-dependent lifestyles and have recommended that planning policy be used to counteract this trend.

The Comprehensive National Master Plan for Land Transport Infrastructure (Plan 42) is being developed to respond to these challenges. Plan 42 sets ten objectives, including integrating land use and transport infrastructure planning, reversing the trend in the modal shift to private cars, and establishing a national plan for transport infrastructure.

6.2. Market-based incentives

Following the 2007 government decision on the reduction of air pollution from road transport, the government introduced a vehicle scrapping scheme, which provided a subsidy for scrapping vehicles more than 20 years old whether or not a new vehicle had been purchased. The vehicle purchase tax was also adjusted according to a "green index" as from August 2009. The new tax varies according to the level of emissions of air pollutants (NO_X, CO, PM_{10} and hydrocarbons) and CO_2.[28] Car buyers are thus given less incentive to favour diesel vehicles, which tend to emit less CO_2 and more local pollutants per kilometre driven than petrol vehicles, than in the case of a tax differentiation based exclusively on CO_2 emissions. This avoids over-incentivising diesel vehicles, a desirable outcome in view of the relatively high air pollution in Israel's urban areas. Particularly low taxes are imposed on hybrid and fully electric vehicles. However, the overall level of taxation on car purchases remains very high and potentially highly distortive (Chapter 1).

In the first year of implementation, the impact on the CO_2 emissions performance of vehicles has been relatively modest, falling by 2.6% compared to a much larger decrease in emissions of NO_X and PM (Table 6.7). Average GHG emissions per kilometre travelled by a new car sold in Israel are 177 g CO_2/km, still very high compared to the EU average of approximately 140 g CO_2/km in 2010 (EC, 2010). Diesel cars continue to account for a very low share of the fleet (less than 3%) compared to other OECD countries. However, the number of diesel cars has continued to increase, including after the change in the purchase tax, and despite diesel prices being higher than those of petrol in 2008 and 2009 (Figure 1.5).

Table 6.7. **Impact of green motor tax reform on vehicle emission performance**

	June 2008-July 2009 g/km	August 2009-June 2010 g/km	% change
CO_2	181.8000	177.1000	–2.6
NO_X	0.0360	0.0290	–17.8
CO	0.3520	0.3410	–3.4
PM	0.0012	0.0009	–24.2

Source: Israeli Taxation Authority, 2010.

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As explained in more detail in Chapter 1, distortionary incentives for car ownership persist, leading to higher emissions from the transport sector than would otherwise be the case. In the banking and civil service sectors, for example, allowances are available for car ownership. Company cars, which account for a relatively large share of this overall car fleet, benefit from a favourable tax treatment that allows unlimited travel and creates a zero marginal cost for car users (OECD, 2011). Free parking is also provided by many employers, and no tax is paid on this benefit.

Israel should consider correcting these perverse incentives for car ownership and use, and using taxes and charges to target car use (*i.e.* the activity generating the environmental costs, rather than ownership). The Bank of Israel (2010) compared the impact on distance travelled of similar tax revenue increases generated by raising the vehicle purchase tax and the petrol tax. It found that an increase in the petrol excise duty would reduce distance travelled more than three times as much as an increase in the purchase tax.

Transport fuel prices in Israel are already among the highest in the OECD, especially for diesel and when purchasing power parities are taken into account. This is partly due to relatively high pre-tax prices, as the share of taxes (including VAT) in fuel prices is lower than in a number of other OECD countries. While lower than that on petrol, the excise duty on diesel is among the highest in the OECD. However, there is some scope to further increase fuel taxation, and the government should continue with its plan to equalise tax rates on transport fuels. As in all OECD countries, excise duty rates on transport fuels are very much above those on fuels for stationary installations and those that would be implied by a carbon price around the rate at which CO_2 emissions allowances are traded in the EU (EUR 15 CO_2/tonne) (Table 6.4). Therefore, accounting for excise duties in terms of environmental externalities requires either the assumption of a higher carbon price and/or consideration of other externalities such as air pollution (OECD, 2011).

The use of road pricing or charging schemes has been limited in Israel. The introduction of an electronic toll system on the main highway to Tel Aviv from the eastern part of the country in early 2011 was a positive step forward. One lane is reserved for paying customers; tolls are paid through the internet and vary on a real-time basis, depending on traffic conditions. The impact of this system should be carefully monitored. If it is successful in reducing congestion and/or emissions, it could be extended to other congested motorway stretches. Moreover, congestion or pollution charges could be considered for the metropolitan areas of Jerusalem and Tel Aviv, which suffer from high levels of congestion. The possibility of introducing such schemes is currently limited by co-ordination difficulties between the municipalities and the central government. However, to be effective in encouraging a modal shift away from private cars, implementation of road charging schemes and an increase in fuel taxation would also require the development of a more widespread and integrated public transport network.

7. Policy and measures in other sectors

7.1. Waste

At the end of the 1990s, the MoEP initiated the collection of methane from landfills for the purpose of reducing environmental hazards and GHG emissions. This was one of the biggest successes in Israeli climate policy during the review period. Most of Israel's operational landfills collect methane, with a 40% collection rate compared with total methane emissions from this source. Some facilities use the collected methane to produce energy at three installations, with a total capacity of 5.1 MW, while others transfer it to a thermal treatment plant for burning. An additional 12 wastewater treatment plants (representing 28% of the wastewater treated in Israel) collect methane from sludge. The economic potential of methane collection and use is being examined for the remaining 52 closed landfills whose restoration is planned.

To reduce the amount of waste disposed in landfills, and associated emissions, efforts have been made to increase the waste recovery rate through legislation, economic

incentives and education. A landfill levy was introduced in 2007. Its objective is to reflect the true cost of landfilling; one of the main components of the cost is the emission of methane from decomposition of organic matter in landfills (Chapter 7).

7.2. Agriculture and land use

The Israeli agricultural sector is highly efficient in its use of resources. Agricultural policies have indirectly contributed to meeting national climate change policy goals during the review period.

From 1999 to 2007, the MoEP provided NIS 493 million in investment grants to facilitate enhanced environmental standards on dairy farms. The reform programmes on livestock farms have led to an increase in manure recycling and advanced waste treatment methods, and to the establishment of regional manure collection and recycling sites. These reforms have probably also led to a lower rate of ammonia emissions (OECD, 2010), although emissions were not monitored during the review period. Furthermore, the installation of cooling systems on dairy farms has led to an increase in milk production and a net reduction of methane emissions.

The improvement of fertilisation practices has helped reduce the contribution of agriculture to GHG and ammonia emissions.[29] Since the late 1990s, a decline in inorganic fertiliser use has also been observed in Israel, mainly because of the increased use of reclaimed wastewater (with its high nutritional value) for irrigation. Almost all the waste from livestock manure and about half of sewage sludge are currently recovered for use in the agricultural sector, according to stringent regulations set by the MoEP and the Ministry of Health.

Israel is a leader in resource and nutrient management in agriculture. No reliable data are available, however, for the GHG emissions efficiency of Israeli produce measured on a life cycle basis. International comparisons would therefore be impossible. This may be an avenue by which Israel could gain a competitive advantage in the marketplace for the produce, technologies and farming systems it has developed.

Afforestation programmes have been pursued for several decades, resulting in a net removal of CO_2 from the atmosphere. In 2007, Israel's forest area included 83 200 ha of plantations[30] and about 99 400 ha of natural woodlands. Although most forests are composed of conifers and broad-leaved species, the relatively small area planted in eucalyptus contributes about 12% of CO_2 removals.

Notes

1. "F gases" are hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). For the purposes of all GHG comparisons during the review period, "F gases" will not be included since data on them became available for the first time in 2008.
2. "F gases" not included.
3. No breakdown is available for emissions from private transport, public transport and freight, although emissions from "international bunkers" (aviation and shipping) not included in Israel's official inventories were 3.5 Mt in 2007, a 26% increase on 2000 levels.
4. It is unclear whether the decline in CO_2 emissions is attributable to policies and measures implemented during the review period, structural changes in the Israeli economy, or changes in the manner in which inventories are calculated.
5. The Haifa Bay area, in the north of the country, hosts the petrochemical industry, which is characterised by heavy oil consumption. Israel's largest coal-fired power plant is located in Hadera, a short distance to the south. In the southern coastal area, two major industrial zones in Ashdod

and Ashkelon include an oil refinery, recycling of sulphur and metals, fertiliser manufacturing, a natural gas power plant and a coal-fired power plant. The Ramat Hovav industrial zone in the Negev is home to the chemical industry, characterised by large quantities of hazardous materials, and to the national site for the disposal and treatment of hazardous waste.

6. For example, adult mortality due to long-term exposure to $PM_{2.5}$ and to ozone in Greater Tel Aviv in 1995-99 was estimated to be 8 and 1% of the yearly baseline mortality, respectively. In Greater Tel Aviv in the period 1997-99, an estimated 20% and 14% of yearly recorded respiratory diseases in children were related to PM_{10} and to $PM_{2.5}$.

7. United Nations Framework Convention on Climate Change, 1992, Article 4.

8. The business-as-usual scenario includes prevailing emissions trends and existing government policies as of 2009.

9. The accord recognised that deep cuts in global emissions would be required "so as to hold the increase in global temperature below 2 degrees Celsius" and that action should be taken "consistent with science and on the basis of equity". Developed countries' pledges to cut GHG emissions were subsequently formally recognised at the 16th Conference of the Parties, although they remain non-binding.

10. The UK Climate Bill (2008) sets out a robust climate policy framework which: makes GHG reductions targets for 2020 and 2050 legally binding; introduces a system of "carbon budgeting" that caps emissions over five-year periods; establishes an independent body to advise on the setting of carbon budgets and to report on progress; and introduces a system of government reporting to Parliament, including on climate change adaptation policies.

11. Under the Abatement of Nuisances Law, the Minister of Environmental Protection can address administrative orders (personal decrees) to operators of existing industrial and energy facilities indicating specific requirements to prevent and reduce their emissions.

12. There will be an air permit fee, consisting of a substantial one-time fee and an annual fee, depending on the economic sector's environmental impact. The revenue will go to the general budget.

13. Business licensing conditions also include stack sampling and monitoring and reporting obligations.

14. While the rewarding mechanism would provide incentives to abate emissions at the installation level, it can have the perverse effect of increasing aggregate emissions by attracting more firms into the market. Insofar as there is some level of discretion in setting the permitted emission level, installations also have an information advantage over the regulator.

15. Under the Clean Air Law, a pollutant is defined as a material whose presence in the air causes or is liable to cause changes in climate, weather or visibility.

16. In the transport sector, for example, sub-sectoral data are unavailable on emissions from freight, private transport and public transport. In the agricultural sector a rapid decline in CO_2 emissions is evident, for which no explanation is available.

17. Examples of international best practices include Annual Progress Reports from the UK Climate Change Committee and the Irish Environmental Protection Agency's annual emissions inventory report.

18. There can be cases in which a fee is required to cover the cost of handling a large information set.

19. This is a financial instrument that allows international trade in GHG permits. Under the mechanism, Annex I parties to the Kyoto Protocol may acquire emissions reduction permits from non-Annex I parties instead of reducing their own emissions. Permits are generated by projects in non-Annex I countries which reduce emissions and are certified by the UNFCCC.

20. CO_2 emissions are valued at USD 22 per tonne of CO_2 (or USD 0.0164/kWh). The shadow prices for emissions of air pollutants from electricity generation are USD 7 420/tonne, USD 4 297/tonne and USD 10 590/tonne (or USD 0.012/kWh, USD 0.007/kWh and USD 0.0006/kWh) for SO_2, NO_X and particulate matter, respectively.

21. Almost 200 bcm of natural gas was discovered at the Tamar field in 2008. An additional discovery at the Leviathan field in 2009 may contain 400 to 500 bcm of natural gas, according to the Israel Electric Corporation (IEC).

22. Quotas are allocated on a first-come, first-served basis. The feed-in tariffs for the current quotas vary between NIS 1.51/kWh for small facilities (up to 50 kW) and NIS 1.02/kWh for large installations (above 50 MW).

23. The flagship large-scale project, the Ashalim tender in the Western Negev region for an estimated 250 MW of solar energy, has not been delivered and has suffered a series of delays. The MoNI officially

called for tenders from energy companies in 2007 with the understanding that the power plant would be build-operate-transfer (BOT). The tenders committee hoped to complete the entire tendering process by the fourth quarter of 2008, but the financial aid criteria for the winner have yet to be formulated.

24. Israel Standard 5281 for "green" buildings 2005; Israel Standard 5282 Part 1 for energy rating of buildings (2005); and Israel Standard 5282 Part 2 (2007) for energy rating of office buildings.

25. While ministries that invest in energy efficiency will be able to withhold any resulting budget savings, those that fail to achieve energy efficiency objectives will experience budget cuts.

26. In the building sector, principle-agent difficulties create barriers to investment in high-energy standards by developers, which will not be paying energy bills. In cases of investment in building retrofit and high efficiency lighting, lack of information, lack of access to private capital and high discount rates may prevent homeowners and businesses from making investments with reasonable returns.

27. There may be additional investment in rail.

28. The green index is to be revised on the basis of updated estimates of the social, environmental and health costs of pollution from transport, to be produced by the MoEP in 2011.

29. Nitrogen fertiliser is applied through pressurised irrigation systems, which can reach 85-95% efficiency.

30. Including 50 300 hectares of conifers, 8 000 hectares of eucalyptus and 24 900 hectares of broad-leaved species.

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PART II

Chapter 7

Waste management

Population growth, rising standards of living, and rapid industrial development are the major drivers of increasing waste generation. While Israel has largely succeeded in curtailing illegal dumping and in closing unregulated dumps, which were major problems in the 1990s, the vast majority of waste is still disposed in landfills. Israel has responded to these challenges by adopting waste management plans and legislation in line with good international practices. This chapter takes stock of such policy initiatives, including those that aim to reduce waste generation, encourage recovery and recycling, and ensure safe disposal of municipal and hazardous waste. It discusses the environmental and economic implications of recently implemented measures such as Extended Producer Responsibility systems and a landfill levy, as well as of the lack of explicit waste collection charges. The challenge of remediating contaminated land is also examined.

Assessment and recommendations

Demographic and economic trends have resulted in an increase of about 15% in municipal waste generation in Israel over the last decade, but the growth was relatively decoupled from the growth of GDP and private final consumption. Despite new policy initiatives in the second half of the 2000s, municipal waste generation per capita in 2009 was among the highest in OECD countries. Throughout the decade, Israel continued its efforts to exercise adequate control over unregulated waste dumping, a major problem in the 1980s and 1990s. Significant improvements have been made to ensure safe operation of landfills, which remain the principal means of municipal waste disposal. However, challenges remain and strong local opposition has impeded the opening of new landfill sites.

Two recent policy initiatives provide a basis for developing a modern waste management policy, in line with good international practices. The 2006 Sustainable Solid Waste Management Master Plan identified priorities, set ambitious goals for waste recovery and recycling, and led to the introduction of a set of new policy instruments including a landfill levy and Extended Producer Responsibility schemes. In 2010, the Recycling Action Plan reinforced some of these measures and provided a basis for separate waste collection and recycling for household waste, with an emphasis on organic waste which could support greater use of composting, anaerobic digestion and waste-to-energy. The Action Plan established an ambitious target of reducing the share of municipal waste in total waste subject to landfilling, from the current 87% to 50% by 2020.

Municipalities have the main responsibility for delivering waste services. Private operators account for 20% of waste collection, and there is evidence that in some cases their operations are more efficient than municipal utilities. A greater role for the private sector in this area has been blocked by labour union opposition. Nevertheless, the private sector is playing a bigger role in waste treatment and disposal. Introducing more competition between public and private operators across the range of waste management activities, with appropriate regulation, has the potential to reduce costs and improve service quality. This should be supported by measures that allow for greater recovery of costs, including: waste collection charging based on the real costs of the service; gradual introduction of weight- or volume-based charging for mixed waste; and increased use of composting, anaerobic digestion and waste-to-energy solutions.

The introduction of Extended Producer Responsibility (EPR) for beverage containers and used tyres has resulted in higher rates of collection. A similar system for packaging was introduced in 2011 and a voluntary system has been introduced for waste paper recovery and recycling. These systems could be extended to a range of other products (*e.g.* batteries, waste electric and electronic equipment, vehicles), as has been done in other countries. However, the system design should address existing organisational and recycling market failures and ensure that efforts to reduce environmental impacts from post-consumer products maximise social welfare. Further efforts are needed to make the construction industry responsible for its waste. However, so far the EPR schemes have not

resulted in a significant increase in the rates of recycling and recovery of municipal waste. One of the main obstacles is the low cost of landfilling. Introduction of the landfill levy and a recent increase of its rate were important steps to address this problem, but so far it has not raised the cost sufficiently. Nevertheless, the revenue generated by the levy has been used to support several pilot projects in municipalities.

Good progress has been made in managing industrial waste, of which 60% is recycled. Generation of hazardous waste has grown rapidly (by 33% between 2000 and 2008) while capacity to treat and dispose it safely has not kept pace. Lack of adequate waste collection infrastructure in some areas has led to landfilling of hazardous (*e.g.* medical) waste in municipal landfills. The regulatory framework for hazardous waste management is fragmented and needs to be consolidated in a new law. Co-operation with the business sector could be strengthened, with a view to developing voluntary initiatives and preventive actions.

Contaminated soil has been identified at a number of locations. It is largely the result of past industrial and agriculture activities, or of inadequate waste disposal and treatment. Some measures have been taken to identify the most severely polluted sites and to formulate clean-up requirements. Technical remediation measures have also been implemented, including at one of the most affected sites at the Ramat Hovav industrial zone in southern Israel, and the site of the country's main hazardous waste disposal facility. However, progress has been slow due to the high costs of the clean-up and unresolved issues concerning liability for past pollution. Resolving these problems will take decades. In the short term, a more comprehensive framework should be established for identifying priority problems that pose the greatest risk to human health and the environment. The rapid adoption of the law on the Prevention of Land Contamination and the Remediation of Contaminated Land should provide a good basis for comprehensive rehabilitation efforts.

Recommendations

- Review current arrangements for the management of waste, including hazardous waste, and consolidate them in a comprehensive and coherent new policy, possibly a new law, and an action plan.
- Strengthen national and local efforts to address remaining problems with unregulated waste disposal, in particular: identify alternative landfill locations for Jerusalem's waste disposal; strengthen responsibilities of the construction sector for treatment and safe disposal of construction and demolition waste; and accelerate measures that would help to discontinue direct discharges of sewage sludge to the Mediterranean Sea.
- Increase the level of the waste collection component of the municipal property tax to reflect the real costs of the service; gradually introduce volume- or weight-based waste disposal fees for mixed waste; identify and exchange good practice approaches for waste management among municipalities.
- Building on pilot projects, roll out the programme for separate collection of dry and organic waste to all municipalities; develop the related treatment infrastructure, including a wider use of waste-to-energy solutions, and engage the private sector in this effort.

Recommendations *(cont.)*

- Broaden Extended Producer Responsibility systems to other priority waste streams, including batteries, waste electric and electronic equipment, and vehicles; strengthen the collection and safe disposal of used oils and car oil filters; ensure that their design and implementation is effective and efficient.
- Develop a comprehensive legislation on liability for past pollution and a programme for the remediation of contaminated sites, providing adequate resources and using risks to human health and the environment to prioritise actions.

1. Policy and institutional setting

1.1. Policy objectives and regulatory development

Israel's waste management policies and regulations have evolved from addressing unregulated waste dumping in the 1980s to the current focus on integrated waste management, which promotes reduction at source, reuse and recovery.

Although the first regulations concerning the effective disposal of solid waste date back to the 1970s, illegal and unregulated waste disposal was common throughout the 1980s. In recognition of the seriousness of the situation, the 1984 Maintenance of Cleanliness Law (still in force) introduced fines for individuals and legal persons dumping waste in the public domain and called for establishing a limited number of properly managed landfills.[1] The 1984 Law and further regulations in 1986-87 established the Cleanliness Maintenance Fund, through which fees and fines applied under various environmental laws were earmarked for strengthening waste disposal and treatment. The 1989 National Outline Plan for Solid Waste (NOPSW) was the first comprehensive attempt to regulate the locations and operational criteria for waste treatment and disposal sites, in particular for municipal waste. Since then, new sites have had to be approved by the National Building and Planning Board (NBPB), Israel's highest planning authority. However, the Outline Plan did not set a timetable for shutting down unauthorised landfills or establishing new ones that would meet appropriate sanitary and environmental standards. It stopped short of creating a framework for comprehensive waste management (Nissim *et al.*, 2005).

The government decided in 1993 to close all unregulated waste dumps. Far-reaching amendments to the NOPSW determined the location of central sanitary landfills subject to environmental impact assessment procedures. In parallel, a regulatory framework for waste recovery and recycling was developed. The 1993 Collection and Disposal of Waste for Recycling Law, and further regulations promulgated in 1998, established waste recycling targets for local authorities: at least 10% by 1999, 15% by 2001 and 25% by 2008 (Nissim *et al.*, 2005). The 1999 Deposit Law on Beverage Containers introduced deposits on non-refillable beverage containers and required manufacturers, importers and retailers to collect and recycle these containers.[2]

Although illegal waste dumping was largely eliminated, landfilling remained the principal option for disposing non-hazardous waste in Israel during the 2000s. In view of the growing volume of waste generated, and concerns about land scarcity, the government and the National Building and Planning Board approved a new Sustainable Solid Waste Management Master Plan (SSWMMP) in 2006. This Master Plan introduced integrated waste management, based on the waste management hierarchy that governs waste

policies in other OECD countries.[3] The SSWMMP set new goals for national and local governments, including reducing the total quantity of waste in general and reaching a 50% recycling rate by 2015, subsequently pushed back to 2020.[4]

Adoption of the SSWMMP reinvigorated waste management efforts and stimulated the introduction of new instruments, including: a landfill levy (through the 2007 Landfill Levy Amendment to the 1984 Maintenance of Cleanliness Law); a system for recycling used tyres (through the 2007 Tyre Disposal and Recycling Law); broadening of the deposit-refund system for beverage containers (through the 2010 Amendment to the 1999 Deposit Law on Beverage Containers); and the Extended Producer Responsibility System for collection and treatment of packaging waste (through the 2011 Packaging Management Law).

The Recycling Action Plan adopted in 2010 is expected to be a turning point with regard to large-scale recycling of household waste, reduction of landfilling, and achieving the overdue target of 50% recycling of municipal waste. Changing the concept of waste management "from burden to a resource", the Plan envisages the simultaneous implementation of a mix of measures: increasing the landfill levy; providing dedicated assistance to local authorities in establishing systems for the separation of household waste into two streams, wet (organic) and dry (other mixed waste); strengthening existing Extended Producer Responsibility systems and introducing new ones; supporting the construction of recycling and energy recovery plants; and supporting the creation of markets for recovered products.

Less progress has been made in developing a policy and regulatory framework for hazardous waste management, with regard to which the 1993 Hazardous Substances Law remains the key legal instrument. New regulations under the 1993 law, currently being drafted, will change the methods of defining hazardous waste and prioritise hazardous waste management methods in line with EU requirements. They will also introduce better mechanisms for inspection and response to non-compliance regarding hazardous waste collection, transport, treatment and disposal.

There have been some amendments to the waste laws regulating the treatment and disposal of construction and demolition waste (*e.g.* the 2009 amendment to the Quarries Ordinance), but this sector is still not properly regulated. The new regulations are expected to transfer responsibility for appropriate management of construction and demolition waste to local authorities and construction companies, and to strengthen recycling and safe disposal.

Several contaminated sites have been identified, but progress in developing comprehensive rehabilitation efforts for thousands of contaminated "hotspots" which present risks to human health and the environment have been slow. In early 2011, approval of a law on the Prevention of Land Contamination and the Remediation of Contaminated Land was still pending.

1.2. Institutional framework

The Ministry of Environmental Protection (MoEP) prepares waste management policies and legislation.[5] Together with its regional offices, it co-ordinates waste management activities horizontally with other governmental agencies, especially the Ministry of Finance and the Ministry of the Interior, and vertically with local authorities. The MoEP also provides financial support to municipalities for waste management projects and for education and awareness-raising activities. It supervises a state-owned company that treats hazardous waste at Ramat Hovav in the Negev desert.

An important role is played at the national level by the National Board for Planning and Building (NBPB) under the Ministry of the Interior (MoI). The Board, comprising representatives of 11 ministries including the MoEP, as well as of local governments, academia and NGOs, is authorised to issue directives for the preparation of national master plans and to approve regional plans. It makes decisions concerning the location of waste management infrastructure across the country.

The MoEP's regional and local offices are responsible for implementing national environmental policy, which includes waste management policy. They participate in land use planning processes, define environmental conditions in the business licences of larger enterprises, monitor and enforce compliance with environmental requirements, and support regional environmental projects (Chapter 1).

The MoEP's compliance monitoring and enforcement functions, including for waste-related infringements, are carried out by the Green Police (Chapter 1). A major part of its activities is targeted at illegal waste disposal. In 2009, the Yahalom enforcement unit of 12 inspectors was created under the Nature and Parks Authority (NPA) for countrywide enforcement activities related to waste, especially illegal disposal of construction and demolition waste.

Municipalities, most of which have local environmental units subordinate to the MoEP, are responsible for organising the collection, storage and disposal of municipal solid waste according to national environmental and municipal laws. Waste collection in large cities is carried out by municipal sanitary units, while in most small municipalities services are subcontracted to private waste management companies. Municipalities are authorised to establish sites for landfills and to determine other waste disposal locations, in accordance with the Planning and Building Law and the SSWMMP and subject to approval by the NBPB. The 2008 Local Authorities Law (Environmental Enforcement – Authority of Inspectors) significantly enhanced the powers of local inspectors, including enforcement of the Hazardous Substances Law and the Environmental Nuisances Law (Chapter 2).

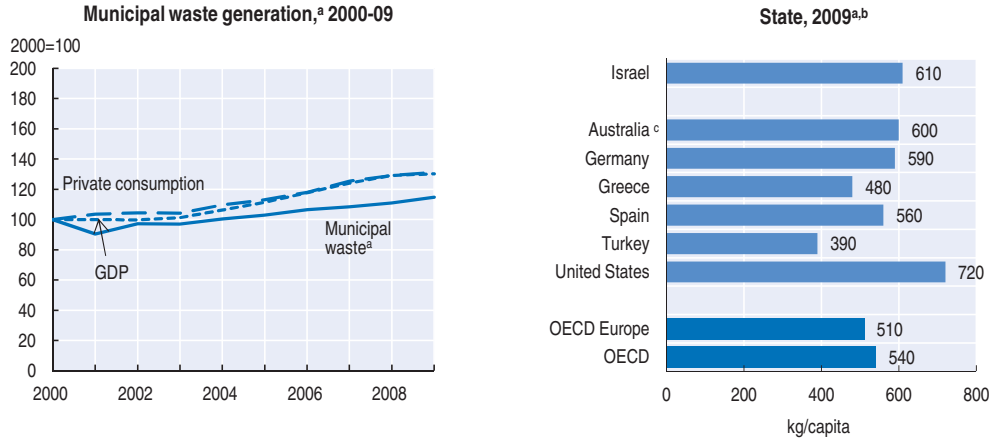
The private sector plays an increasingly important role in managing waste. The share of private operators in waste collection is relatively small (around 20%), but many treatment and waste disposal operations are managed by around ten large private waste companies. A number of small companies operate at the local level. Since 2001, the Eesuf le'ma'an Ha'Sviva Recycling Corporation (ELA), set up by soft drink manufacturers and importers, has been responsible for collecting and recycling waste beverage bottles under the Deposit Law on Beverage Containers.

2. Trends in waste generation

In 2009, nearly 15 million tonnes of solid waste was generated in Israel. This included 4.6 million tonnes of municipal waste, 4 million tonnes of excavation material, 3.5 million tonnes of construction and demolition waste, 1.4 million tonnes of non-hazardous waste from industry, and 1.2 million tonnes of fly ash from the coal-powered power plants at Hadera, Ashdod and Ashkelon. In addition, around 100 000 tonnes of sewage sludge (dry weight) is generated each year by 45 municipal wastewater treatment plants.

Population growth and rising standards of living resulted in a 15% increase in municipal waste generation during the last decade (Figure 7.1). While the increase was slower than the growth of GDP and private final consumption during the same period, the 610 kg of municipal waste generated per capita per year was well above the OECD and OECD Europe averages (Figure 7.1).

Figure 7.1. **Municipal waste generation**



a) Survey methods and definitions of municipal waste may vary from one country to another. According to the definition used by the OECD, municipal waste is waste collected by or for municipalities and includes household, bulky and commercial waste, and similar waste handled at the same facilities.
b) Or latest available year.
c) Household waste only.
Source: OECD, Environment Directorate.

StatLink http://dx.doi.org/10.1787/888932495570

The amounts of construction and demolition (C&D) and industrial waste have also increased since 2004, when statistics on these types of waste started to be collected separately. Annual C&D waste increased from 3.3 million tonnes in 2005 to 3.5 million tonnes in 2009. Annual industrial waste increased from 1.3 million tonnes in 2004 to 1.4 tonnes and 2009 (having peaked at 1.7 million tonnes in 2007 and 2008). These increases reflect accelerated activity in the construction and industrial sectors before 2009-10. The amount of fly ash generated by coal-powered power plants fell from 1.35 million tonnes in 2004 to 1.2 million tonnes in 2009 due to a switch to better quality coal.

According to a 2005 survey of solid waste composition, the organic fraction was the main component of the waste stream by weight, constituting 40% of collected solid waste (down from 50% in 1995), followed by paper (17%), plastic (13%) and cardboard (8%). Plastic waste accounted for 46% of waste by volume (up from 34% in 1995), followed by paper (15%) and cardboard (13%) (MoEP, 2008). The MoEP estimates that around 85 000 tonnes of waste electrical and electronic equipment is generated in Israel each year (about 2% of municipal waste), of which 77 500 tonnes from households. The majority of household e-waste (about 65% by weight) consists of large household appliances such as washing machines, refrigerators, freezers, dishwashers, tumble dryers, ovens and air conditioners (MoEP, 2008).

Rapidly developing industrial sectors have contributed to rapid growth in the generation of hazardous waste. In 2008, 321 000 tonnes of hazardous waste was generated, 33% more than in 2000 (Figure 7.2). The bulk of hazardous waste is generated by the chemical industry, which is concentrated in the Haifa Bay area in the north and in the Ramat Hovav industrial zone in the south. Other sources include hospitals, garages and the agricultural sector.[6] Small amounts of hazardous waste are exported and imported (Chapter 4).

Figure 7.2. **Hazardous waste, 2000-08**

a) Including imports and excluding exports.
Source: OECD, Environment Directorate.

StatLink http://dx.doi.org/10.1787/888932495589

3. Progress in environmentally sound management of non-hazardous waste

3.1. Municipal waste[7]

Addressing illegal and unregulated waste disposal

In the late 1980s and throughout the 1990s, Israel experienced serious problems in managing its waste. About 96% of municipal waste during this period was disposed in about 500 unregulated waste dumps throughout the country. These sites, often close to urban areas and lacking safety and sanitary measures, are considered to have adverse effects on the environment and health of local populations (Nissim *et al.*, 2005).

Following a 1993 decision by the MoEP and the MoI, 77 large, unregulated waste disposal sites were closed. This included the largest site, Hiriya, adjacent to Ben-Gurion International Airport.[8] The decision also involved intensive enforcement actions against the continuous use of such landfills. Between 1993 and 2003, more than 60 criminal proceedings were brought against municipal authorities and, in half of these cases, mayors were indicted. Fifteen cases resulted in criminal sanctions (MoEP, 2008).

Between 1994 and 2003, financial support of around NIS 400 million was provided by the MoEP to 107 local authorities (serving about half the population) to support closure of illegal landfills and to transport waste to new regulated landfills.[9] However, planning for new landfills was difficult, partly due to the limited choice of locations that would not negatively impact water resources, but also due to local opposition to the establishment of new waste disposal sites. In many cases, municipal authorities (with the full backing of residents) waged campaigns and court battles against plans for new landfills (Nissim *et al.*, 2005). In some cases, the opposition of nearby settlements had to be overcome by introducing a "host fee" (*e.g.* at the level of NIS 3.5 per tonne of waste disposed at the Duda'im site northwest of Beer Sheva and the Talya site south of Lake Kinneret, to be paid by the landfill operator to the regional council).

Currently, 16 regulated landfills are operated by the Israeli authorities. There are also 37 transfer stations, at 6 of which material recovery operations are carried out. In the

period 2000-09, the MoEP transferred nearly NIS 25 million to local authorities to upgrade existing waste disposal infrastructure. State-of-the-art landfills now operate at Duda'im (Ganey Hadas), Hagal (in the north), Nimra (near Eilat) and, most recently, Ef'e (in the south). Other sites have been upgraded to comply with strict environmental and sanitary requirements, or are in the process of being upgraded. Most regulated landfills have installed systems for leachate collection and treatment. Methane gas is captured at eight major landfills and used as an energy source. Two major landfills have an environmental liability regime in case of closure (effective for up to five years after closure), requiring restoration of the area to its previous state, dismantling of all infrastructure, and clean-up of the area.

While significant improvements have been made to ensure safe operation of landfills, and Israel's last unregulated waste dump at Retamim was formally shut down in July 2003, problems with safe waste disposal still exist. In several cases, continued use of illegal landfills was allowed until an alternative was found, which was often delayed due to both a long, complicated statutory approval process for new landfills (requiring approvals at the national, district and local levels) and strong local opposition (Nissim *et al.*, 2005). Waste disposal at the Abu Dis landfill, operated by the Israeli authorities, is particularly problematic as this landfill does not meet environmental and sanitary standards (MoJ, 2010). Although the site was originally scheduled to close in 2003, and has reached its capacity, it continues to receive waste and presents serious environmental and sanitary risks because of inadequate fencing, illegal dumping, burning of waste, and its location over an aquifer. In January 2010, the MoEP and the MoI acknowledged that this site failed to meet Israeli standards for landfills. It was announced that municipal waste would be directed to alternative sites and that the Abu Dis landfill would eventually be closed. The announcement was supported by the Mayor of Jerusalem, who outlined a five-year plan to address this issue. A number of decisions were made, including that 20% of the city's waste would be sent to the Ef'e landfill site near the Dead Sea and that a pilot project would be launched in two neighbourhoods to separate wet and dry (*i.e.* organic and inorganic) waste at the point of collection. Next steps include building a sorting plant for all generated waste by 2013 and a waste treatment plant by 2015. Waste-to-energy installations are also planned (MoJ, 2010).

Illegal waste dumping and waste burning close to urban areas still occur. Policies that address illegal waste disposal include increased monitoring, higher penalties for non-compliance, and educational campaigns. The Green Police of the MoEP have been responsible for most of the inspection and investigation activities. In the early 2000s, criminal charges were filed against about 15 of the 30 large waste transporting companies operating in the Haifa district, which were suspected of illegal waste dumping, mostly of construction and demolition waste, and criminal investigations were initiated (MoEP, 2008). To reinforce the response to non-compliance, the enforcement authorities launched waste truck seizure proceedings in 2004 based on provisions in the Penal Law which permitted seizure of the instrument used to commit an offense until trial. The Green Police and the ("blue") police in the Haifa district conduct joint inspections to discover waste offenders. In 2004, 11 trucks were seized and transferred to state custody pending trial.[10] This successful campaign brought about a decrease in illegal waste dumping (MoEP, 2008).

The rehabilitation of closed waste dumps has also been problematic. To date, only 10 sites have been rehabilitated and 35 sites are prioritised for immediate action. About

NIS 300 million is required to cover the rehabilitation costs, but these funds have yet to be allocated.

Strengthening waste collection

Virtually all Israeli households are served by waste collection systems. National regulations require municipalities to organise waste collection and transfer waste to treatment and disposal sites. Around 80% of collection services are owned by municipalities and operated by their sanitation departments. Formally, local authorities are free to subcontract a private company to collect waste. However, labour union opposition has generally prevented municipalities from outsourcing this service to the private sector. Some studies have shown that many private companies are providing better and cheaper waste collection services than municipal utilities (Simana, 2001). This suggests that further efficiency gains could be made by opening the waste collection market to competition. Despite their limited role in waste collection, private companies have been active in the construction and operation of waste transfer points, and have become partners in constructing and operating treatment and disposal facilities.

The cost of waste services is included in the municipal property tax (*arnona*), which is based on the size of dwellings or businesses in square metres.[11] However, the waste-related part of the tax is not explicitly shown on the bill, and there is no connection between the actual costs of waste collection and treatment and the share of the municipal tax dedicated to waste management. According to some estimates, this could be as low as one-tenth of the actual costs (Simana, 2001). On the other hand, municipal authorities have little discretion to set taxes. Any tax increase is subject to approval by the Ministries of Finance and of the Interior. Consequently, municipalities rely on budget balancing grants from the central government, as well as funding from the MoEP that supports waste collection and treatment infrastructure.

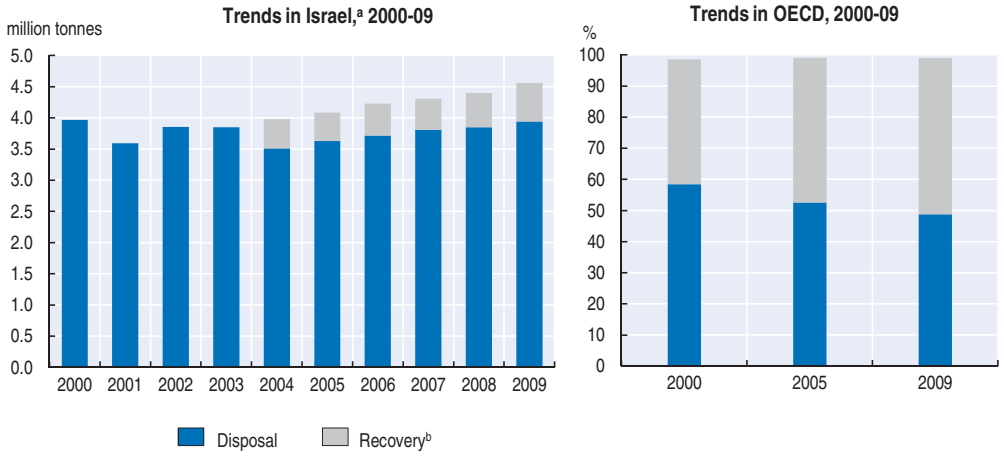
Some analysis has been carried out concerning the introduction of explicit volume- or weight-based waste collection charges for mixed waste (on top of a fixed component to cover overheads and management), based on experience in EU countries (MoEP, 2008). Such a system could provide incentives for waste separation and help to finance waste infrastructure. So far, little consideration has been given to how such a system could be introduced in practice. A dialogue among the key government agencies (the MoEP and the Ministries of Finance and of the Interior), municipalities and the private sector could help to identify steps that might be taken to move faster in this direction.

Encouraging municipal waste recovery and recycling

The share of waste subject to recovery and recycling (by weight) accounted for 13% of total municipal waste in 2009, only two percentage points higher than in 2004 (Figure 7.3). Most municipal waste recovery occurred through informal, voluntary and *ad hoc* schemes involving charities as well as small companies that collect reusable waste (*e.g.* textiles and electronic waste), which is sold on second-hand markets.[12]

Efforts have been made to encourage separate collection and recycling of specific waste streams under Extended Producer Responsibility (EPR) systems. EPR systems have been introduced for beverage containers, used tyres and packaging waste. Legislation has been an important driver, as it has been used to establish specific targets for annual collection and recycling, with timetables for implementation and deadlines after which landfilling of some of

Figure 7.3. **Municipal waste treatment, 2000-09**



a) Total waste collected for the period 2000-03 (breakdown by treatment not available). Disposal includes landfill only; recovery includes recycling and composting.
b) Material recovery plus energy recovery.
Source: OECD, Environment Directorate.

StatLink http://dx.doi.org/10.1787/888932495608

the waste streams (*e.g.* tyres and packaging waste) would not be allowed. Each programme has been supported by an analysis of benefits to the economy and environment. The EPR system for beverage containers, introduced in 2001, met its target of recovering up to 60% of containers introduced on the market in 2003. Further changes to the system broadened its scope and tightened targets. However, the system for recovery and recycling of used tyres encountered obstacles in the first years of implementation. The EPR for packaging, introduced very recently, will require further analysis and adjustments to make it fully operational (Box 7.1).

Box 7.1. **Extended Producer Responsibility systems in Israel**

Beverage containers

Provisions for separate collection of non-refillable beverage containers between 0.1 and 1.5 litre were introduced in 1999 through the Beverage Container Deposit Law. The law's main objectives were to reduce littering, reduce landfill volume, and encourage recycling and reuse of beverage containers. Consumers were required to pay a NIS 0.25 deposit on a purchased beverage container, to be reclaimed when the empty container was returned to the sales point or other collection point. The deposit was increased to NIS 0.3 in 2010. The ELA Recycling Corporation was set up by soft drink manufacturers and importers to organise the collection and recycling of waste bottles. The system was effective in raising the collection rate from 33% in 2001, when it started, to 68% in 2009. The Beverage Container Deposit Law also made provisions to continue the voluntary higher deposit on 0.5 litre glass beer bottles, of which around 90% are collected and reused after cleaning.

Producers and importers of plastic beverage containers with a volume of more than 1.5 litre have been subject to a cleanliness maintenance fee (0.25% of total sales/imports of beverage containers) since 1987. This fee has been paid into the Maintenance of Cleanliness Fund and used for environmentally related projects. The bottles have not been included in the deposit system, but have been voluntarily collected through street containers ("cages") provided by local authorities and private recycling companies. The current level of collection for this type of container is 18%. Since January 2011, the

Box 7.1. **Extended Producer Responsibility systems in Israel** *(cont.)*

cleanliness maintenance fee is no longer applied and beverage containers are subject to the provisions of the 2010 amendments to the Deposit Law for Beverage Containers.

The 2010 amendments to the Deposit Law for Beverage Containers established more ambitious collection targets. The target for collection of beverage containers smaller than 1.5 litre was increased to 77%. The obligation to take back empty small bottles at sales points has also been strengthened: shops are required to take back up to 50 containers per person per day, whereas some shops now refuse to accept such containers. The new law establishes compensation of up to NIS 1 800 for anyone denied the possibility to return a bottle. It also prevents reducing annual recycling targets. Non-compliance with targets leads to direct fines on manufacturers or importers. Provisions regarding larger beverage bottles (above 1.5 litres) were introduced, setting a target of a 55% collection rate. The system, which will be implemented starting in 2016, does not involve a deposit-refund system, but major manufacturers of large beverage bottles have adopted a voluntary action plan to significantly increase the distribution of bottle collection containers throughout Israel (up to 20 000, compared to 8 000 currently, with the goal of one collection container serving 400 residents compared with 1 500 residents today).

Used tyres

The 2007 Tyre Disposal and Recycling Law regulates the disposal and recycling of some 3 million waste tyres every year. It made tyre producers and importers responsible for collecting used tyres and transferring them for recycling and recovery. This law envisaged a ban on tyre landfilling after July 2013.

Some preliminary data suggest that around 40-50% of tyres placed on the market are collected, but no data exist on recycling rates. There were problems with the implementation of this law during the first years, as no unified system was established by legislation for tyre collection and treatment. In particular, there is a lack of provision for co-ordination of collection efforts between garages and manufacturers/importers. Unstable markets for recycled rubber products (*e.g.* rubber powder) and public opposition to storage facilities and treatment prevent further progress. Further discussion with tyre producers and importers, as well as representatives of the collection points, is needed to establish a comprehensive collection and recycling system and analyse options for energy recovery. Two tyre recycling plants were built very recently (one in the north of Israel and the other in the south) and the market is currently stabilised.

Packaging waste

The weight of packaging waste in Israel is estimated at 1 million tonnes per year. The new Packaging Management Law introduced in 2011 makes manufacturers and importers directly responsible for collecting and recycling their products' packaging waste. The law applies to packaging made of any material (*i.e.* paper, glass, plastic, metal, wood and others) and to a wide range of products, both household and industrial. It establishes targets for gradual recycling of 60% of the total weight of the packaging of products sold each year by 2014. Producers will also have to comply with annual recycling targets according to the type of material (*e.g.* 60% of glass, paper and cardboard, 50% of metal and 22.5% of plastic). Non-compliance with these targets will be subject to a sanction of NIS 2 500 per tonne. The law envisages the prohibition of landfilling of packaging waste by 2020. It is expected to encourage the development of local employment in the field of recycling and recovery, with the potential of creating 20 000 to 50 000 jobs in Israel.

Source: MoEP.

Waste electrical and electronic equipment, end-of-life vehicles, batteries, used oil and used oil filters from cars or other waste streams which the EPR systems have been designed to address could be considered by Israel. Some of these waste streams are already separately collected, but the systems are fragmented. For example, out of 85 000 tonnes of e-waste, only around 10% is known to be collected. This translates into 1.2 kg per capita per year, well below the EU target for e-waste recovery of 4 kg per capita. In practice, data from landfill sites show that a negligible amount of electronic waste is landfilled due to operations of small unauthorised collectors which export this type of waste to the metal recycling industry abroad. Most batteries (of which around 80 tonnes is collected, in most of the country's schools) are landfilled at the Ramat Hovav hazardous waste treatment centre. According to estimates, some 3-4 million car oil filters are changed each year. Until 2001, they were discarded at municipal landfills. In 2002, inspections increased with regard to the collection of oil filters and used oil, with positive results. Several companies currently collect oil filters and transfer them for recycling.

Although it is not the subject of an EPR system, a system for waste paper recovery has been established. The amount of recycled paper increased by 50% between 2000 and 2009 (from 215 000 to around 315 000 tonnes). However, the recycling rate is low, estimated at 35% of total consumption. The system operates on a voluntary basis, with paper recycling containers placed by municipalities and private recycling companies in residential neighbourhoods and in many public institutions. Current projections suggest that the future recycling potential could be 520 000 tonnes per year within the next five years. Three Government Decisions have been adopted to encourage government purchasing of recycled paper. Lack of recycling infrastructure forces Israel to export about 40 000 tonnes of waste paper every year.

Despite various efforts made to increase recycling and recovery of municipal waste, 87% is still landfilled, well above the OECD average (Figure 7.3). The low cost of landfilling compared to other options is the main reason for this continued high rate. During the early 1990s the original gate fee was as low as NIS 0-14 per tonne of waste delivered. Although it has been raised (in some cases up to NIS 60-90), it still does not cover the full costs of landfilling, let alone the external costs of environmental impacts. Other factors include lack of comprehensive policies and infrastructure to encourage separate waste collection and other waste treatment options. Many municipalities have tried to introduce recycling programmes (*e.g.* for waste paper), but they have been forced to return to landfilling when the contracted recycling firms decided to opt out of the agreements or after recycling firms demanded significant increases in the amount paid for collection services (Lavee and Regev, 2010).[13] These developments have entailed significant costs, associated with making changes in the waste management system, while also damaging the image of municipalities in the eyes of their residents. The continuing weak response to non-compliance with regard to illegal waste disposal adds to the problem.

The purpose of the landfill levy introduced in 2007 was to better reflect the external costs of landfilling, and to allow fairer competition with other treatment methods (including recycling and energy recovery). In 2009, the levy was NIS 40 per tonne of mixed waste, but only NIS 3.2 per tonne of sorted dry waste. It was increased substantially in 2011, reaching NIS 50 per tonne of mixed waste and NIS 10 per tonne of dry waste, and is expected to be raised further (Box 7.2).

Box 7.2. **The landfill levy**

In January 2007, the Knesset approved an amendment to the 1984 Maintenance of Cleanliness Law, requiring landfill operators to pay a levy on every tonne of waste received for landfilling. This amendment came into effect on 1 July 2007.

Landfill levy rates were differentiated according to the type of waste delivered to a landfill, with lower rates for sorted or pre-treated waste. The levy on construction and demolition waste was low, which was due to low external costs but also aimed to discourage widespread illegal disposal as practised in the past. The rates were scheduled to increase between 2007 and 2010. A further amendment, which came into effect in 2011, raised the rates further until 2015 (Table 7.1).

Table 7.1. **Landfill levy rates**

Type of waste	July 2007	2008	2009	2010	Jan. 2011	Feb.-Dec. 2011	2012*	2013*	2014*	2015*
Mixed dry waste	10.0	20.0	30.0	40.0	50	50	60	70	85	90
Residual after sorting (< 5% organic matter)	0.8	1.6	2.4	3.2	4	50	60	70	85	90
Dry waste	0.8	1.6	2.4	3.2	4	10	20	30	45	60
Sludge	24.0	48.0	72.0	96.0	120	120	120	120	120	120
Stabilised industrial sludge	8.0	16.0	24.0	32.0	40	40	40	40	40	40
Construction and demolition	0.8	1.6	2.4	3.2	4	4	4	4	4	4

* Rates approved in 2011.
Source: MoEP.

StatLink http://dx.doi.org/10.1787/888932496045

Levy payments are collected in a separate account of the Maintenance of Cleanliness Fund. The fund revenues has increased since the introduction of the landfill levy: around NIS 20 million was collected between July 2007 and December 2007; NIS 81 million in 2008; NIS 120 million in 2009; and nearly NIS 160 million in 2010.

The MoEP has published criteria for the allocation of grant assistance from the Fund, which can be allocated for: waste management within municipal boundaries, including assistance to local authorities in planning recycling systems, establishing collection points and recycling centres, and supporting information and educational activities; and waste management outside municipal boundaries, including assistance to local authorities and the private sector in the establishment of regional recovery, treatment and recycling infrastructure.

In 2008 and 2009, the Maintenance of Cleanliness Fund, in co-operation with the Union of Local Authorities in Israel, decided to allocate most of the landfill levy funds to assisting local authorities in: establishing infrastructure for municipal collection points; supporting education and information activities; and building recycling infrastructure. Recycling projects within cities were approved for 139 local authorities (NIS 39 million) in 2008 and for 186 municipalities (NIS 86 million) in 2009.

Revenue from this levy was used to support municipalities' establishment of systems for waste separation and to develop alternative treatment methods. It is too early to assess the levy's direct impact on the diversion of waste from landfills, especially since its introduction was only expected to reduce landfilling by another 10-15% (BoI, 2010). The levy aimed to increase the costs of final disposal, but it did not do so immediately since for political reasons some local authorities decided to absorb the costs rather than passing them on to consumers (by increasing the waste collection part of the *arnona*). It is estimated that the levy represents about 12% of the average cost of waste

disposal and less than 1% of total expenditure by local authorities (BoI, 2010). Municipalities have also been limited by not having the discretion to introduce taxes, which is a national level prerogative. There have been some problems with payment of the levy, as it is common to falsify reports on the type of waste delivered to landfills (in order to pay a smaller amount) (MoEP, 2008).[14]

Revenue raised by the landfill levy has helped to accelerate the pace of developing separate collection and recycling programmes in municipalities. In 2008-10, nearly NIS 125 million from the levy was used for this purpose, compared to around NIS 60 million in 2002-05, with no funding in 2006-07.[15] In 2010, the MoEP announced the Recycling Action Plan, which launched the comprehensive development of infrastructure for separate collection and treatment of waste with the goal of increasing household waste recovery to 50% in 2020. The plan envisaged allocating NIS 3 billion to municipal collection systems for two waste streams – wet and dry waste – as well as the development of sorting, recycling and waste-to-energy facilities.[16] The MoEP estimated potential benefits arising from the plan as follows: saving NIS 380 million through reduced use of raw materials; reducing CO_2 emissions by 6 million tonnes by using waste-derived fuel; generating nearly 900 million kWh of electricity from biogas; and creating an additional 10 000 jobs. The overall net contribution to the GDP was estimated at NIS 0.5-1 billion.

In 2010, some NIS 18 million was allocated to set up pilot separate collection of two waste streams in five local authorities (Ra'anana, Kfar Saba, Emek Hefer, Savion and Bat Yam) and an additional NIS 3 million for separate collection in Tel Aviv. NIS 1 million was also set aside for the establishment of a biowaste treatment facility.[17] The MoEP has estimated that by 2014 around half a million residents will take part in the separation of waste at source programme during the first phase of the plan. The system is expected to be implemented gradually throughout Israel.

The Recycling Action Plan will be a very good basis for launching a comprehensive programme to move away from landfilling to more recovery and recycling. Further simultaneous (and well co-ordinated) measures are needed. They should include, first of all, increasing charges for waste collection and the cost of landfilling. The latter can be achieved by further increasing the landfill levy and strengthening landfills' environmental and sanitary standards. Further reform of municipal waste management companies, stricter monitoring of their performance and opening up waste collection to competition should be carried out, supported by enforcement measures to prevent illegal waste disposal. The creation of markets for recovered and recycled material should also be promoted. More emphasis needs to be placed on waste-to-energy solutions, as these can reduce overall costs and contribute to energy security. Since separation at source depends on changing the behaviour of residents, awareness-raising and education measures are also needed. These efforts are even more important in the context of limited landfilling capacity. Based on current annual waste input of 5.5 million tonnes, the existing capacity of 66.4 million tonnes in 2009 will be reached in 12 years.

However, the combination of a landfill levy and heavy investment subsidies may lead to a recycling level that is higher than optimal. Thus, these processes should be synchronised so that separate collection and treatment facilities are established as a

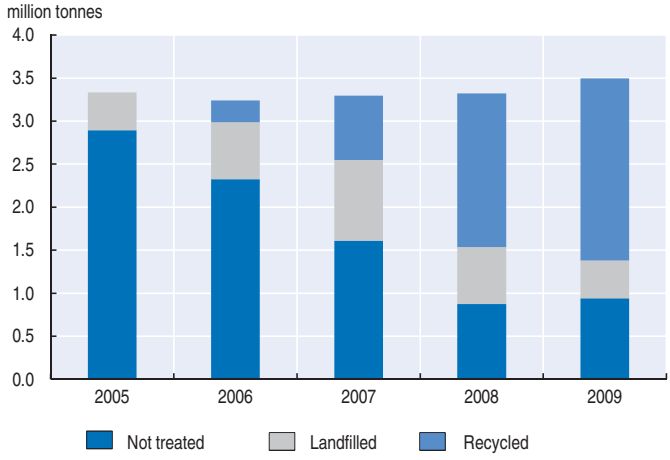
function of the quantity and rate of the waste generated, supported by appropriate pricing and additional funding by the State and private sources.

3.2. Strengthening management of construction and demolition waste

It has long been recognised that illegal dumping of construction and demolition (C&D) waste represents a serious policy failure. In 2005, out of 3.3 million tonnes of C&D waste generated, only 0.4 million tonnes was landfilled. The remainder was illegally dumped along roads and in other open areas, including protected natural areas (Nissim *et al.*, 2005).

The situation has improved in recent years, as efforts by the authorities have focused on promoting the establishment of authorised sites for disposal (and ensuring that waste is transferred to these sites) and promoting recycling. As of 2010, there were eight designated sites for the disposal of C&D waste and nine recycling plants. The amount of recycled C&D waste used as filling material reached 2.2 million in 2009 (Figure 7.4).

Figure 7.4. **Construction and demolition waste treatment, 2005-09**



Source: MoEP.

StatLink http://dx.doi.org/10.1787/888932495627

However, some areas still do not have proper disposal sites and recycling plants. Disposal sites are missing in the north of the country and in the northern part of the central region. Recycling facilities are missing in the north and south (the Negev desert). Around 0.9 million tonnes of C&D waste is still unaccounted for.

Further efforts should focus on strengthening enforcement measures with regard to illegal disposal of waste, creating an appropriate legal framework to strengthen the construction sector's responsibility for safe collection and disposal of C&D waste, and developing additional infrastructure to receive this type of waste. The 2009 amendment to the Quarries Ordinance, prepared by the MoEP and the Ministry of Finance, requires quarry owners producing quarry material to recycle C&D waste at a rate based on the quantity of quarry material produced. The other steps were taken in 2010, when the Yahalom enforcement unit of 12 inspectors was created under the Nature and Parks Authority (NPA) to carry out countrywide enforcement activities related to waste offences, especially illegal

disposal of C&D waste. Rapid adoption of the current draft regulations that increase the responsibilities of municipalities and construction companies for proper disposal of C&D waste should help to address the problem.

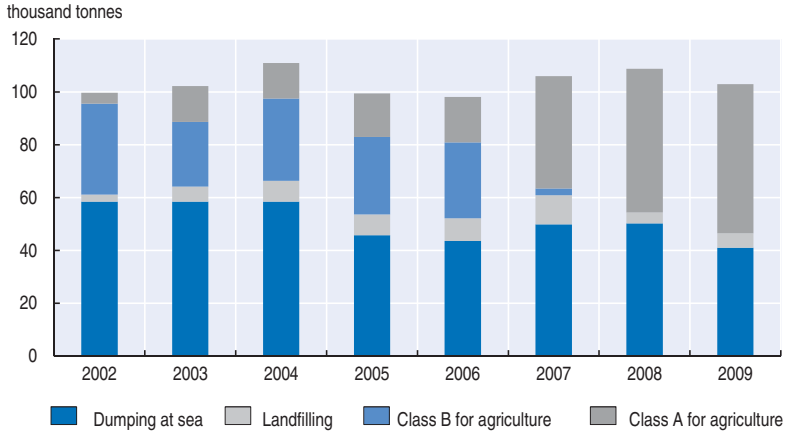
It is estimated that around 4 million tonnes of excavation material is generated every year in Israel. Efforts have been made to use the excavation surplus as filling material in infrastructure and construction projects. A special department has been set up in the Israeli Land Administration to manage surplus excavation waste throughout the country.

3.3. Treatment of sludge from wastewater treatment plants

During the last 15 years, many wastewater treatment systems have been converted into intensive plants. Forty-five plants are currently in operation, using the activated sludge method. They generate around 100 000 tonnes (dry matter) of sewage sludge a year.

The 2004 Water Regulations (Prevention of Water Pollution, Usage of Sludge) required wastewater treatment plants to stabilise and treat the sludge they generate as a condition for its use in agriculture for soil improvement. These regulations established maximum permitted levels for heavy metals and pathogen concentrations in sludge designated for agricultural use; defined specific uses for different classes of sludge (A and B); and set limits on areas where sludge could be used. In 2007, the requirement for Class A sludge, which is pasteurised and highly stabilised with no pathogens, entered into force. Since then, sludge generated in Israel is characterised by pollutant concentrations lower than in the European and United States equivalents. These two factors have transformed sludge into a resource for unrestricted agricultural use, replaced chemical fertilisers, and prevented damage to agricultural crops, public health, soil and groundwater. As of 2010, three centralised sludge treatment plants in Israel process sludge for agricultural use. Around 56 000 tonnes of sludge generated in 2009 was utilised as Class A in agriculture, a dramatic increase from only 4 000 tonnes produced in 2002 (Figure 7.5).

Figure 7.5. **Sewage sludge, 2002-09**



Source: MoEP.

StatLink http://dx.doi.org/10.1787/888932495646

However, the remaining 41 000 tonnes of activated sludge[18] is discharged to the Mediterranean Sea via a marine outfall 5 km long, at a water depth of 38 metres. This sludge mostly comes from the Dan Region Wastewater Reclamation Project, which treats the domestic sewage of the 2 million inhabitants of the Tel Aviv metropolitan area. The discharge has long affected the seafloor: contaminated sediments have displayed increased levels of organic matter, nutrients and heavy metals and their biota have shown decreased species diversity (Kress *et al.*, 2004). Termination of this discharge was originally scheduled for 2008 after an incinerator to treat the sludge was scheduled to begin operations. However, due to local opposition, the Dan Region Association of Towns for Sewage and Environment (Shafdan) announced in January 2008 its decision to abandon the incinerator option and to convert sewage into fertiliser – with the opening of a facility to produce Class A biosolids scheduled for 2014. The other option of disposing sludge at landfills was discarded, as the costs of solidifying the sludge to 25% dry matter and payment of a gate fee and the landfill levy would make this type of disposal more costly.

4. Reducing impacts of hazardous and industrial waste

Hazardous waste

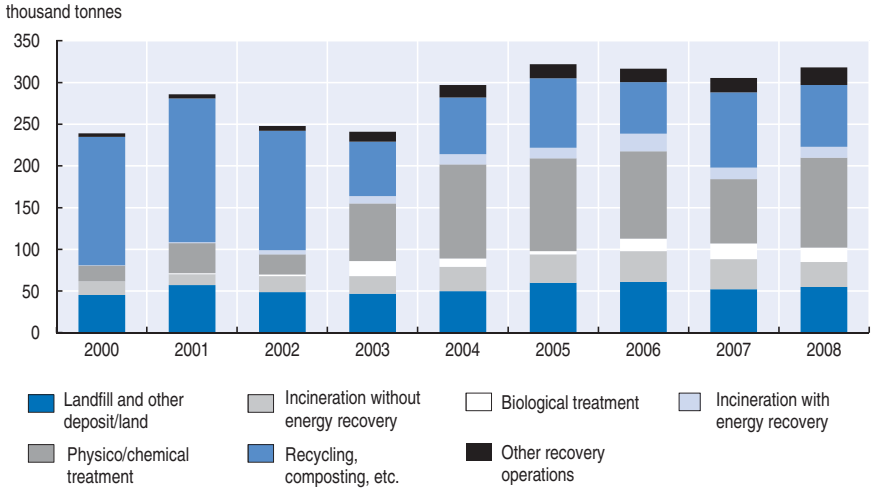
Hazardous waste management is based on the legal framework developed in the 1990s.[19] A Poisons (hazardous materials) Permit is required for handling hazardous materials listed in an annex to the Hazardous Substances Law. This permit includes conditions for proper storage and marking of hazardous materials, emergency preparedness and response, and transport and treatment of hazardous waste, among others.[20] The regulations require industrial plants to dispose of their hazardous waste not later than six months after waste generation, either at the national site for the disposal and treatment of hazardous waste at Ramat Hovav or at other facilities following written approval from the MoEP.[21] Some of the waste generated by industrial plants in Israel is also treated, recycled or reused on-site. A Poisons Permit holder is required to maintain a toxic substances register in which details of all sales and purchases of hazardous substances are recorded.

Of nearly 318 000 tonnes of hazardous waste managed in Israel in 2009, around 34% has been subject to recovery operations. This includes incineration with energy recovery, recycling and composting.[22] The remainder has been subject to disposal operations, including treatment before landfilling (34% by physico-chemical treatment, 11% by incineration without energy recovery, 4% by biological treatment) and direct landfilling (15%) (Figure 7.6).

Around 36% of hazardous waste generated (organic and inorganic, liquid and solid, excluding radioactive, pathogenic and explosive waste) is received at the central state-owned hazardous waste treatment facility at Ramat Hovav in the Negev desert. Treatment includes biological treatment or incineration of organic waste, physico-chemical treatment of inorganic waste, and secure landfilling. Direct landfilling of hazardous waste in Israel is authorised only at this facility. Since 2009, all inorganic and solid waste has been subject to solidification and stabilisation prior to landfilling. Charges paid for delivering waste for treatment are substantially higher than those for solid waste treatment and include all treatment costs.

The Ramat Hovav facility operates under strict conditions, as stipulated in its business license. The site has environmental liability insurance, is certified by ISO standards (9001, 14001, 17025, 18001), has an online emission monitoring system that transmits data

Figure 7.6. **Hazardous waste treatment, 2000-08**



Source: OECD, Environment Directorate.

StatLink http://dx.doi.org/10.1787/888932495665

directly to the authorities, and is audited on a monthly basis by the MoEP. Management of the site is required to alert the MoEP about any incidents within 15 minutes and to provide a report within 24 hours. The company has a training programme for its staff in emergency response.

Hazardous waste not delivered to the Ramat Hovav facility is treated, recycled or used as a source of energy at 30 treatment and recycling plants for hazardous waste. All operations are subject to the supervision and approval of the MoEP, under the 1990 Licensing of Businesses Regulations.

The quantity of waste incinerated, excluding with energy recovery, in the only incinerator for hazardous waste (which has been operating since 1998) increased from the original capacity of 15 000 tonnes to 34 000 tonnes in 2009. The Ramle Nesher Cement Plant began to use hazardous waste as alternative fuel in 2001. A small quantity of waste, especially contaminated soil, has been burned in the steam boilers of the Edom Company in Rotem Amfert. However, Israel's incineration capacity is still insufficient and some organic waste is sent for incineration abroad. Every transfer of hazardous waste for incineration requires prior approval by the MoEP, according to the 1990 Licensing of Businesses Regulations. Approval for incineration of hazardous waste in cement kilns and other industrial facilities is given following reviews by the Air Quality and Climate Change Division of the MoEP.

New facilities for physico-chemical treatment of hazardous waste were established in 2004, increasing competition with the Ramat Hovav plant. Around 102 000 tonnes of waste and sewage sludge is now treated, compared with 2 300 tonnes in 2002.

Steps have been taken to discontinue the injection of hazardous waste into abandoned oil wells. Injection of caustic soda from the oil refineries of Ashdod into wells was discontinued in 2006 as oil refineries and the Carmel Olefins company, which generated waste disposed in the Heletz oil fields in the southern part of Israel, had constructed on-site facilities for treatment and recovery of their waste. Since 2008, there has been no injection of hazardous waste into abandoned oil wells in Israel.

More recently, the MoEP provided financial assistance (up to 40% of the investment value) to industries to reduce hazardous waste, with priority given to plants where waste or waste toxicity is reduced at source. Total investment in waste minimisation projects is estimated at NIS 20 million, of which NIS 5 million was granted by the MoEP during the last decade. The annual financial savings to industrial plants as a result of these projects is NIS 15 million per year.

Despite investment and financial support, problems with the safe treatment and disposal of hazardous waste persist. The amount of hazardous waste is growing fast (by 33% between 2000 and 2008), with capacity for safe treatment and disposal lagging behind. Lack of adequate waste collection infrastructure in some areas results in hazardous waste (*e.g.* medical waste) being disposed in municipal landfills. Some illegal transboundary movements of hazardous waste have been reported (JPF, 2008).

The regulatory framework for hazardous waste management is fragmented and based on a law nearly 20 years old. New regulations, currently being drafted, under the 1993 law will introduce three principal changes to existing legislation: a change in the method of defining hazardous waste to comply with relevant EU Directives; prioritisation of hazardous waste management methods, in line with EU requirements; and introduction of better mechanisms for inspection and non-compliance response regarding hazardous waste collection, transport, treatment and disposal. However, an in-depth review and revision of the hazardous waste management system, with a view to developing a new comprehensive law, would help to determine priority actions and identify cost-effective solutions. The possibility of voluntary initiatives and preventive actions by the business sector should be explored. The planned Pollutant Release and Transfer Register (PRTR) mechanism, to be implemented in 2012, will provide the authorities and the public with improved information regarding the transfer of hazardous waste from industrial plants.

More human resources are also needed to strengthen management and enforcement efforts, particularly in reviewing applications for treatment and recycling of waste outside Ramat Hovav and approving imports/exports of hazardous waste. Only two people at the national level and two to three co-ordinators at the regional level currently handle a large number of operations in each region.

Israel's international trade in hazardous waste is quite small, and it is in full compliance with the provisions of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal and the 1995 Basel Ban Amendment, under which exports of hazardous waste from EU and OECD countries to other Parties to the Convention are prohibited (although Israel has not yet ratified this amendment). With its accession to the OECD in 2010, Israel is bound by the OECD's framework of decisions and procedures governing international movements of hazardous waste (Chapter 3). In 2008, 8 164 tonnes (2.5% of total hazardous waste generated) was exported for recycling/reclamation or incineration. The main exports were metal wastes for recycling, batteries and hazardous organic wastes, which included organic solvents, pharmaceuticals, paints and lacquers sent principally to Germany (with a small fraction sent to Finland) for recovery or final disposal.

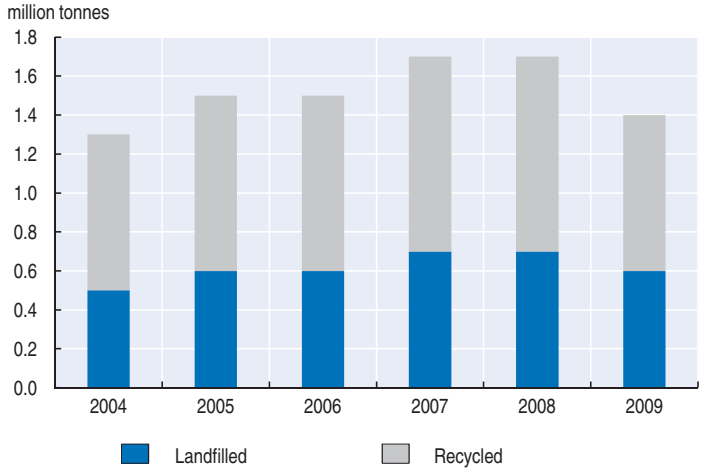
Israel imported 4 905 tonnes of hazardous waste in 2008, of which some 80% consisted of lead-acid batteries sent for recycling from Cyprus,[23] Mauritius, Romania and South Africa. Used battery imports have been important to Israel during the decade in maintaining the economic viability of the Hakurnas Lead Works, Ltd., and expanding its

capacity to respond to Israel's domestic waste treatment needs. The remaining 20% of hazardous waste imports in 2008 consisted of inorganic cyanide and waste mineral oils from Jordan. In 2009, Israel imported only 774 tonnes of hazardous waste (all of which was lead-acid batteries), as EU countries stopped exporting this type of waste to Israel because of the Basel Ban Amendment, which prohibits the export of hazardous waste from EU and OECD countries to other Parties to the Basel Convention. Having become an OECD member in 2010, Israel can again receive hazardous waste for recovery, as it is in full compliance with the requirements of the Basel Convention and with the OECD requirements.

Industrial waste

The rate of recovery and recycling of non-hazardous industrial waste has been high, around 60% of the total (Figure 7.7). Recycling efforts have been facilitated by the Israel Cleaner Production Center established in 2001 by the MoEP and the Manufacturers Association of Israel. The Center supports a waste material exchange bulletin board, which facilitates the reuse of waste components produced by one plant in another plant. As the exchange of waste materials using the bulletin board is anonymous and voluntary, no specific data on waste reuse and recycling are available. The MoEP is currently upgrading the website to broaden participation and stimulate exchange.

Figure 7.7. **Industrial waste treatment, 2004-09**



Source: MoEP.

StatLink http://dx.doi.org/10.1787/888932495684

5. Addressing impacts of contaminated sites

Contaminated land has been discovered in hundreds of industrial, commercial and agricultural areas in Israel. These areas include several sites where hazardous waste was buried before the hazardous waste management site at Ramat Hovav was established. Such sites affect soil and water, including groundwater contamination at 30% of sites. A comprehensive survey conducted for the MoEP in 2010-11 revealed that the total number of potentially contaminated soil sites in Israel, including those already confirmed, reaches approximately 3 300. These sites comprise 23 000 hotspots including: a pesticides plant at Ashdod, the asbestos-contaminated area at Nahariya, the oil refineries at Haifa and Ashdod, the industrial and hazardous waste site at Ramat Hovav, 2 000 petrol stations and

250 industrial zones (including sites of the Israeli defence industry in the Tel Aviv metropolitan area and in Jerusalem).

Steps have been taken to develop a comprehensive framework for the identification, characterisation and remediation of contaminated sites. In 2000, the MoEP formulated a policy for the clean-up of contaminated land and prepared several guidelines to facilitate the process of further identification of sites and their clean-up. These documents included preliminary clean-up targets for 100 pollutants, to serve as a basis for land remediation (2004), and guidelines on planning and implementing soil site characterisation and remediating contaminated soil at petrol stations (2009). In 2009, the MoEP identified the 20 most severely polluted sites and began remediation measures. For example, EUR 42 million was allocated for the remediation of the hazardous waste treatment site at Ramat Hovav, which included a closed landfill, sedimentation and evaporation ponds, and temporary storage areas. However, further progress in clean-up activities has been prevented by lack of appropriate legislation and procedures for soil clean-up that are necessary to establish liability for past pollution, including the ability to find responsible parties and make them pay the costs of remediation.

Since addressing past pollution will probably take decades, immediate actions should focus on immediate risks, such as at Ramat Hovav, and monitoring of other sites for potential contamination. Swift adoption of the recently drafted Law on the Prevention of Land Contamination and the Remediation of Contaminated Land should help to create a comprehensive framework for rehabilitation efforts. This framework should include creating instruments to carry out soil surveys on land suspected to be polluted (within the framework of building permits and real estate transactions, and state-owned land leasing agreements), with contamination and clean-up status recorded in the land registry. As the cost of implementation of this bill is estimated at approximately EUR 1.6 billion, efforts are needed to ensure that soil clean-up funds will be established with a sufficient budget to enable clean-up according to a multi-year plan. A database for contaminated and potentially contaminated sites (which would include state-owned land, such as army bases, defence industries, government-owned companies, as well as private sector-owned contaminated areas) is also required for successful implementation of the law. A risk-based methodology for soil and groundwater, expected to be approved in 2011, should enable better risk assessment procedures.

Notes

1. In 1997, fines were increased, especially for littering and disposal of waste. In 2000, immediate monetary fines (similar to parking tickets) in lieu of an appearance in court were introduced, with higher rates for littering and disposal of waste in sensitive areas and for illegal disposal of hazardous waste.
2. This applied to containers with a volume of between 0.1 and 1.5 litre.
3. The hierarchy stipulates that waste prevention and minimisation are preferable to waste management and that recovery, including recycling, is preferable to disposal.
4. The plan was initiated by the Ministry of Environmental Protection (MoEP) and developed with the Ministries of the Interior and of Health and local authorities. During the preparation of the plan, four public hearings were held, with the participation of the Israeli Public Solid Waste Forum (a 200-member group including stakeholders from all sectors).
5. Waste management is dealt with by two divisions of the MoEP: the Solid Waste Division, which is responsible for non-hazardous waste, mostly municipal waste; and the Hazardous Substances

Division, which is responsible for all hazardous substances and issues permits for handling hazardous waste.

6. Around one-third of hazardous waste comes from surface treatment of metals and plastics classified under "Source oriented waste types" (Y1-Y18) within the Basel Convention classification. Around half of hazardous waste is classified as "Other hazardous waste" (Y19-Y47), which refers to hazardous substances or chemicals incorporated in waste.
7. Municipal waste includes household and commercial waste, as separate statistics on these two types of waste are not collected in Israel.
8. The Hiriya waste site used to receive 3 000 tonnes of waste every day, mostly from Tel Aviv but also from surrounding communities. In view of the risk to the environment as well as to airport safety, the site was closed in 1997. Today the site has been rehabilitated and comprises a waste transfer station and waste separation, recycling and waste-to-energy installations. It also hosts an information and education centre. In the future, it will become the site of an extensive Ayalon park.
9. Support was granted for a set period of five years, with a decrease of 20% each year.
10. In 2008, the Israeli Civil Administration issued a military order against illegal dumping of waste by Israeli trucks in the West Bank. This decision provided for immediate confiscation of trucks and fines against the drivers of waste trucks caught driving in the West Bank without proper permits even if they did not dump waste (JPF, 2008).
11. The *arnona* is levied by the municipality (or, in smaller localities, by the Regional Council (*moatza eizorit*). Specific rates vary widely among municipalities, with Jerusalem and Rehovot having the highest rates in the country. In rental dwellings, tenants (rather than owners) generally pay the *arnona*. Single parents, families with some forms of economic hardship, and selected religious groups qualify for discounts or exemptions.
12. For example, Ruach Tova, a not-for-profit organisation which co-ordinates the exchange of second-hand goods, in co-operation with the Israel Union for Environmental Defense (a major environmental NGO) and Koala Recycling Solutions (a company set up to collect metal packaging for recycling), distributes receptacles for the collection of e-waste, metal packaging and nylon bags in 11 major cities throughout the country. Electrical appliances in good working order are transferred to disadvantaged people while other e-waste is sent to recycling. Some 3 000 pieces of electronic waste were collected within a certain period, of which 800 were donated and 2 200 recycled.
13. In the case of one municipality, the municipality continued to maintain waste paper collection containers for recycling, while sending the collected waste paper for disposal, to avoid damage to its public image.
14. The MoEP conducts sampling to ensure that substances meet the legal definition of residual waste, but these checks have apparently not solved the problem.
15. The NIS 125 million included NIS 95 million allocated for waste collection and treatment infrastructure, NIS 9 million for preparing municipal master plans, and NIS 11 million for public awareness activities.
16. Of this, some NIS 2 billion will be allocated for establishing recycling and sorting plants (of which NIS 750 million will come from state funds and the rest from matching funds from the private sector and local authorities). Another NIS 1 billion will be invested in municipal infrastructure, of which NIS 700 million will come from government.
17. Funding is used for: *i)* purchase of bins for sorting waste into two streams (bins for public areas and for residences); *ii)* purchasing waste collection vehicles for collecting waste separated at source; *iii)* renovation and adaptation of bin storage areas in residential buildings; and *iv)* local activity targeted at information and education. Every household joining the programme was awarded an NIS 120 payment.
18. Activated sludge is a solid compound resulting from a process for treating sewage. The process involves the introduction of air or oxygen into a mixture of primary treated or screened sewage combined with organisms to develop a biological floc, which reduces the organic content of the sewage.
19. The 1990 Licensing of Businesses Regulations (Disposal of Hazardous Waste) and the 1993 Hazardous Substances Law and subsequent regulations provide a framework for the disposal, treatment, import and export of hazardous waste.
20. The import or export of hazardous waste are also subject to permitting.
21. Since 1993, an Information and Response Center for Hazardous Substances operates at the MoEP. The Center provides support on a 24-hour-a-day basis, including data on hazardous materials

used, produced, imported, exported, transported, recovered and disposed of in Israel. It serves as a focal point for response and risk assessment during hazardous substance spills and accidents.

22. Hazardous waste managed in Israel includes imports and excludes exports (Chapter 3).

23. *Footnote by Turkey:* The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of United Nations, Turkey shall preserve its position concerning the "Cyprus issue".
Footnote by all the European Union Member States of the OECD and the European Commission: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

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* The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

I.A: SELECTED ENVIRONMENTAL DATA (1)

		AUS	AUT	BEL	CAN	CHL	CZE	DNK	EST	FIN	FRA	DEU	GRC	HUN	ISL	IRL	**ISR**	ITA	JPN	KOR	LUX	MEX	NLD	NZL	NOR	POL	PRT	SVK	SVN	ESP	SWE	CHE	TUR	GBR*	USA	OECD*
LAND																																				
Total area (1000 km²)		7741	84	31	9985	756	79	43	45	338	549	357	132	93	103	70	**22**	301	378	100	3	1964	42	268	324	313	92	49	20	505	450	41	784	244	9832	35294
Nitrogenous fertiliser use (t/km² of agricultural land)		0.2	2.7	9.8	2.9	2.1	7.6	6.5	4.4	7.5	6.9	9.2	3.7	5.1	0.7	8.0	**9.1**	5.2	9.3	17.3	11.3	1.1	10.9	2.3	10.2	9.1	2.8	5.9	4.9	2.7	7.4	3.4	3.6	5.2	2.7	2.2
Pesticide use (t/km² of agricultural land)		-	0.11	0.51	0.05	..	0.11	0.12	..	0.07	0.25	0.19	0.22	0.17	-	0.07	**..**	0.61	1.18	1.32	-	0.04	0.56	0.04	0.07	0.09	0.47	0.20	0.24	0.15	0.07	0.09	0.04	*0.15*	0.07	*0.07*
Livestock densities (head of sheep eq./km² of agr. land)		59	500	1586	139	218	244	824	250	321	470	649	388	159	58	1120	**1121**	422	723	1492	999	252	1982	817	844	312	425	211	750	307	380	765	244	*547*	168	190
FOREST																																				
Forest area (% of land area)		19.7	47.0	22.3	34.1	1.7	34.3	12.7	52.6	72.9	29.0	31.8	29.8	22.4	0.3	10.5	**7.1**	30.6	68.5	64.3	33.5	33.5	10.8	31.5	32.4	30.5	37.7	40.2	62.0	35.7	68.7	30.8	14.4	11.8	33.2	30.7
Use of forest resources (harvest/growth)		..	0.6	0.8	..	..	..	..	..	0.7	..	1.0	..	..	..	0.9	**..**	..	0.2	1.0	..	..	..	0.7	0.4	0.5	..	..	..	..	..	..	..	..	0.5	..	..
Tropical wood imports (USD/cap.)	*2*	9.1	0.9	28.1	3.2	-	0.9	7.7	-	5.8	9.8	3.7	5.0	0.1	8.0	7.1	**-**	7.4	7.9	5.0	0.7	0.9	33.2	5.3	4.0	1.4	14.1	1.8	-	6.1	1.5	0.6	2.1	3.0	2.8	4.9
THREATENED SPECIES																																				
Mammals (% of species known)		24.4	26.7	27.7	20.3	30.6	20.0	22.0	2.9	10.8	19.0	34.4	25.7	37.8	-	1.8	**56.2**	40.7	23.3	7.4	51.6	31.8	25.0	19.0	18.2	12.4	26.2	21.7	38.2	13.3	18.3	32.9	14.3	*7.9*	16.8	..
Birds (% of species known)		13.2	27.3	22.6	9.8	11.6	50.0	16.3	10.3	13.3	19.2	35.6	14.1	14.5	44.0	24.1	**18.6**	18.4	13.1	5.2	34.8	16.2	20.7	19.6	14.5	7.6	33.3	14.0	27.1	26.9	17.5	35.7	3.7	*2.4*	11.7	..
Fish (% of species known)		0.9	46.4	60.0	29.6	58.7	41.5	15.8	12.2	11.8	36.1	30.1	31.8	43.2	-	33.3	**18.8**	35.1	36.0	8.9	27.9	27.6	60.0	25.9	-	28.6	62.9	24.1	47.1	51.4	10.9	43.6	11.1	*11.1*	31.7	..
WATER																																				
Water withdrawal (% of gross annual availability)		3.6	4.1	31.2	1.1	5.2	10.7	4.0	11.2	2.1	17.0	17.2	12.1	4.9	0.1	2.3	**..**	24.0	20.1	40.3	2.9	17.8	11.8	1.6	0.8	18.3	12.4	0.8	2.9	29.2	1.4	5.0	17.3	*12.0*	19.5	*10.3*
Public waste water treatment (% of population served)		..	93	69	86	83	76	90	80	80	80	94	67	57	57	63	**95**	94	74	89	95	40	99	80	79	64	70	58	52	92	86	97	46	*97*	68	*75*
Fish catches (% of world catches)		0.2	-	-	1.1	..	-	0.9	..	0.2	0.6	0.3	0.1	-	1.6	0.2	**..**	0.3	4.7	2.0	-	1.6	0.5	0.5	2.6	0.2	0.3	-	..	1.0	0.3	-	0.6	0.7	5.2	25.7
AIR																																				
Emissions of sulphur oxides (kg/cap.)		122.9	2.7	9.1	52.0	51.1	16.8	3.6	51.7	12.9	5.8	6.1	39.8	8.8	48.1	10.0	**25.2**	4.9	6.1	8.3	6.4	..	3.1	18.7	4.2	26.2	10.0	12.8	6.7	11.6	3.3	1.8	15.1	8.3	34.2	18.2
(kg/1000 USD GDP)	*3*	3.5	0.1	0.3	1.5	3.7	0.7	0.1	2.8	0.4	0.2	0.2	1.5	0.5	1.3	0.3	**1.0**	0.2	0.2	0.3	0.1	..	0.1	0.7	0.1	1.6	0.5	0.6	0.2	0.4	0.1	-	1.2	0.2	0.8	0.6
% change (2000-2008)		11	-29	-43	-25	-34	-34	-33	-26	-15	-42	-22	-10	-82	74	-68	**-35**	-61	-15	-18	134	..	-29	25	-25	-34	-64	-45	-86	-64	-26	-15	-26	-58	-29	-30
Emissions of nitrogen oxides (kg/cap.)		82.5	24.7	21.9	64.2	23.9	25.1	27.6	25.6	31.7	20.5	16.8	31.8	18.2	70.3	24.4	**27.0**	18.0	14.7	24.5	38.2	..	16.6	37.8	36.8	21.8	24.5	17.5	23.3	27.5	16.9	10.6	18.1	22.9	48.7	28.0
(kg/1000 USD GDP)	*3*	2.3	0.7	0.7	1.8	1.7	1.1	0.8	1.4	0.9	0.7	0.5	1.2	1.0	1.9	0.6	**1.0**	0.6	0.5	1.0	0.5	..	0.4	1.5	0.8	1.3	1.1	0.9	0.8	1.0	0.5	0.3	1.5	0.7	1.1	0.9
% change (2000-2008)		17	-	-29	-15	24	-18	-25	-5	-20	-23	-25	7	-2	-17	-20	**-17**	-27	-11	6	12	..	-26	16	-14	-1	-13	-12	-4	-11	-27	-18	24	-25	-27	-19
Emissions of carbon dioxide (t./cap.)	*4*	18.5	8.3	10.4	16.5	4.4	11.2	8.8	13.1	10.6	5.9	9.8	8.3	5.3	6.9	9.9	**8.6**	7.2	9.0	10.3	21.5	3.8	10.8	7.8	7.9	7.8	4.9	6.7	8.3	7.0	5.0	5.7	3.7	8.3	18.4	10.6
(t./1000 USD GDP)	*3*	0.52	0.23	0.31	0.46	0.32	0.48	0.26	0.71	0.32	0.19	0.29	0.31	0.29	0.19	0.25	**0.34**	0.26	0.29	0.40	0.29	0.29	0.28	0.31	0.16	0.48	0.22	0.33	0.30	0.25	0.14	0.15	0.30	0.25	0.42	0.34
% change (2000-2008)		17	13	-6	3	34	-4	-4	21	4	-2	-3	7	-2	3	7	**15**	1	-3	19	30	18	3	12	12	2	-12	-3	19	12	-13	5	31	-2	-2	1
WASTE GENERATED																																				
Industrial waste (kg/1000 USD GDP)	*3, 5*	10	..	40	..	..	30	10	..	100	50	20	..	30	-	30	**..**	20	40	30	20	..	30	10	20	90	40	80	..	20	100	-	20	20	..	40
Municipal waste (kg/cap.)	*6*	600	580	490	390	380	310	820	510	480	530	590	480	430	550	660	**610**	540	380	390	710	360	610	580	830	320	520	300	450	560	480	690	390	540	720	540
Nuclear waste (t./Mtoe of TPES)	*7*	-	-	2.2	6.3	-	1.8	-	-	2.0	4.3	0.9	-	1.9	-	-	**-**	-	1.4	2.9	-	0.1	0.1	-	-	-	-	3.3	-	0.8	4.9	2.3	-	1.8	0.9	1.4

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

3) GDP at 2005 prices and purchasing power parities.

4) CO_2 from energy use only; sectoral approach; international marine and aviation bunkers are excluded.

Source: OECD Environmental Data Compendium.

5) Waste from manufacturing industries.

6) CAN, NZL: household waste only.

7) 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.

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

OECD: excludes Chile, Estonia, Israel and Slovenia.

I.B: SELECTED ECONOMIC DATA (1) **OECD EPR / THIRD CYCLE**

		AUS	AUT	BEL	CAN	CZE	DNK	FIN	FRA	DEU	GRC	HUN	ISL	IRL	**ISR**	ITA	JPN	KOR	LUX	MEX	NLD	NZL	NOR	POL	PRT	SVK	ESP	SWE	CHE	TUR	GBR	USA	OECD*
GROSS DOMESTIC PRODUCT																																	
GDP, 2009 (billion USD au 2005 prices and PPPs)		773	288	349	1166	232	179	164	1909	2639	294	168	11	159	**190**	1600	3804	1243	35	1334	603	108	228	637	227	106	1243	301	286	837	1976	12880	35778
% change (2000-09)		30.8	14.1	12.0	16.8	33.8	5.7	16.1	10.8	5.1	31.4	19.1	28.7	29.3	**30.2**	1.3	4.8	41.1	30.4	10.9	12.3	25.4	16.4	40.9	5.4	54.3	22.9	16.2	14.6	33.8	13.4	14.7	14.1
per capita, 2009 (1000 USD/cap.)		35.2	34.5	32.4	34.6	22.1	32.4	30.7	30.5	32.2	26.1	16.7	33.9	35.7	**25.3**	26.8	29.8	25.5	70.4	12.4	36.5	25.0	47.2	16.7	21.4	19.5	27.1	32.4	36.9	11.6	32.4	42.0	30.0
Exports, 2009 (% of GDP)		19.9	51.2	73.0	28.7	69.2	47.2	37.3	23.0	40.8	19.1	77.4	53.0	90.7	**34.7**	23.9	12.5	49.9	167.6	27.8	69.2	28.5	42.4	39.5	27.9	70.1	23.4	48.5	51.7	23.2	27.7	11.2	28.3
INDUSTRY	*2*																																
Value added in industry (% of GDP)		27	29	22	32	38	23	28	19	27	18	29	27	32	**22**	25	29	37	13	34	24	25	40	32	23	35	26	25	27	26	21	21	..
Industrial production: % change (2000-09)		12.9	9.4	-3.5	-15.9	35.6	-11.0	3.8	-12.9	0.2	-8.1	28.4	142.0	35.4	**19.3**	-20.4	-15.2	30.2	-3.8	0.2	2.6	1.1	-10.7	57.5	-15.4	54.3	-15.3	-7.0	11.3	27.4	-15.9	-4.6	..
AGRICULTURE																																	
Value added in agriculture (% of GDP)	*3*	2.6	1.5	0.7	1.7	2.3	0.9	2.7	1.7	0.8	3.2	3.3	6.4	1.0	**2.1**	1.8	1.5	2.6	0.3	3.7	1.7	5.6	1.2	3.6	2.3	3.9	2.6	1.8	1.2	9.3	0.7	1.2	..
Agricultural production: % change (2000-09)		-7.2	-	-7.7	15.7	..	8.1	2.0	-3.0	4.0	-22.0	7.5	5.9	-9.1	**19.8**	-4.0	-5.0	-	-7	18.4	-6.0	11.9	-3.1	13.3	-6.0	4.3	-5.9	-1.0	2.0	10.6	-3.9	11.9	..
Livestock population, 2009 (million head of sheep eq.)		247	16	22	94	10	22	7	137	110	18	9	1	47	**6**	57	37	27	1	259	38	93	9	50	15	4	86	12	12	96	97	689	2320
ENERGY																																	
Total supply, 2009 (Mtoe)		131	32	57	254	42	19	33	256	319	29	25	5	14	**22**	165	472	229	4	175	78	17	28	94	24	17	127	45	27	98	197	2163	5176
% change (2000-09)		21.2	10.8	-2.2	1.1	2.5	-0.2	2.8	1.7	-5.6	8.7	-0.6	68.6	4.7	**18.1**	-4.0	-9.0	21.9	20.4	20.3	6.8	3.5	9.2	5.5	-2.3	-5.8	3.8	-4.5	7.8	27.9	-11.7	-4.9	-1.2
Energy intensity, 2009 (toe/1000 USD GDP)		0.17	0.11	0.16	0.22	0.18	0.10	0.20	0.13	0.12	0.10	0.15	0.48	0.09	**0.11**	0.10	0.12	0.18	0.11	0.13	0.13	0.16	0.12	0.15	0.11	0.16	0.10	0.15	0.09	0.12	0.10	0.17	0.14
% change (2000-09)		-7.3	-2.9	-12.7	-13.5	-23.4	-5.5	-11.4	-8.2	-10.1	-17.3	-16.5	31.0	-19.0	**-9.3**	-5.3	-13.2	-13.7	-7.7	8.5	-4.9	-17.5	-6.2	-25.2	-7.3	-38.9	-15.5	-17.9	-5.9	-4.4	-22.2	-17.1	-13.4
Structure of energy supply, 2009 (%)	*4*																																
Solid fuels		42.0	9.1	5.2	9.3	40.7	21.6	16.3	4.3	22.4	29.0	10.5	1.5	15.1	**34.0**	7.9	21.5	28.4	2.1	4.4	9.6	8.3	1.9	54.1	12.1	23.3	7.4	4.3	0.6	30.5	15.2	22.4	19.6
Oil		30.8	38.0	42.2	34.3	21.1	37.9	28.7	31.3	32.9	54.3	27.7	14.2	50.3	**45.5**	41.9	42.5	39.7	63.5	56.5	39.0	35.4	36.4	25.5	49.5	20.0	47.4	26.5	42.4	29.8	32.5	36.9	37.2
Gas		21.6	23.7	25.8	30.3	15.6	21.0	10.9	14.9	23.9	10.2	37.4	-	30.0	**15.6**	39.7	17.1	13.5	30.4	27.9	45.0	20.3	19.0	13.0	17.8	26.6	24.5	2.5	9.9	29.6	39.7	25.1	24.1
Nuclear		-	-	21.6	9.2	16.5	-	19.1	41.3	11.0	-	16.6	-	-	**-**	-	15.4	16.9	-	1.6	1.4	-	-	-	-	22.4	10.8	30.4	26.7	-	9.2	10.0	11.3
Hydro, etc.		5.6	29.3	5.2	16.8	6.1	19.5	25.1	8.1	9.8	6.5	7.8	84.3	4.6	**4.9**	10.4	3.5	1.5	4.0	9.5	5.0	36.0	42.7	7.4	20.6	7.6	9.8	36.4	20.4	10.2	3.4	5.7	7.8
ROAD TRANSPORT	*5*																																
Road traffic volumes per capita, 2007 (1000 veh.-km/cap.)		10.1	10.3	9.2	10.1	4.6	8.2	10.1	8.5	7.0	10.1	2.3	9.6	10.1	**..**	9.4	6.8	4.7	8.8	0.7	8.4	13.7	8.2	4.2	8.9	2.9	5.2	8.6	8.3	1.0	8.4	16.3	8.7
Road vehicle stock, 2007 (10 000 vehicles)		1417	513	575	1883	483	262	299	3665	4922	608	349	24	226	**235**	4021	7413	1590	36	2569	822	273	269	1702	573	166	2696	478	430	946	3316	24795	67323
% change (2000-07)		19.4	3.6	9.8	7.2	29.5	16.3	21.1	8.4	7.9	42.1	26.9	34.4	46.5	**33.9**	11.2	4.8	31.8	20.8	67.7	11.7	17.4	16.7	41.2	20.6	15.6	25.8	9.0	11.9	58.6	17.1	12.2	14.9
per capita (veh./100 inh.)		67	62	54	57	47	48	56	59	60	54	35	78	52	**31**	68	58	33	75	24	50	65	57	45	54	31	60	52	57	13	55	82	57

.. 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.

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.

OECD: excludes Chile. Estonia, Israel and Slovenia.

Source: OECD Environmental Data Compendium.

I.C: SELECTED SOCIAL DATA (1) **OECD EPR / THIRD CYCLE**

		AUS	AUT	BEL	CAN	CHL	CZE	DNK	EST	FIN	FRA	DEU	GRC	HUN	ISL	IRL	**ISR**	ITA	JPN	KOR	LUX	MEX	NLD	NZL	NOR	POL	PRT	SVK	SVN	ESP	SWE	CHE	TUR	GBR	USA	OECD
POPULATION																																				
Total population, 2009 (100 000 inh.)		220	84	108	337	169	105	55	13	53	626	819	113	100	3	45	**75**	598	1275	487	5	1076	165	43	48	382	106	54	20	459	93	77	719	609	3070	11936
% change (2000-09)		14.6	3.1	5.2	10.0	9.9	2.3	3.4	-2.2	3.1	6.0	-0.3	3.3	-1.9	13.5	17.6	**19.0**	4.5	0.5	3.7	13.1	9.3	3.8	11.9	7.5	-0.3	4.0	0.4	1.7	14.1	4.8	7.8	11.9	3.5	8.8	6.1
Population density, 2009 (inh./km²)		2.8	99.7	353.4	3.4	22.4	133.2	128.1	29.6	15.8	114.0	229.4	85.5	107.7	3.1	63.5	**339.2**	198.3	337.4	488.8	190.5	54.8	397.9	16.1	14.9	122.0	115.5	110.6	99.7	90.9	20.7	187.6	91.8	250.1	31.2	33.8
Ageing index, 2009 (over 64/under 15)		69.6	116.9	106.0	84.3	39.6	107.0	88.5	112.3	101.3	90.8	148.2	131.8	110.6	56.4	55.8	**35.2**	145.9	170.5	63.5	77.8	20.0	86.0	62.0	78.0	88.5	116.4	80.0	117.0	112.8	107.9	117.5	29.1	89.4	63.9	..
HEALTH																																				
Women life expectancy at birth, 2008 (years)		83.7	83.3	82.6	83.0	..	80.5	81.0	..	83.3	84.3	82.7	82.5	77.8	83.0	82.3	**..**	84.2	86.1	83.3	83.1	77.5	82.3	82.4	83.0	80.0	82.4	78.7	..	84.3	83.2	84.6	75.8	81.8	80.4	..
Infant mortality, 2008 (deaths /1 000 live births)		4.1	3.7	3.4	5.1	7.0	2.8	4.0	5.0	2.6	3.8	3.5	2.7	5.6	2.5	3.1	**3.8**	3.7	2.6	4.1	1.8	15.2	3.8	4.9	2.7	5.6	3.3	5.9	2.1	3.5	2.5	4.0	17.0	4.7	6.7	..
Expenditure, 2008 (% of GDP)		8.5	10.5	10.2	10.4	..	7.1	9.7	..	8.4	11.2	10.5	9.7	7.3	9.6	8.7	**..**	9.5	8.1	6.5	7.2	5.9	9.9	9.8	8.5	7.0	9.9	7.8	..	9.0	9.4	10.7	6.0	8.7	16.0	..
INCOME AND POVERTY																																				
GDP per capita, 2009 (1000 USD/cap.)		35.2	34.5	32.4	34.6	13.1	22.1	32.4	16.1	30.7	30.5	32.2	26.1	16.7	33.9	35.7	**25.3**	26.8	29.8	25.5	70.4	12.4	36.5	25.0	47.2	16.7	21.4	19.5	25.1	27.1	32.4	36.9	11.6	32.4	42.0	30.0
Poverty (% pop. < 50% median income)		12.4	6.6	8.8	12.0	..	5.8	5.3	..	7.3	7.1	11.0	12.6	7.1	7.1	14.8	**..**	11.4	14.9	14.6	8.1	18.4	7.7	10.8	6.8	14.6	12.9	8.1	..	14.1	5.3	8.7	17.5	8.3	17.1	10.6
Inequality (Gini levels)	*2*	30.1	26.0	26.0	31.7	..	25.0	25.0	..	26.0	26.0	30.0	34.0	26.0	28.0	31.0	**..**	32.0	32.1	31.2	27.0	47.4	28.0	33.5	24.0	32.0	37.0	24.0	..	31.0	23.0	27.6	43.0	33.0	38.1	30.3
Minimum to median wages, 2009	*3*	54.4	x	50.8	42.6	x	36.0	x	41.3	x	60.1	x	48.2	47.8	x	51.1	**x**	x	36.2	40.7	43.0	19.0	47.2	59.4	x	44.9	53.7	45.4	49.0	44.1	x	x	71.3	46.1	37.1	..
EMPLOYMENT																																				
Unemployment rate, 2009 (% of civilian labour force)	*4*	5.6	4.8	7.9	8.3	10.8	6.7	6.0	13.8	8.2	9.5	7.5	9.5	10.0	7.2	11.9	**7.5**	7.8	5.1	3.6	5.2	5.5	3.7	6.1	3.1	8.2	9.6	12.0	5.9	18.0	8.3	4.1	12.5	7.6	9.3	8.3
Labour force participation rate, 2009 (% 15-64 years)		78.5	75.8	68.9	80.1	..	71.0	83.9	..	75.2	69.5	80.5	69.0	60.5	84.1	71.7	**..**	63.4	81.2	69.0	68.8	59.9	80.3	68.3	80.9	63.5	77.8	68.6	..	74.5	70.6	85.6	52.2	76.7	65.4	72.2
Employment in agriculture, 2009 (%)	*5*	3.3	5.5	1.8	2.3	..	3.3	2.5	..	4.6	2.6	2.3	11.7	4.7	1.7	5.3	**..**	3.8	4.2	7.0	1.5	12.9	2.6	6.7	2.7	13.3	11.2	3.6	..	4.2	2.2	3.7	24.7	1.1	1.5	5.0
EDUCATION																																				
Education, 2008 (% 25-64 years)	*6*	69.9	81.0	69.6	87.1	68.0	90.9	75.0	88.5	81.1	70.0	85.3	61.1	79.7	64.1	69.5	**81.2**	53.3	84.0	79.1	67.9	33.6	73.3	72.1	80.7	87.1	28.2	89.9	82.0	51.2	85.0	86.8	30.3	69.6	88.7	71.0
Expenditure, 2007 (% of GDP)	*7*	5.2	5.4	6.1	6.1	6.4	4.6	7.1	5.0	5.6	6.0	4.7	..	..	7.8	4.7	**7.4**	4.5	4.9	7.0	3.1	5.7	5.6	5.9	5.4	5.3	5.6	4.0	5.6	4.8	6.3	5.6	..	5.8	7.6	5.7
OFFICIAL DEVELOPMENT ASSISTANCE	*8*																																			
ODA, 2009 (% of GNI)		0.29	0.30	0.55	0.30	..	..	0.88	..	0.54	0.47	0.35	0.19	..	..	0.54	**..**	0.16	0.18	0.10	1.04	..	0.82	0.28	1.06	..	0.23	..	..	0.46	1.12	0.45	..	0.52	0.21	0.31
ODA, 2009 (USD/cap.)		126	137	242	119	..	..	509	..	242	201	147	54	..	..	225	**..**	55	74	17	840	..	389	72	846	..	48	..	..	143	489	298	..	189	94	109

.. 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.

4) Harmonised unemployment rates.

Source: OECD.

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.

OECD: excludes Chile, Estonia, Israel and Slovenia.

Reference II

ABBREVIATIONS

ASEZA	Aqaba Special Economic Zone Authority
BAT	Best available technique(s)
BAU	Business-as-usual
BOI	Bank of Israel
C&D	Construction and demolition
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanism
CFCs	Chlorofluorocarbons
CH_4	Methane
CITES	Convention on International Trade in Endangered Species
CLC	Convention on Civil Liability for Oil Pollution Damage
CO	Carbon monoxide
CO_2	Carbon dioxide
COFOG	Classification by governmental function of the national accounts
CSD	United Nations Commission on Sustainable Development
CSP	Concentrated solar power
CUEs	Critical use exemptions
DAC	Development Assistance Committee (OECD)
EEA	European Environment Agency
EIA	Environmental impact assessment
EMP	Euro-Mediterranean Partnership
ENPI	European Neighbourhood and Partnership Instrument
EPR	Extended Producer Responsibility
EU	European Union
EU ETS	European Union Emission Trading Scheme/System
EUR	Euro
FAO	Food and Agriculture Organization of the UN
FDI	Foreign direct investment
FoEME	Friends of the Earth Middle East
FTA	Free Trade Agreement
GDP	Gross domestic product
GFRA	Global Forest Resources Assessment
GHG	Greenhouse gas(es)
GSTC	Global Sustainable Tourism Criteria
IEA	International Energy Agency
IEC	Israel Electric Corporation

IGB	Israel Gene Bank
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated pest management
IPPC	Integrated pollution prevention and control
ISO 14000	International Organization for Standardization, Environmental Management Standards
IUCN	World Conservation Union
JNF	Jewish National Fund
kWh	Kilowatt hour
LPG	Liquefied petroleum gas
MAB	Man and the Biosphere Programme (UNESCO)
MAP	Mediterranean Action Plan (UNEP)
MBSL	Metres below sea level
MEAs	Multilateral environmental agreements
MED POL	Marine pollution assessment and control component of the Mediterranean Action Plan (MAP) for the Barcelona Convention (UNEP)
MERC	Middle East Regional Co-operation Program (USAID)
ML	Megalitres
MoEP	Ministry of Environmental Protection
MoI	Ministry of the Interior
MoNI	Ministry on National Infrastructures
Mt	Million tonnes
Mt CO_2 eq	Million tonnes of CO_2 equivalent
MW	Megawatt
N_2O	Nitrous oxide
NBS	National Biodiversity Strategy
NGO	Non-governmental organisation
NIS	New Israeli shekel
NMVOCs	Non-methane volatile organic compounds
NO_X	Nitrogen oxides
NPA	Nature and Parks Authority
NPBB	National Planning and Building Board
O_3	Ozone
OCS	Office of the Chief Scientist
ODA	Official development assistance
ODP	Ozone depleting potential
ODS	Ozone depleting substances
OPRC	International Convention on Oil Preparedness, Response and Co-operation
PCT	Patent Co-operation Treaty
PIC	Prior Informed Consent
PM	Particulate matter
POPs	Persistent organic pollutants
PPP	Purchasing power parities
PRTR	Pollutant Release and Transfer Register
PSE	Producer Support Estimate
PV	Photovoltaic

R&D	Research and development
RES	Renewable Energy Sources
SAICM	Strategic Approach to International Chemicals Management
SEA	Strategic environmental assessment
SPAMIs	Specially Protected Areas of Mediterranean Importance
SPNI	Society for the Protection of Nature in Israel
TPES	Total primary energy supply
TWh	Terawatt hour
UNCCD	United Nations Convention to Control Desertification
UNCED	United Nations Conference on Environment and Development
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
USD	United States dollar
VAT	Value added tax
VOCs	Volatile organic compounds
WEOG	Western European and Others Group (UNEP)
WHO	WHO World Health Organization
WSSD	WSSD World Summit on Sustainable Development

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