Approximation of Environmental legislation

Role of Compliance Costing for Approximation of EU Environmental Legislation in Cyprus

Final report
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Final Report

Authorship and Acknowledgement

Authors Richard Boyd
Prof. Anil Markandya

Editor Anna de Courcy, EDC

Major Contributors Nikos Georgiades, Cyprus Environment Service

With thanks to

For the European Commission:
Paulus Brouwer
Richard Burger
Jesper Jorgensen
Simone Pieri

Environment Policy Europe

15, Avenue des Pleiades,
B-1200 Brussels
Belgium
Phone (322) 775 8400
Fax (322) 775 9799

Environmental Development Consultants

TDI Group
48, Lower Mount Street,
Dublin 2, Ireland
Phone (353 1) 661 1903
Fax (353 1) 661 4991

This report has been prepared by Metroeconomica Ltd under the initiative entitled "Approximation of environmental legislation Central and Eastern Europe and Cyprus (DGXI.6)".

The findings, conclusions, interpretations and language expressed in this report are those of Metroeconomica Ltd. alone and should in no way be taken to reflect the policies or opinions or the prejudice the position of the European Commission or any other body of the European Community.

Executive Summary[1]

The study seeks to produce 'order of magnitude' estimates of the capital (non-recurring) and recurring costs associated with Cyprus complying, by piece or category of legislation as far as this is possible, with the main EU environmental legislation in accordance with their intention to join the EU. Since the *de facto* partition of the island in 1974, the Republic of Cyprus controls only the southern part of the island. Due to the lack of accessible data relating to the north of Cyprus, it has only been possible to undertake the analysis for the Republic of Cyprus.

The report breaks the EU environmental *acquis* down into five 'key' sectors, air quality, water quality, waste management, industrial pollution control and risk management, and 'other'. For each of these sectors the main 'cost driving' directives were assessed to approximate, as best as possible, the cost of Cyprus's compliance. The key findings of the cost analysis are presented below.

An estimated 1,117.7 to 1,263.5 million ECU (1997 prices) is needed to provide the necessary infrastructure and related capital equipment to comply with the environmental *acquis*. If these investment costs are amortised over a fifteen-year period at a 3 per cent real discount rate, the annual capital requirement is between 93.6 and 105.8 million ECU. The total annual compliance cost, i.e. the annualised capital costs plus the associated recurring costs, ranges from 141.5 to 166.5 million ECU. By far the majority of these costs relate to the water quality sector (60.1 per cent); the IPPC and risk management, waste management, and air quality sectors account for 23.4 per cent, 12.8 per cent and 2.9 per cent, respectively. The total annual costs for the other 'key' directives amounts to less than 1 per cent of the total costs, although this may be slightly misleading as the cost analysis is incomplete in these areas at present

Annualised investment needs, when expressed as a percentage of GDP, account for 1.50 per cent. This figure is less than the investment needs for the CEECs, but considerably higher than the needs of the Cohesion countries (0.2 per cent of GDP). The difference in annualised capital costs per capita between the Republic of Cyprus and the CEECs is even more pronounced; 134 ECU per capita for the Republic vs. 1,168 ECU per capita for the CEECs.

Estimated total annual compliance costs correspond to 205 ECU per capita or 2.30 per cent of GDP. In per capita terms, total annual compliance costs are only slightly more than the average per capita figure for the EU 15 (just over 13 per cent greater). However as a percentage of GDP, the total annual compliance costs for the Republic of Cyprus are more than twice as high.

Compliance with the EU environmental *acquis* will inevitably improve the quality of the natural environment in Cyprus for all those who 'use' it, including humans, flora and fauna. A preliminary assessment of the benefits of these improvements is undertaken. For the purpose of this study however, the discussion is purely qualitative, i.e. the magnitude of the benefits is not estimated.

In general, compliance with the *acquis* will mainly benefit Cyprus through:

- reduced levels of air pollution;
- reduced levels of water and ground contamination; and
- the provision of suitable sanitation capacity to support tourist growth.

All of these will result in the protection of the natural environment, and, directly and/or indirectly, improve the welfare of Cypriots and tourists alike. Compliance will also require a co-ordinated approach to the all the aspects listed above in contrast to the present piecemeal legislation and control. This overall view will have benefits in terms of increased efficiency, as well as with respect to the integration of environmental protection.

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List of Acronyms

BAT	Best Available Technique
BATNEEC	Best Available Technology Not Entailing Excessive Cost
CEEC	Central and Eastern European Countries
CO	Carbon monoxide
CWWTP	Central waste water treatment plant
CY £	Cyprus pounds
EAC	Electricity Authority of Cyprus
EAP	Economically active population
EIA	Environmental impact assessment
FGD	Flue gas desulphurisation
GDP	Gross domestic product
GSW	Good Status of Water
IPPC	Integrated pollution prevention and control
MW	Megawatt
NO_x	Nitrogen oxides
O_3	Ozone
PM_{10}	Particulates (dust)
PRA	Petrol Retailers Association
SO_2	Sulphur dioxide
SPA	Special Protection Areas
UKPIA	United Kingdom Petroleum Industry Association
UWWTD	Urban Waste Water Treatment Directive
VAT	Value added tax
VOC	Volatile organic compounds
WHO	World Health Organisation

1. Introduction

1.1. Background

The terms of reference for the study were provided to EDC and Metroeconomica Ltd. by DGXI of the EC, and expanded upon during a subsequent meeting. A copy of the terms of reference and the amendments agreed at the start-up meeting are attached as Appendix I to this report. The final terms require that a study be carried out to provide cost estimates (capital and recurring) of compliance with the main environmental legislation of the EU for Cyprus, in line with that country's intention to join the European Union. It should be noted that under the amended terms of reference the study is not required to make assumptions relating to the timing of the investments required, although it is recognised that the time phasing of the investment programme will influence the present value of the total compliance costs. The administrative needs of meeting with the *acquis* are also to be examined and evaluated. Finally, the study is to undertake a preliminary assessment of the potential benefits resulting from Cyprus's compliance with the *acquis*.

1.2. The Objective

The objective of the study is to produce an 'order of magnitude' estimate of the cost associated with Cyprus complying, by piece or category of legislation as far as this is possible, with the main EU environmental legislation.

A problem specific to Cyprus is that of the coverage of the study. Ideally, cost estimates for both parts of the divided island would be gathered (as required by the terms of reference). Realistically however, data are not available for the north part of the island, although some general economic data are available through the Internet and the press. Hence, this study provides compliance costs estimates for the Republic of Cyprus only. This data omission is recognised as a weakness in the study. The Ministry of Agriculture, Natural Resources and Environment of the Republic of Cyprus, which has been the counterpart agency for this work, has provided a letter indicating that it is unable to assist in the provision of information for the north part of the island.

1.2.1. Approach Adopted to the Cost Analysis

Accession to the EU has been on the 'public agenda' in Cyprus for some time. As a result, a considerable number of feasibility studies have been undertaken over the last few years to investigate and identify strategies, and associated investment programmes (in particular in the waste water and waste management sectors) to align the Republic of Cyprus with western European standards. During the course of this work most of this data that is relevant to the objectives of this study have been collected. Consequently, the approach to the cost analysis adopted here is to utilise 'actual' data as much as possible, i.e. the data and knowledge base developed as a result of these recent studies. The studies that form the basis of the compliance cost estimates are noted at appropriate points throughout the report[2]. The data from these studies have been checked, to the maximum extent possible against other studies of compliance costs with which the consultants are familiar. Where the 'actual' cost data are not available, compliance costs are approximated by applying standard unit costs taken from this literature (e.g. the cost of FGD units per MW) to 'physical gaps' that need to be closed to comply with the *acquis* (e.g. the number of MW requiring SO_2 abatement).

This approach differs from that used in some approximation cost studies, which have constructed cost estimates derived from 'modelling' exercises.

While some of the programmes to improve the environmental infrastructure in the Republic of Cyprus were intended specifically to comply with EU directives, others were not. Only those costs related to

[2] The majority of the technical and economic data used to develop the compliance cost estimates derived during the course of this study were obtained during a Mission to Cyprus from the 22nd to the 26th of September 1998. During this Mission, meetings where held with most relevant stakeholders, including representatives of various Government departments, the Cyprus Petroleum Refinery, the Electricity Authority of Cyprus, and the five main urban Sewerage Boards. Data was either obtained during the Mission or forwarded to Metroeconomica Ltd. shortly thereafter.

complying with the *acquis* are considered within the cost analysis. Proposed directives are also included in the cost analysis because they will influence the costs of compliance in the near future, but they have been separated out in the estimates. Finally, some required investments have already been made; these are reported separately from those investments still required to ensure compliance. In some of the other approximation studies, such costs are included in the estimated total costs of meeting the *acquis*. Hence a comparison between this study and these earlier studies should be undertaken with care.

In recognition that approximation is an iterative process, and this study represents a first step in this process, it cannot be said with certainty at this stage whether the costs identified in this assessment are sufficient to ensure absolute compliance with a particular directive. It may be said however, that the cost estimates derived in this report approximate – as best as possible – the order of magnitude of likely compliance costs to be incurred.

Cost Components

Compliance costs are likely to fall into two categories:

- Costs related to the provision and operation of needed environmental infrastructure (e.g. air pollution abatement equipment, waste water collection and treatment systems, incinerators, etc.).
- Costs related to institutional restructuring, administrative reform and monitoring (e.g. additional staff requirements, monitoring equipment, adequate training, etc.).

Either category may comprise capital and/or recurring (operating and maintenance) costs, although so-called infrastructure costs will tend to be dominated by the former. In contrast, institutional costs will tend to be predominantly recurring costs. Where possible, efforts were made to split the costs into these categories. To provide an indication of the annual capital requirement and the total annual financial burden, annualised capital costs and total annual costs (i.e. annualised capital plus annual recurring costs) are also provided. Investment costs are amortised over a fifteen year period at a 3 per cent real discount rate. Of course, annualised costs are sensitive to the capital recovery period and the discount rate: as the discount rate increases, the annualised capital cost rises (*ceteris paribus*); and as the period over which the capital is recovered increases, the annualised capital cost decreases (*ceteris paribus*).

The impact of any required investment programme on the economy of the Republic of Cyprus will depend to a large extent on the timing of the investment programme. Although consideration of the time phasing of the investment programme is not a requirement of the terms of reference of this study, it should be noted that the present value of the estimated total compliance costs will vary considerably according to how the capital programme is implemented over a set time period, and how short this period is.

All costs are expressed in 1997 prices, unless otherwise stated. All summary figures and all figures in the main text are given in ECU. Some of the detailed tables, however, give the data in Cyprus pounds (denoted by CY £). Conversions between CY £ and ECU are based on an exchange rate of 1.602 ECU per CY £.

1.2.2. The Structure of the Report

In accordance with the Terms of Reference, Chapter 2 of the report provides a summary of the economic situation in the Republic Cyprus. This section also provides some insights into the tourist sector in the Republic of Cyprus.

The discussion of compliance costs is divided into five Chapters, one for each of the 'key' environmental sectors of the *acquis*. Chapter 3 looks at the costs of aligning environmental management and protection practices with EU standards as regards air quality. The costs of complying with the main EU water quality legislation are covered in Chapter 4. Chapter 5 considers the costs of complying with the waste management sector of the *acquis*. Not all aspects of the EU environmental *acquis* relate solely to these three environmental themes. Hence, the costs of compliance with the main directives of the industrial pollution control and risk management sector and 'other' key directives (including horizontal and nature protection legislation) are covered in Chapters 6 and 7 respectively.

Chapter 8 concludes the report by pulling together and summarising the cost estimates made in previous Chapters of the report. The estimated compliance costs are compared to those estimated previously for the CEECs.

Detailed information on various environmental investment programmes in the Republic of Cyprus are presented in the accompanying annexes.

2. Economic Situation in Cyprus

2.1. Introduction

In 1960 Britain granted independence to the Island of Cyprus, which continued as a single republic for 14 years. In 1974, in response to a coup inspired by supporters of union (Enosis) with Greece, Turkey intervened militarily and occupied part of the territory of the Republic of Cyprus, leading to the *de facto* partition of the island and the separation of the two communities, Turkish Cypriot in the northern part and Greek Cypriot in the southern part. The northern part of the island, as currently divided, represents 37% of the total area. Reflecting the availability of data, this section mainly deals with the area under the control of the Government of the Republic of Cyprus. Where available, data for the north part of the island is also provided.

The capital of the island is Nicosia, which is divided between the two communities, and has a total population of 191,000. The second largest city in the area under the control of the Government of the Republic of Cyprus is Limassol on the south coast, with a population of 148,700. Limassol is also the area's main port, an industrial centre, and an important centre for tourism. Larnaca, the second commercial port in the Republic of Cyprus and another important tourist resort, is also on the south coast. This town has 66,400 inhabitants and is home to the Cyprus Petroleum Refinery as well as an international airport. Paphos, on the south-west coast, has 36,300 inhabitants and is a fast-developing tourist resort and home to the second international airport. It is also an active fishing harbour.

Despite the problems presented by the divided nature of Cyprus the area under the control of the Government of the Republic of Cyprus has a relatively buoyant economy. This is reflected in part by the present levels of growth, high employment levels and stability which it exhibits. In terms of income per capita, the area under the control of the Cyprus government is classified among the upper middle-income countries.

The success of the economy of the Republic of Cyprus is attributed, at least in part, to the adoption of a market oriented economic system (although an indicative plan is regularly produced by the Ministry of Finance); the existence of a dynamic and flexible entrepreneurial community; and a highly educated labour force. The economy also benefits from the close co-operation between the public sector and the social partners.

During the last decade the economy has intensified its links to Europe. Relations with its largest trading partner are currently governed by a Customs Union Agreement, which provides for the gradual and mutual dismantling of trade barriers.

2.2. Key Economic Indicators

2.2.1. Economic Activity

Table 2.1 illustrates the economic situation of the area under the control of the Government of the Republic of Cyprus. Selected economic indicators for the north part of the island are given in Table 2.2.

Table 2.1 Economic Indicators (94/95): Republic of Cyprus

Gross Domestic Product	**6,652.9 million ECU**
annual growth rate (95-96)	*4.2%*
annual GDP/capita	*ECU 10,206/inhabitant*
Labour Force	**307,600**
unemployment rate	*3.1%*
participation rate	*47.5%*
Public Expenses (Budget)	**2,349.6 million ECU**
public debt	*54% GDP*
budget deficit	*3.4% GDP*
Inflation rate	**3.6%**

Source: Department of Statistics & Research, Ministry of Finance (1996)

Table 2.2 Economic Indicators: North Part of the Island

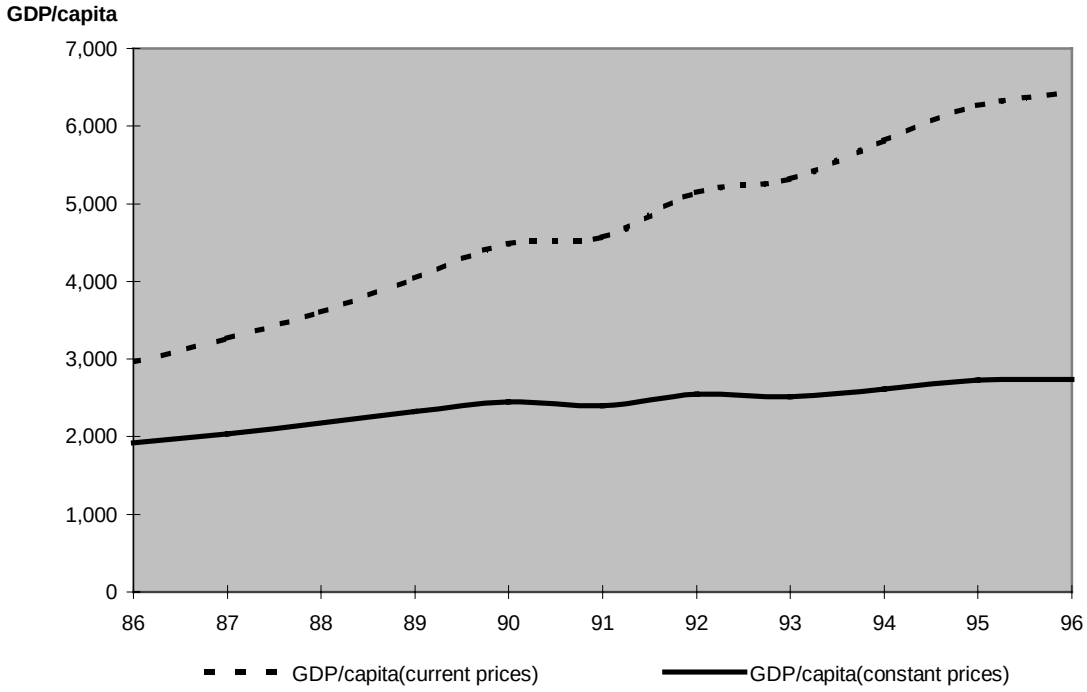
	Year				
Economic Indicators	**1989**	**1990**	**1991**	**1992**	**1993**
GDP[1] (billion Turkish Lira)	898.1	1,538.6	2,218.0	4,013.5	6,704.7
GDP (million ECU)	381.7	462.7	259.4	213.1	204.7
Real GDP Growth (%)	5.2	4.2	-6.4	6.2	1.5
Price Inflation (%)	51.8	69.4	46.4	60.3	71.1

Source: Economist Intelligence Unit

Notes:
[1] At current prices.

The growth in gross domestic product over the last decade has been relatively constant, as shown in Figure 2.1.

Figure 2.1 GDP Per Capita Evolution (CY £)



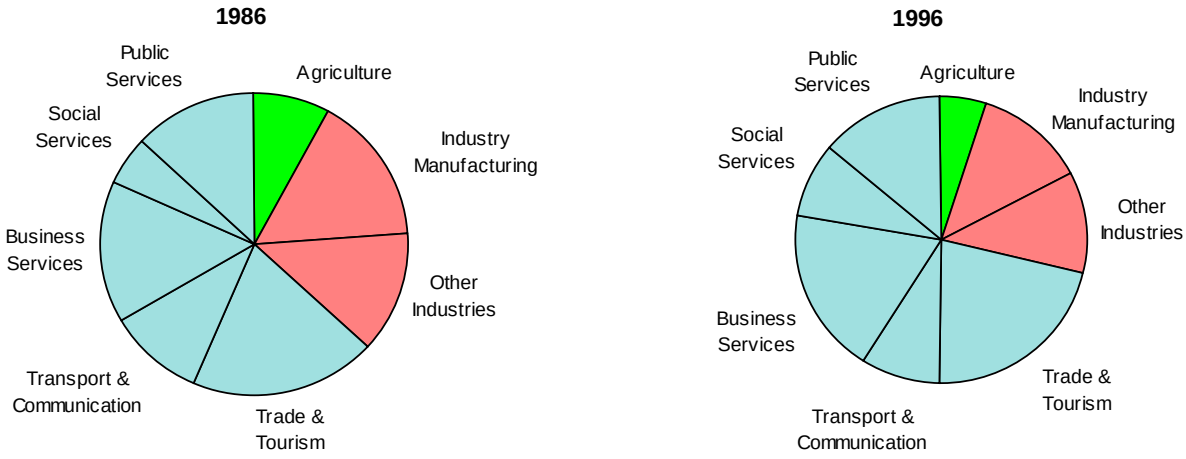
Differences in growth rates exist between the various economic sectors. The economy in the area under the control of the Government of the Republic of Cyprus is resolutely a 'tertiary' one, with the growth rate of activities in this sector often being higher than the global average, as shown in Table 2.3 and Figure 2.2.

Table 2.3 Distribution of GDP (1996) and Growth Rates (95-96) per Economic Sector (Republic of Cyprus)

Primary Sectors	**5.5% GDP**	**0.2%**
Agriculture	5.2%	0.0%
Mining and Carrying	0.3%	3.0%
Secondary Sectors	**24.9% GDP**	**3.4%**
Manufacturing	12.6%	2.0%
Electricity	2.5%	8.5%
Construction	9.8%	3.0%
Tertiary Sectors	**69.6% GDP**	**4.6%**
Trade	11.7%	4.0%
Restaurants & Hotels	9.1%	4.0%
Transports	5.7%	2.5%
Communication	2.2%	6.0%
Finance, Insurance	5.4%	7.0%
Business Services	3.3%	7.5%
Real Estate	8.9%	3.0%
Community and Social Services	8.8%	7.5%
Government Services	14.5%	4.0%

Source: Department of Statistics & Research - Ministry of Finance (1996 data)

Figure 2.2 Evolution of Each Economic Sector in GDP of the Republic of Cyprus



The economy in the north part of the island is equally reliant on the tertiary sector with (as shown in Table 2.4) this sector accounting for about 57 per cent of total GDP (excluding the 'Others').

Table 2.4 Gross Domestic Product At Factor Cost (1992)

Sector	Percent of Total
Agriculture	8.5
Manufacturing	11.2
Construction	7.2
Wholesale & Retail Trade & Tourism	20.9
Government Services	19.6
Communication and Transport	8.6
Property Income	1.9
Other Private Services	6.0
Other	16.1

Source: Economist Intelligence Unit

2.2.2. Labour Market Indicators

In 1996, the economically active population in the area under the control of the Government of the Republic of Cyprus was estimated at around 308,000 individuals, with those actually in employment averaging 285,000. The unemployment rate is relatively low for western standards (around 3%). Note that more than 60% of the workers are male, with the unemployment rate for females currently at 4.5%.

The trade and the tourism industry employ the largest number of individuals, followed closely by the public services sector, as shown in Table 2.5.

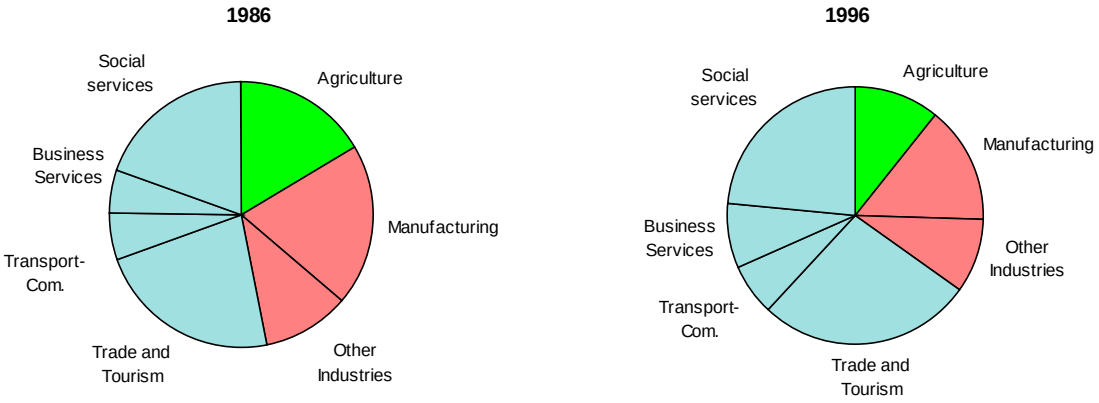
Figure 2.3 shows how the structure of the labour market in the area under the control of the Government of the Republic of Cyprus has changed over the last decade.

Table 2.5 The Composition of the Labour Force in Republic of Cyprus (1996)

Sector	Percentage of Total
Agriculture	10.5%
Mining and quarrying	0.3%
Manufacturing	14.8%
Electricity, gas and water	0.5%
Construction	8.9%
Trade, Hotel & Restaurant	26.7%
Transport and communication	6.5%
Finance, insurance, business services	8.3%
Public services	23.5%

Source: Department of Statistics & Research, Ministry of Finance (1996)

Figure 2.3 Changes in the Structure of the Labour Market in the Republic of Cyprus



Between 1995 and 1996, the increase in labour productivity has been estimated at 2.3 per cent; 3.2 per cent for the public services sector, and 2.0 per cent for the private sector (excluding agriculture). Over the same period, unit labour costs have increased between 2.5 per cent and 3.1 per cent (in real terms).

The Labour force in the Turkish Cypriot Community is estimated to be around 75,000, of which 5,000 are civil servants. The official unemployment rate in the northern part of the island is around 2%[3]. No data accompanied these figures, but they are believed to be representative of the early 1990s.

2.2.3. Trade Indicators

According to foreign trade figures, the value of imports to the area under the control of the Government of the Republic of Cyprus presently exceeds the value of exports, with the trade deficit being approximately one billion Cypriot pounds. This is illustrated in Table 2.6 below.

[3] Obtained from the Government web site.

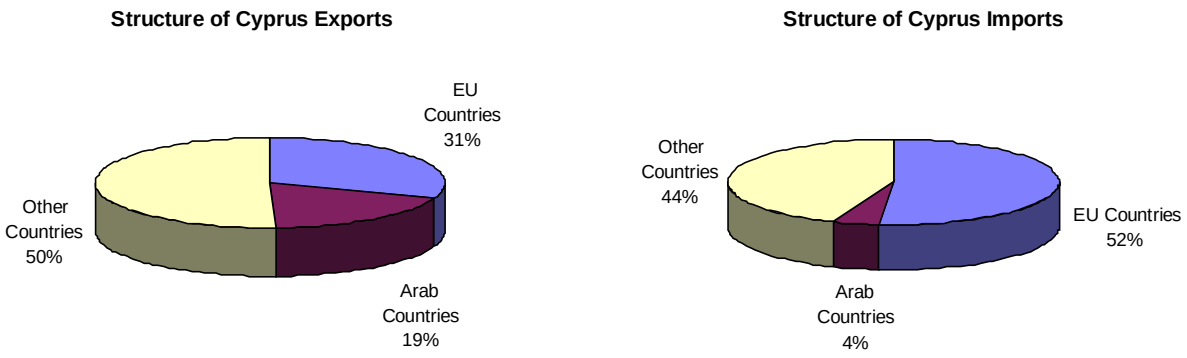
Table 2.6 Selected Trade Indicators for the Republic of Cyprus

Export value	**867.2 million ECU** • *Agriculture* **15%** *(potatoes, citrus, wines & spirits, fruits)* • *Industry* **30%** *(clothes, pharmaceuticals products, cement)* • *Re-export* **55%**
Import value	**2,505.4 million ECU** *Consumer goods, intermediate inputs, fuels and lubricants (10%), transport equipment*

Source: Department of Statistics & Research - Ministry of Finance (1996)

In addition, the relative contribution of the various trading partners differs between imports and exports. This is illustrated in Figure 2.4.

Figure 2.4 Import/Export Trading Partners of the Republic of Cyprus (1996)



According to the most recently available data for the north part of the island, a large trade deficit is also evident (see Table 2.7).

Table 2.7 Selected Trade Indicators for the North Part of the Island (million ECU, 1991)

PRINCIPAL EXPORTS	
Manufactured Goods	20.3
Agricultural Products, of which	21.8
Citrus Exports	17.4
PRINCIPAL IMPORTS	
Manufactured Goods	88.6
Machinery & Transport Equipment	54.4
Consumer Goods	47.7
Fuels and Lubricants	28.1
Chemicals	19.2

Source: Economist Intelligence Unit

The main origin of imports was Turkey (47.5 per cent of the total), followed by the United Kingdom and other EU countries, with 15.2 and 15.7 per cent of the total respectively. Far Eastern countries accounted for 10.7 per cent of total imports.

2.3. Situation by Sector

2.3.1. The Agricultural Sector

Historically, Cyprus as a whole was dependant on the export of agricultural produce, largely citrus fruit, potatoes and wine. Since 1974, the agricultural base of the area under the control of the Government of the Republic of Cyprus (at least) has became more restricted. However, despite its reduced contribution to the GDP and total employment figures, agriculture is still a fundamental sector with respect to both the production of essential food items for domestic consumption and export, and the containment of the depopulation of the (rural) villages. Some agricultural indicators are given in Table 2.8.

Table 2.8 Agriculture Indicators (94/95)

Agricultural Production value	**555.2 million ECU**
% of GDP	*5.5%*
% of Labour Force	*10.1%*
% of total domestic exports	*41.7%*

Source: Department of Statistics & Research - Ministry of Finance (1996)

The agriculture industry in the area under the control of the Cyprus Government can be divided into two major sub-sectors; crop production and livestock production. These respectively contribute 67.6 per cent and 21.8 per cent to the value of the agricultural sector as a whole. Ancillary production, such as milk, wine etc. represent 4.5 per cent, fishing 4.3 per cent and forestry 1 per cent.

Crop production can be divided into two main types:

- irrigated agriculture, including citrus fruits, potatoes, vegetables and fruits; and
- non-irrigated crops, including cereals, olives, carrots, almonds and wine grapes.

Livestock production can also be divided into two main categories:

- sheep, goats, pork and poultry which constitute the main sub-sectors of livestock industry;
- local production of beef, veal, mutton and lamb which is supplemented by imports, and
- milk and milk products.

Fisheries in the area under the control of the Government of the Republic of Cyprus produced more than 3,000 tons of fish in 1995, valued at 19.3 million ECU. Recent developments in this sector have been in marine aquaculture. The evolution of key agricultural indicators over the last decade are illustrated in Table 2.9.

Table 2.9 Evolution of Agricultural Indicators in the Republic of Cyprus

	1986	1996
Agriculture output in current price (million ECU)	326.6	553.8
Agricultural production index (1985 = 100)	99.1	136.6
Employment:		
- number of workers	35,400	30,000
- of active population	*16.1%*	*10.5%*

Source: Dept. of Statistics and Research, Ministry of Finance (1996)

In the north part of the island an estimated 60 per cent of the total population lives in rural areas. For the year 1990, about 26.7 per cent of the economically active population were employed in the agricultural sector. As a whole, this sector accounted for 9.2 per cent of GDP in 1990, while agricultural produce comprised 45.5 per cent of the total exports for the same year. Between 1986 and 1990 (the period for which the most recent data is available) agriculture has declined in importance in terms of its proportion of GDP, the economically active population and exports[4].

2.3.2. The Manufacturing Industry

The manufacturing industry in the area under the control of the Government of the Republic of Cyprus has been going through difficult times in recent years with a fall in the growth of production, and reductions in exports and employment. In 1987 the Republic of Cyprus signed a Customs Union Agreement with the EU, but competition in the European market is intense for all the products which the Republic of Cyprus exports. However, the manufacturing sector does continue to play an important role in the economy, accounting for about 15 per cent of GDP[5] and 15 per cent of employment. The evolution of key industrial indicators for the area under the control of the Government of the Republic of Cyprus is shown in Table 2.10.

The most important sub-sectors in terms of value added are food and beverages, clothes and metal products. Other industrial sub-sectors now expanding include printing and publishing, rubber and plastics, chemical products and machinery.

Table 2.10 Evolution of Industrial Indicators in the Republic of Cyprus

	1986	1996
Manufacturing output in current price (million ECU)	1,074.8	2,026.9
Manufacturing production (1985 = 100)	102.7	120.6
Employment:		
number of workers	43,800	42,100
% of active population	*19.9%*	*14.8%*

Source: Dept. of Statistics and Research, Ministry of finance - 1996

In 1990, 11.3 per of the economically active population in the north part of the island were employed in the industrial sector[6]. In the same year this sector accounted for 13.7 per cent of GDP (share of manufacturing was 11.6 per cent) and industrial output comprised 53.7 per cent of total exports. Over the period 1986 to 1990 industry showed a steady upward trend in growth and by 1990 ranked first in exports, and third in its share in GDP. Its share in total fixed investment, however, showed a steady decline over the same period.

[4] Obtained from the Government web site.
[5] Total industry (including the construction and energy sectors) represents 26% of the GDP.
[6] Obtained from the Government web site.
[8] ibid

Growth prospects for the sector in the north part of the island are limited "…to a varying degree by a number of constraints including difficulties in export markets, the inability to attract new investment and to develop new industries, political constraints and cheap imports from Turkey…"

2.3.3. The Tourism Industry

The area under the control of the Government of the Republic of Cyprus has seen enormous development in the tourist industry. The pace of growth has been much greater and faster than was predicted in the early 1980s. Cyprus is now the most popular island destination in the Eastern Mediterranean; over 2.5 million tourists visited the area under the control of the Government of the Republic of Cyprus in 1996 (from Scandinavian countries, Germany, Switzerland and Britain), this represents three times the population of Cyprus.

The increase in tourist earnings was opportune in terms of the Island's balance of payment, since it has helped offset the visible trade deficit through the 1980s, while in the early 1990s, a substantial surplus was recorded. Although the tourists bring foreign exchange receipts, and help stimulate the local economy, the growth in the tourist industry has also caused some problems. For example, it has resulted in uneven development, and the creation of enclave sectors in the economy which can result in distortions in domestic markets as well as having adverse environmental effects.

There is also a foreign exchange cost, since the area under the control of the Government of the Republic of Cyprus has no capital goods industry and therefore equipment has to be imported. This is not as significant as it would be for industrial development, however, and the main costs associated with the industry are construction costs for the hotels and apartments. The area under the control of the Government of the Republic of Cyprus has its own construction companies, which carry out all the major hotel/apartment construction works on the Island, as well as many infrastructure projects throughout the Middle East. Although the equipment is imported, building supplies such as cement and tiles are produced domestically. There is also a domestic furniture industry, which supplies many of the fittings and furnishings in the holiday accommodation. These factors minimise the foreign exchange leakages from tourist expenditure, thereby maximising the local multiplier effects.

Government Revenue and Expenditure on Tourism

Historically, the development of the tourist industry more as a means of stimulating the economy and creating employment, than a source of fiscal revenue, in the area under the control of the Government of the Republic of Cyprus. The main governmental body is the Republic of Cyprus Tourism Organisation, who maintain the tourist information offices both in Cyprus and abroad, provide the official grading of hotels and apartments, and oversee the development and maintenance of tourist facilities.

The Government of the Republic of Cyprus has welcomed and encouraged the development of the tourist industry, but has limited its role to the provision of 'support' rather than direct investment. The Government of the Republic of Cyprus does provide some finances for the restoration and conservation of antiquities, however, (although revenue from admissions covers most of the cost). Direct government spending on tourism averaged only 1 million ECU (in current prices) between 1983-86, an insignificant amount, when compared to the private investment in hotels and self-catering accommodation which came to over 48 million ECU (in current prices) annually by the mid-1980s. Much of this was financed by borrowing from the commercial banks.

The main indirect benefit to the Government of the Republic of Cyprus from the tourist industry is the revenue from the taxes paid by those the industry employs. For example, it is estimated that more than 20 per cent of jobs in the area under the control of the Government of the Republic of Cyprus are tourism dependent (allowing for expenditure multiplier effects). There are also duties on tourist related imports, and excise duties on alcohol (tourists account for over one quarter of all spending on alcohol). The main Government subsidy to the tourist industry is also indirect, through the provision of infrastructure. It is extremely difficult, however, to separate the benefits for tourists from the benefits for the local community more generally.

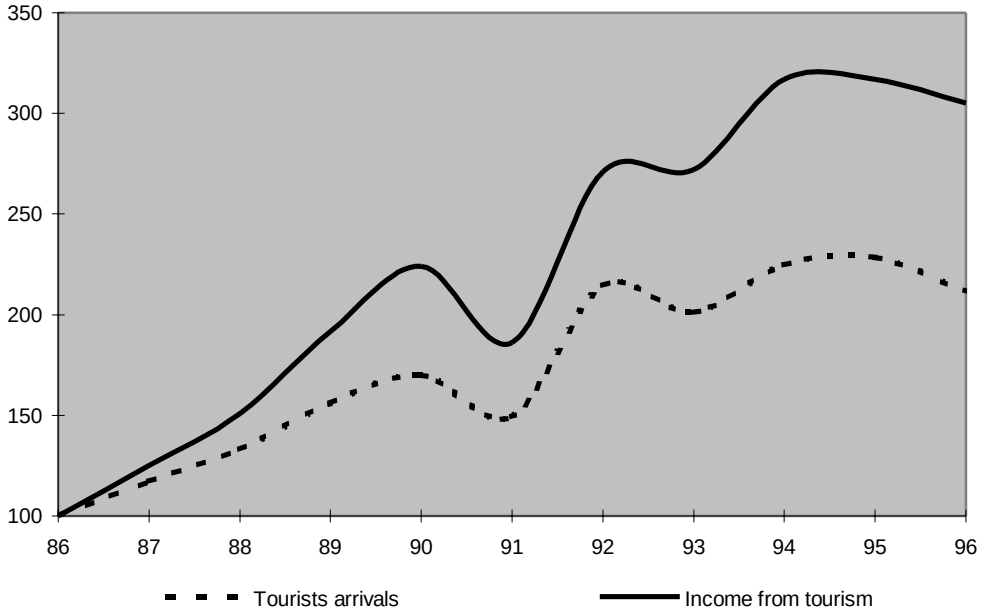
Table 2.11 presents some recent data relating to the Tourism Industry, and Figure 2.5 shows the evolution of the tourism industry over the last decade.

Table 2.11 Tourism Industry Indicators for the Republic of Cyprus

Long stay visitors	2,2 Million, of which *2,1 (Tourists only)* *2,3 (incl. Excursionists)*
Guest-nights in tourist accommodation	12,7 Million (1996)
Transit	138,500 people
Main countries concerned	UK, Germany, Nordic Countries, Russia
Hotel Capacity (numbers of beds)	84,549 beds
Coastal area	*79,785*
Nicosia	*2,370*
Hill resorts	*2,394*
Total receipt from tourism	1,416 million ECU (21% GDP)

Source: Department of Statistics & Research, Ministry of Finance - 1996

Figure 2.5 Evolution of the Tourism Industry in Republic of Cyprus Over the Last Decade



The Government policy on tourism is to increase the contribution it makes towards the economic and social development of the country. One way of doing this is to encourage the development of particular forms of tourism, such as conference tourism, winter tourism etc. The development and expansion of these types of tourism is seen as one way of alleviating the problem of seasonality, thus providing a more rational utilisation of bed capacity. Cyprus has milder winters than many of the Mediterranean destinations to the north and west. Despite this, tourist arrivals on the island show a definite seasonality, with over four times the number of arrivals in the peak months of July and August compared to January and February. Even in April, which is one of the best months climatically in Cyprus, arrivals are below 60 per cent of their August peaks.

The development of particular specialist forms of tourism is also seen as a way of attracting tourists from high income groups, one of the main goals of the tourist policy for the coming years. It is anticipated that the more affluent tourists will spend more on the island, and solve the problem of the limited labour force to support increases in mass tourism. Present occupancy rates show that this strategy has been successful so far, with the highest room utilisation in four-and five- star hotels.

The Spatial Implications of Tourist Development

As mentioned above tourism results in disparities between regional incomes, with the tourist resorts seeing growth, but this having little or no impact on towns and the countryside outside these areas. In the area under the control of the Government of the Republic of Cyprus, tourist development has been highly concentrated, with most employment in the tourist industry concentrated in Limassol, Larnaca, Paphos and Ayia Napa, with the hotels in Nicosia the capital, largely catering for business travellers.

It is estimated that in the area under the control of the Government of the Republic of Cyprus, for each job in hotels and apartment accommodation, 1.27 exist in restaurants, cafes and bars, with a further 0.85 in souvenir shops, taxi and car rental companies, travel agencies and other ancillary services. The employment multiplier from tourism development is therefore relatively high, but since unemployment is at 3.1 per cent (1995/96), large-scale job creation is not as important. On the contrary, the creation of many more tourist jobs might see a decline in other economic activities. There are also important regional implications associated with the development of tourism jobs, with more than one in three of the jobs being in Limassol, a further half in Larnaca, Paphos and Ayia Napa, but very few in Nicosia or the interior.

The Economics of Tourist Transportation

The major foreign exchange cost of tourism is associated with transport. All aircraft and vehicles have to be imported into the area under the control of the Government of the Republic of Cyprus, as is the petroleum to power them.

Many tourists hire cars for all or part of their stay on the Island, so that they can visit the Troodos mountains, Nicosia, or the many antiquities found around the island. The car hire companies argue that their operations create employment opportunities, both in the management and the servicing of the vehicles, with greater numbers being involved than if tourists relied on coach tours.

The Tourism Industry in the North of Cyprus

Tourism in the northern part of the island has been developed into a type of ‘visit and shop’ destination for tourists form the Turkish mainland. Tourism development has also historically been marketed on the region's ‘nature' potential. However, the development strategy of the “Public administration/authorities” is shifting as new and diversified tourism facilities become operational (to attract ‘leisure’ tourists). This shift is necessitated by the gradual erosion of the northern part of the island’s imported goods retail price advantage, in the face of the liberalisation of the Turkish economy.

As Table 2.12 indicates, about 2.3 per cent of the economically active population in the north of Cyprus were directly employed in the tourism sector in 1990. For the same year, tourism accounted for 2.3 per cent of GDP and the earnings from tourism comprised 61.6 per cent (equivalent to 177 million ECU) of total foreign earnings.

Table 2.12 Evolution of Key Indicators of Activity in the Tourist Industry in the North of the Island

Activity Indicator	Year				
	1986	**1987**	**1988**	**1989**	**1990**
Share in GDP (%)	1.8	2.0	2.3	2.2	2.3
Share of EAP (%)	1.8	2.1	2.3	2.3	2.5
Share of Foreign Earnings (%)	39.5	51.7	56.4	60.0	61.6
Earnings from Tourism (million ECU)	53.1	90.0	100.0	140.8	177.0
Tourist Arrivals	131,492	184,337	229,401	274,073	300,810
Share of tourists from Turkey (%)	80.4	80.3	75.6	78.3	80.9
Bed-nights	320,820	554,289	591,261	611,313	616,007
Beds	4,173	4,352	4,567	5,254	6,125
Annual increase in beds (%)	4.29	4.94	15.01	16.58	
Occupancy Rate (%)	27.51	43.35	42.95	37.87	34.68

Source: Obtained from the Government web site.

Table 2.13 shows that tourist arrivals have grown by an average of 23 per cent annually (world average was 4.8 per cent during 1977-1985) between 1986 and 1990. Over the same period earnings from this sector grew by 44.2 per cent and bed-nights by 17.6 per cent annually. The share of investment in the tourist industry, as a percentage of total fixed investment, increased from 1.1 per cent in 1986 to 25 per cent in 1990. This is reflected in the percentage annual rise in the number of beds.

2.3.4. Conclusion

Overall, the area under the control of the Government of the Republic of Cyprus may be regarded as a successful economy, despite the rather large trade deficit. It is evident from the structure of the economy that the area has achieved industrialisation, and is indeed within the range of GDP per capita of the EU15. Unemployment levels are relatively low and growth prospects for the economy are also good.

3. Air Quality

3.1. EU Legislation and Compliance Issues

The relevant environmental *acquis* directives with respect to Air Quality are listed in Table 3.1.

Table 3.1 Air Quality: Directives of the EU Environmental *Acquis*

Reference	Description (Title)
96/62/EC	Air Quality Framework Directive
80/779/EEC	Directive on Sulphur Dioxide and Suspended Particles
82/884/EEC	Directive on Lead
85/203/EEC	Directive on Nitrogen Oxide
92/72/EEC	Directive on Tropospheric Ozone Pollution
70/220/EEC	Light Duty Motor Vehicles (base Directive)
72/306/EEC	Directive on Smoke Emissions from Diesel Engines of Motor Vehicles
92/55/EEC	Roadworthiness Tests for Emissions Directive
94/63/EC	Volatile Organic Compounds Emissions Directive
85/210/EEC	Directive on the Lead Content of Petrol
93/12/EEC	Directive on the Sulphur Content of Liquid Fuels
COM 96/0164 (COD)	Proposed Directive on the Quality of Petrol and Diesel Fuels
COM 96/0163 (COD)	The Auto-Oil Programme

3.1.1. The Air Quality Framework Directive

About This Directive

The Air Quality Framework Directive aims to set the basic principles of a common strategy to define and establish objectives for ambient air quality in the European Union. The intention is to avoid, prevent or reduce harmful effects on human health and the environment as a whole.

Member states have to assess their ambient air quality on the basis of common methods and criteria, and make the information publicly available. Where ambient air quality is good, member states will have to maintain it, in other cases improvements will have to be made.

Existing Situation and Cost Implications

The Control of Atmospheric Pollution Law 1991 (70/91) provides a framework for implementation of the relevant EU Directives with respect to pollution from industrial sources, and establishes a system for the registration and licensing of industrial processes and their operation, which fulfils the conditions of the EU emission standards. In addition, ambient air quality objectives have already been established which meet the EU standards.

Areas where existing Republic of Cyprus legislation does not (completely) meet with the EU requirements can be summarised as follows:

- A formal transposition of emission standards.
- The control on vehicle emissions.
- The establishment and implementation of action programmes to reduce emissions over time.
- Provisions on public information/notification when thresholds are exceeded.
- The establishment of a co-ordinated monitoring programme.

In addition there are practical issues of concern. For example the potential cost to industry of complying with the requirements of the Large Combustion Plants Directive (addressed in Chapter 6),

and the need for additional resources in order to measure air quality and monitor compliance with 'licenses/authorisations'. These issues are addressed below.

Monitoring Requirements

At present, the Department of Labour operates 3 automatic monitoring stations. These stations continuously measure urban air quality in Nicosia. The following parameters are measured: SO_2, NO_x, CO, O_3, hydrocarbons, PM_{10}, wind speed, wind direction, temperature, pressure and relative humidity. Data are collected and transmitted *via* telephone lines directly to the central office in Nicosia.

The Republic of Cyprus is a signatory of the Convention on Transboundary Pollution. One transboundary monitoring station exists on the island. This station continuously measures the following parameters: SO_2, NO_x, O_3, PM_{10}, solar radiation, temperature, pressure and relative humidity.

It is estimated that an additional 6 monitoring stations will be required to measure urban air quality in other major towns in the Republic of Cyprus (e.g. Limassol, Larnaca, Paphos) and an additional 4 units will be required to monitor air quality in 'special' rural zones. The purpose of the latter is to monitor NO_x and O_3 levels. The estimated capital cost of the 'urban' monitoring units is 1.2 million ECU (1997). The 'rural' units are estimated to cost 56,000 ECU (1997) each, or 224,000 ECU for all four. The recurring cost of each unit, inclusive of labour, energy and consumables, is about 12,800 ECU (1997) per annum, or 128,000 ECU for all ten units. For the assessment and characterisation of the ambient air in various areas of Cyprus, a detailed study may be required.

Monitoring equipment is also required at the power stations on the Island. Continuous emission monitoring equipment has been installed at Dhekelia power station and needs to be installed at the proposed power station at Vasilikos (details are provided in Annex C). There is no continuous emission monitoring scheme at the Moni power station, although a portable flue gas analyser was purchased in 1997. The total cost of the emission monitoring units for all three power stations is 0.35 million ECU (1997), of which 296,700 ECU still needs to be spent. Two mobile ambient air quality monitoring units have been purchased for each of the Moni and Dhekelia power stations. Two mobile units are required for the Valilikos power station. The total cost for all six mobile monitoring units is 1.1 million ECU (1997), of which 371,000 ECU has yet to be incurred.

Institutional Strengthening

At present the Factory Inspectorate of the Department of Labour employs 11 (suitably qualified) engineers at the central office in Nicosia; five of whom deal solely with pollution[7]. An additional 20 inspectors, of a higher national diploma (HND) level, are located in District offices throughout the Republic Cyprus. To meet the demands of the EU environmental *acquis*, it is estimated that an additional 4 'professional' level staff will be required for the head office in Nicosia, and an additional 4 inspectors will be required. The cost of these posts is estimated to be 157,800 ECU per annum (see Annex D).

At present, the Republic of Cyprus has a National Action Plan in order to deal with air pollution problems. This plan will need to be expanded and strengthened, however, to harmonise it with requirements of the Directive (e.g. a response system when thresholds values are exceeded, plans to reduce emissions levels). In making the necessary institutional changes some additional (minor) institutional costs will be incurred. The training of existing staff alone is estimated to cost under 20,000 ECU; this is a non-recurring cost (see Annex D).

3.1.2. Sulphur Dioxide and Suspended Particulates

About This Directive

This Directive aims to protect human health by setting limit values and guide values for sulphur dioxide and suspended particulates and setting binding annual values and non-binding guide values

[7] Note: the Factory Inspectorate of the Department of Labour has numerous areas of responsibility, including health in the workplace, dangerous substances, industrial effluent, industrial air pollution, major hazard control, and noise control.

based on the findings of the World Health Organisation. This Directive will be replaced by a (new) Daughter Directive under the Air Quality Framework Directive.

Existing Situation and Cost Implications

With the exception of particulates, limit values for other pollutants are not exceeded. Apart from dust from the Sahara the main sources of the (occasional) particulate problem are selected industries. The main industrial sources of particulate pollution have been identified by the Factory Inspectorate in the Department of Labour (including asphalt and concrete mixing, quarries, foundries, cement works and mining) and measures to reduce emissions assessed. The list of industries, the required measures, and their associated costs, are given in Table 3.2. The estimated total capital cost of implementing the required environmental protection measures is 12.6 million ECU (1997). No data were available on the incremental recurring costs of the required measures.

Table 3.2 Capital Cost of Reducing Industrial (Particulate) Emissions

Industry	Description of Measure	Total Cost (CY £[1997] mn.)
Asphalt mixing: 5 plants require	• Baghouses – dust collectors/filters at CY £[1997] 120,000 per unit	0.600
Concrete mixing: 45 plants require	• Baghouses – dust collectors/filters at CY £[1997] 25,000 per unit	1.125
Quarries: 30 units require	• Dust covers/venting/filter equipment at CY £[1997] 40,000 per unit	1.200
Foundries:		
N. Coupula Foundry	• Dust collector/filter at CY £[1997] 55,000 per unit	0.055
M. & A. Coupola Foundry	• Dust collector/filter at CY £[1997] 27,500 per unit	0.028
		3.008
Cement works:		
Vasilikos Cement Works	• Electrostatic Precipitator upgrading	1.000
	• Baghouse – dust collector/filter	1.000
	• Baghouse – dust collector/filter	0.300
	• Enclosure system including Baghouse for clinker loading of ships	0.300
	• Control of area source emissions (e.g. asphalting, cleaning vehicle, construction works)	0.600
Sub-total		3.200
The Cyprus Cement Co.	• Relining of the internal surfaces and replacement of the electrodes of the Raw Mill Electrostatic Precipitator	0.117
	• Replacement of the electrodes of the By-pass Electrostatic Precipitator	0.068
	• Pulse jet filters for the raw meal silo and clinker tower	0.010
	• Connection of the two Electrostatic Precipitators	0.134
	• Electronic control system for the Electrostatic Precipitators	0.030
	• New pulse jet filter for the cement mill number 2	0.150
	• Repair of the two clinker silos	0.250
	• Automatic bag packing machine	0.400
Sub-total		1.159
Mining:		
Hellenic Copper Mines	• Enclosure of milling/sieving operations to control dust emissions	0.300
	• Asphalting of roads to control fugitive dust emissions	0.200
Sub-total		0.500
Total Capital Cost		**7.867**

3.1.3. Directives on Emissions from Mobile Sources

About These Directives

The light duty motor vehicles Directive lays down the technical requirements and the limit values for carbon monoxide and unburnt hydrocarbon emissions from the engines of motor vehicles. These requirements have been made more stringent by a series of amending directives. Limit values for nitrogen oxides, and particulates from diesels are now also included, and the Directive covers all passenger cars, regardless of engine capacity, and also light commercial vehicles, passenger cars for more than six passengers, and off-road vehicles which previously benefited from less stringent standards. In addition there are requirements relating to evaporative emissions and the durability of emissions-related components.

Directive 94/12/EC (the Auto-oil Programme) requires the Commission to propose standards to be enforced after 2000, based on a comprehensive assessment of costs and efficiency of all measures aimed at reducing the pollution from road transport. This will include improved fuel quality, strengthened car fleet inspection and maintenance as well as tighter emissions standards. The proposal is based on establishing air quality criteria and associated emission reduction objectives, with a cost-effectiveness evaluation of each package and taking into account other measures, such as traffic management, new technologies etc.

Two proposed directives set out amendments under the Auto-oil Programme: COM 96/0163 (COD) is a proposal for an amending directive on emissions from light duty motor vehicles; and COM 96/0164 (COD) lays down requirements to improve the quality of motor fuels.

Directive 77/143/EEC on road worthiness tests for motor vehicles and their trailers, amended by 92/55/EEC, requires that vehicle emissions be tested regularly for the control of carbon monoxide, and with respect to the air-fuel ration for petrol fuelled vehicles, and of the opacity of the exhausts from diesel vehicles.

Existing Situation and Cost Implications

The composition of the annual registration of motor vehicles in the Republic of Cyprus is given in Table 3.3. Figure 3.1 illustrates the trend in vehicle registration in accordance with constant price GDP evolution.

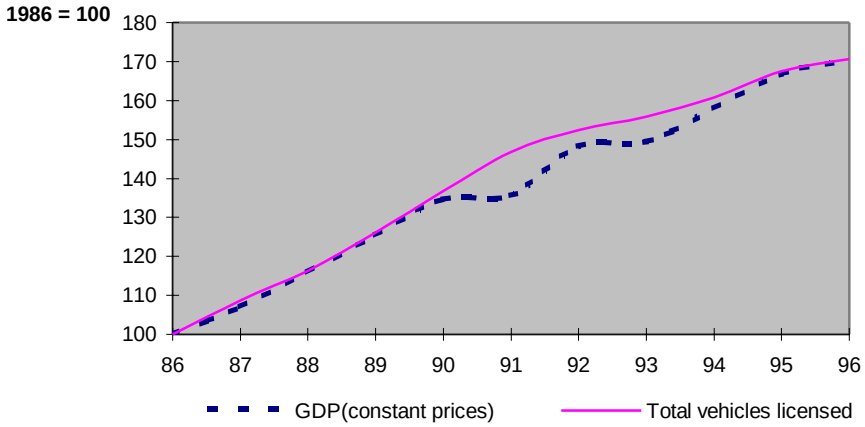
Table 3.3 The Composition of Annual Registration of Motor Vehicles (1996)

Registration of Motor Vehicles by type:	
Cars	59%
Buses	1%
Goods conveyance vehicles (e.g. trucks)	23%
Mechanised Cycles (e.g. motorcycles)	15%
Tractors	2%
Registration by fuel used	
Petrol	67%
Diesel	33%
Registration by age	
New	49%
Used (i.e. 'second hand')	51%

Source: Department of Electrical and Mechanical Services (1998) Motor Vehicles in Cyprus.

In 1997 there were 403,956 motor vehicles in circulation; equivalent to 2.6 inhabitants per private vehicle (or 1.7 inhabitants per vehicle). Also, 45% of vehicles were over 10 years old.

Figure 3.1 Vehicle Registration According to Constant Price GDP Evolution



The Motor Vehicles and Road Traffic Law regulates the registration of vehicles with the Ministry of Communication and Work as the responsible authority. The main weakness in this law with respect to the EU regulations is that it does not state specific technical requirements, or require compliance with any national or international standards for the construction of vehicles. Moreover, a number of European Directives dealing with Active Safety, Passive Safety, Environment, Lights, etc. are not complied with under the present legislation.

The adoption of the directives dealing with safety, lights and signals is not expected to cause any serious concern. However EU legislation dealing with environmental issues raises potential problems. EU requirements for vehicle emissions have been becoming more and more stringent as a result of a series of directives, the first of which was introduced in 1970. The problems which need to be addressed can be summarised as follows:[8]

- The Republic of Cyprus has no emission standards (i.e. no quantitative limits) for vehicles except for a regulation concerning 'visible smoke'. Because there are no quantitative limits, even this regulation is not practically applicable.
- There is no periodic inspection for vehicle emissions, thus there is no administrative structure either.
- There is no stringent specification for the fuels which are almost all imported (sulphur and lead contents are often high).

There are four testing centres on the island (one in each major town). These centres are operating at present, however they only test public service vehicles and newly registered 'used' cars. It is hoped that by the end of 2000, these centres will be capable of testing all motor vehicles; (currently, they do not have the skilled personnel).

In conclusion, the Republic Cyprus will need some additional measures in place before it can begin to meet the EU demands in this area. In addition to adapting the legislation, the following changes will also be needed. First, a competent authority needs to be set up to boost the administrative capacity; second, testing stations are needed to check permissible sound levels from the exhaust systems, and vehicle exhaust gas emissions; and finally approved laboratories will need to be set up for testing components, and to introduce standards for the production of the components. The costs associated with these measures are summarised in Table 3.4. Note however that the cost implications on the vehicle fleet from the adoption of fuel quality standards are not addressed.

[8] Department of Electrical and Mechanical Services (1998) Motor Vehicles in Cyprus.

Table 3.4 Estimated Costs of Additional Measures (ECU[1997])

Recurring costs of boosting administrative capacity and technical infrastructure	400,500
Establish testing station:	
Capital cost	400,500
Recurring costs	80,100
Introduce vehicles exhaust testing; capital cost of emission testing equipment	160,200
Set up Laboratories for component testing	n/a

The capital costs of harmonisation are estimated to be 0.56 million ECU, and the associated recurring costs are about 0.48 million ECU.

It is anticipated that the private sector will be involved in testing private passenger vehicles. Also, the full costs of operating the system will be recovered from vehicle owners.

3.1.4. Volatile Organic Compounds (VOC) Emissions

About This Directive

This Directive aims to control emissions of VOCs from the storage of petrol and its distribution from terminal to service stations. Specifically, the Directive covers the transfer of gasoline from terminals into mobile containers (Stage 1A) and from these mobile containers to storage tanks at service stations (Stage 1B).

Existing Situation and Cost Implications

At present petrol storage facilities in the Republic of Cyprus do not comply with the requirements of the Directive. The cost of up-grading these facilities to the required standards is estimated below.

Stage 1A

Petrol storage facilities currently in operation in the Republic of Cyprus are shown in Table 3.5.

Table 3.5 Petrol Storage Terminals in the Republic of Cyprus

Company	Throughput (tonnes / year)	Tank Capacity (m^3)	Estimated Emissions (tonnes / year)
Petrolina	30,000	4,000	50
BP	45,000	7,350	80
Mobil	39,000	4,724	100
Lina	14,000	1,383	15-20
ESSO	46,000	1,600	85
Total	174,000	19,057	330-335

An indicative estimate of the cost of upgrading terminals to meet Stage 1 emissions can be made based on the real costs incurred by an oil company in modifying a large terminal in the UK[9]. Based on the assumptions given below, the estimated cost per tonne of VOC abated is 1,100 ECU (1997):

- The non–recurring capital cost is 2.8 million ECU (in 1993 prices), i.e. 0.3 million ECU for tank refurbishment, 1.9 million ECU for bottom loading racks, and 0.6 million ECU for the vapour recovery unit.
- Annual incremental operating costs are assumed to be zero.
- The value of recovered gasoline is 130 per tonne.
- The modifications require 1 year to complete and the modified tanks have an operating life of 30 years.

The throughput of this terminal, however, is 200,000 tonnes per year. A UKPIA survey indicated that the costs of modifying the storage tanks at two smaller terminals, where the throughput was 10,000 and 50,000 tonnes per year, could be as low as 1.5 million ECU per terminal. The corresponding abatement costs are 12,050 and 2,260 ECU per tonne of VOC. Due to the similarity in throughput, these compliance costs are likely to be closer to those for the storage facilities in the Republic of Cyprus. Hence, the estimated capital cost of up grading the petrol storage terminals is about 8.2 million ECU. At the same time, modifying the storage tanks will save about 200 tonnes of petrol per year. The retail price of petrol is about CY £[1997] 455 per tonne (note: this is the selling price at the filling station exclusive of VAT). Recurring costs (savings) are therefore negative CY £[1997] 91,000 (or 145,800 ECU) per annum.

Vehicles used to transport petrol from the storage terminals to petrol stations will also need to be re-fitted. However, no data is available at present on the number of units requiring such modifications.

Stage 1B

There are presently 230 petrol stations in the Republic of Cyprus. Each station typically has 3 tanks, the capacity of which ranges between 20 and 30 m^3. The cost of upgrading these service stations to meet Stage 1B emission standards is estimated based on the results of a PRA survey of 19 stations in the UK[10].

The average capital cost for all stations surveyed was 6,362 ECU (1992), of which 18% was for materials, 28% for labour, and 54% for civil engineering. Given that the average number of tanks per station surveyed was 3, this equates to 2,121 ECU per tank. This cost is representative of retrofitting below ground manifolds. However, if the manifolds are above ground, no civil engineering costs are incurred. Hence, the cost per tank reduces to 980 ECU, which is assumed to be representative of installing new tanks. Annual incremental operating costs are assumed to be zero. The estimated capital cost of up grading all petrol stations in the Republic of Cyprus therefore ranges between 0.75 million and 1.65 million ECU (1997).

As with Stage 1A measures, modifying the storage tanks will result in petrol savings; about 153 kg per tank per year[11]. Estimated recurring costs (savings) are therefore negative CY £[1997] 48,000 (or 76,900 ECU) per annum.

[9] CHEM SYSTEMS (1994) Compliance Cost Assessment of Proposed VOC Directive. A report produced for the UK DoE.

[10] ibid

[11] Based on the following assumptions: the average throughput of all stations surveyed by the PRA was 477,810 litres, i.e. 159,270 litres per tank; 1.7 tonnes of VOC are emitted during the unloading of fuel at service stations per 1,000 tonnes of throughput; the emission adjustment factor for 1995 was 0.91; there are 6.92×10^{-4} tonnes of gasoline per litre; and modified storage tanks reduce VOC emissions by 90 per cent.

3.1.5. Lead Content of Petrol and Sulphur Content of Liquid Fuels

About These Directives

The former Directive allows member states to reduce the permitted lead content to 0.15 Pb/l as soon as they consider it appropriate. The provisions of this Directive will be replaced from the year 2000 by the requirements of the proposed Directive on the quality of petrol and diesel fuel COM 96/0164 (COD). As the title implies, this Directive sets limits of the sulphur content of certain liquid fuels, diesel fuel and other gas oils. With regard to diesel fuel used in road vehicles, the provisions of this Directive will be replaced by the requirements of the proposed directive on the quality of petrol and diesel fuel**.**

Existing Situation and Cost Implications

At present, the gas oil produced at the Cyprus Petroleum Refinery in Larnaca is at 1.0 percentage weight sulphur maximum. The current lead content for premium gasoline (98 RON) is below 0.4 grams per litre and 0.15 grams per litre for Regular (92 RON). All unleaded petrol is currently imported, and complies with the EU standards for Premium Unleaded (95 RON).

An environmental up-grade project has recently been initiated at the refinery for the following purposes:

- To meet EU Auto Oil legislation for Mogas for 2000 and 2005 specifications, and higher demand for unleaded petrol.
- To meet Auto Oil legislation for Diesel for 2000 and 2005 specifications.
- To enhance CDU performance by removing water in crude oil and treating effluent to EU water quality standards.
- To provide for additional LPG storage.
- To enhance the central control building.

Only the first two elements are relevant to the fuel quality Directives, and are considered further here.

The main elements of the environmental up-grade project consist of an Isomerisation Unit and a Diesel Hydrofiner. The plan is to implement these two projects simultaneously and manage them as a single entity.

After the completion of the (Isomerisation) Mogas project, at an estimated capital cost of 7.4 million ECU (1997), the gas oil produced by the refinery will comply to the following EU specifications[12]: lead - 0.005 grams per litre max (2000); aromatics - 42 vol. % max (2000) and 35 vol. % max (2005); and benzene - 1.0 vol. % max (2000).

The estimated capital cost of the Hydrofiner project is 14.8 million ECU, enabling the refinery to produce gas oil at 350 ppm wt sulphur content by 2000 and 50 ppm wt sulphur content by 2005[13].

The up-grade project received Government approval on the 15th of September 1998, and the refinery is currently in the process of seeking suitable contractors. It is expected that front-end engineering and design will commence shortly thereafter, and be completed by the end of August 1999. Detailed

[12] The Isomerisation (Mogas) project involves the following elements: modifications to the existing Naphtha; the installation of a new Reformate; and the installation of a new UOP licensed Isomerisation Unit (including De-isohexaniser).

The above cost estimates are the result of detailed consultations between BP Oil International and the Cyprus Petroleum Refinery; BP Oil International act as technical advisors to the Cyprus Petroleum Refinery. Estimates of recurring costs are not available at present.

[13] The Hydrofiner project consists of the following elements: the installation of a new Hydrofiner Unit to treat 1,000 tonnes of gas oil per day; the installation of a new Amine Treatment Unit; and the installation of a new Sulphur Recovery and Pelletisation Unit.

design, procurement and construction is then expected to begin by February 2000 and be completed by July 2001[14].

An alternative way of meeting the requirements of the directive is to import petrol of the required quality. The decision to go ahead with the refinery was taken by the main stakeholders[15], who had considered, at an earlier stage, a number of options, including importation. The consultants did not have access to the underlying analysis. It would be unreasonable, however, to assume that they had made the wrong decision with respect to the full costs of both options. Hence we argue that the above costs should be taken as the relevant minimum figures for the purposes of the approximation[16].

[14] It should be noted that BP believes that the costs of the Isomerisation Unit is an underestimate, given the more complex scheme that is required to meet the 2005 Auto Oils legislation (i.e. the Naphtha cracker, Reformate Splitter and DIH, in addition to the Penex Unit).

[15] Currently the government of the republic of Cyprus is re-examining the entire spectrum of refinery-related issues.

[16] The refinery is jointly owned by the State (65 per cent), Petrolina (15 per cent) and Mobil (20 per cent), and essentially operates as a processing facility. That is, oil companies pay a fee to have their oil processed at the refinery. In fact, a processing agreement exists that permits all oil companies operating in the Republic of Cyprus to process a set percentage of their oil at the refinery; the percentage is based on their share of the total domestic market.

3.2. Summary of Cost Analysis for Air Quality

The full results of the cost analysis (i.e. the capital, recurring, annualised capital and total annual costs) for those directives where major infrastructure investments are required are summarised in Table 3.6. The estimated investment costs of compliance with the environmental *acquis* directives with respect to Air Quality are summarised in Table 3.7.

The institutional implications of complying with the 'Air Quality' Directives mainly derive from the need to expand and strengthen the National Action Plan to deal with air pollution problems (e.g. a response system when threshold values are exceeded, plans to reduce emissions levels), and the provision of additional monitoring. Major institutional changes are also required as regards motor vehicle inspections. Relative to the investment needs, the required institutional modifications will have a minor cost burden. The 'best estimate' of the cost of additional (Government) staff to meet the requirements of the Framework Directive is 0.2 million ECU per annum. Training needs in the air quality sector are estimated at under 0.02 million ECU; this is a non-recurring cost.

Table 3.6 Summary of Results for Air Quality Sector (million ECU[1997])

	Capital Cost	Recurring Cost	Annualised Capital Cost[1]	Total Annual Cost
Compliance Measures in Place	0.8	n/a	0.07	> 0.07
Future Compliance Measures[2]	**46.9**	**> 0.6[3]**	**3.9**	**> 4.5**

Note:
[1] The capital recovery factor used to determine the annualised capital costs is 0.08375 (r = 3%; n = 15 years).
[2] Required (relevant to environmental *acquis*) investments yet to be made.
[3] This is definitely an underestimate as recurring cost estimates were not available for a number of measures.

Table 3.7 Summary of Investment Needs for the Air Quality Sector (million ECU[1997])

Measures	Existing Directives						Proposed
	Ref. 96/62/EC	Ref. 80/779/EEC	Ref. 92/53/EEC	Ref. 94/63/EC	Ref. 85/210/EEC	Ref. 93/12/EEC	Ref. COM 96/0164
Compliance Measures in Place:							
Monitoring equipment (EAC)	0.8						
Future Compliance Measures:							
Air monitoring equipment:							
Department of Labour	1.4						
Electricity Authority of Cyprus	0.7						
Particulate abatement measures	*	12.7					
Vehicle inspection/testing equipment			0.6				
VOC abatement measures:							
Stage 1 A				8.2			
Stage 1 B				1.2			
Isomerisation (Mogas) project					7.4		*
Hydrofiner project						14.8	*
Sub-total	**2.1**	**12.7**	**0.6**	**9.4**	**7.4**	**14.8**	*

Notes:
***** Implementation of identified measure may also contribute to compliance with this Directive.

4. Water Quality

4.1. EU Legislation and Compliance Issues

The relevant environmental *acquis* directives with respect to Water Quality are listed in Table 4.1.

Table 4.1 Water Quality: Directives of the EU Environmental *Acquis*

Reference	Description (Title)
Com (97) 49	Proposed Water Framework Directive
91/271/EEC	Urban Waste Water Treatment Directive
91/676/EEC	Nitrates from Agricultural Sources Directive
76/464/EEC	Dangerous Substances Directive (& 'Daughter' Directives)
80/778/EEC	Drinking Water Directive
75/440/EEC	Surface Water for Drinking Water Abstraction Directive
79/869/EEC	Measurement and Abstraction of Surface Waters Directive
78/659/EEC	Freshwater Fish Directive
79/923/EEC	Shellfish Waters Directive
80/68/EEC	Groundwater Directive
76/160/EEC	Bathing Water Directive

4.1.1. Urban Waste Water Treatment Directive 91/271/EEC

About the Directive

The objective of this Directive is to protect the environment from the adverse effects of discharges of urban waste- water and of waste- water from industrial sectors of agro-food industry. The Directive requires that member states provide regulation or authorisation for all discharges of urban waste- water and industrial waste from the particular sectors identified as well as for all discharges of industrial waste- water into urban waste water systems. There must also be provision of urban waste- water collecting systems (sewerage) and treatment plants for all agglomerations above 2,000 population equivalent. The general rule is for secondary treatment, i.e. biological treatment. However, the treatment must be more stringent for discharges to the relevant catchments of sensitive areas as identified by member states. They may also be less stringent under certain conditions. For industrial sources, discharges must meet the established conditions for all plants representing 4,000 population equivalent or more. Urban waste water discharges and their effects must also be monitored.

Member states must also provide general rules for the sustainable disposal of sludge arising from waste water treatment, and phase out any dumping or discharge of sewage sludge into surface waters.

Sensitive areas must be designated according to certain criteria, including: those water bodies which are found to be eutrophic or which in near future might become eutrophic; surface freshwater intended for the abstraction of drinking waters; areas where further treatment is necessary to fulfil other Directives. The list of sensitive and less sensitive areas must be reviewed every four years.

Existing Situation and Cost Implications

At present, a permit is required to discharge industrial effluent. The permit can contain terms and conditions relating to effluent standards, volume, place of discharge, manner of disposal, as well as technical, operational and monitoring specifications and conditions. A system of specific authorisation, as required by the Directive, therefore already exists.

The Water Pollution Control Law includes provisions for the definition of 'sensitive areas'. To date, however, no such areas have been established although, for the reasons given in Annex A, the entire Republic of Cyprus may be defined as 'sensitive'. The magnitude of the investment programme

required to comply with the UWWTD will depend on this designation, and on the interpretation of 'appropriate treatment' in relation to the provisions of other Community Directives (e.g. 75/440/EEC, 80/68/EEC and 76/160/EEC). For example, all of the investment programmes considered as necessary below provide for tertiary level treatment, even to agglomerations with populations equivalents below 2,000. It is therefore possible that the cost estimates given are overestimates, as infrastructure built to these standards may not be required by the Directive. At the same time, however, there may be a case for tertiary level treatment to facilitate the re-use of treated effluent, in accordance with the principle objectives of the proposed Water Framework Directive (if adopted in its present form).

In terms of the waste- water collection and treatment infrastructure required to comply with the Directive, various levels of investment are needed in four main areas:

- the main urban and coastal areas (for domestic sewage);
- villages in rural areas (for domestic sewage);
- sources of domestic and industrial waste water not included in the above two areas; and
- individual agro-industries.

Each of these areas is discussed briefly below, and details relating to each area are provided in Annex A. Table 4.4 at the end of the section provides a summary of the investment needs required under the UWWTD.

Urban Areas

Collection and treatment of domestic sewage in the main urban centres and developed tourist areas is the responsibility of publicly operated Sewerage Boards. An individual Sewerage Board serves the following main municipalities: Nicosia, Limassol, Larnaca, Ayia Napa/Paralimni and Paphos. The first three municipalities currently have a (partial) central sewerage collection system and sewage treatment plant; in no case does the existing system serve the entire population of the service area. In the case of the latter two municipalities, no central system exists[17]. Programmes are currently underway, however to provide central collection and treatment facilities to the entire service area of each Sewerage Board. In fact the Aya Napa / Paralimni system is now under construction and tenders are to be invited for the Paphos scheme.

The total incremental capital and recurring cost of providing the necessary infrastructure in each of the urban areas served by the Sewerage Boards is given in Table 4.2.

Table 4.2 UWWTD Investment Needs in Urban Areas

Sewerage Board	Capital Cost [1] (million ECU)	Capital Cost [2] (million ECU)	Recurring Cost (million ECU)
Nicosia	150.0	140	3.7
Limassol	211.5	85	3.8
Larnaca	148.9	104	1.0
Ayia Napa & Paralimni	16.0 *	62 *	
Paphos	129.7	70	1.1

Sources: [1] Independent verification of investment programmes supplied by sewerage boards.
[2] Cyprus Environment Service
* includes recurring costs for 5 years

[17] In general, households use a combination of absorption pits and septic tanks.

Rural Areas

In general, rural villages in the Republic of Cyprus have piped water systems, but no corresponding sewage collection and treatment systems, although in recent years, some of the more problematic villages have been provided with central sewage systems (about 20 villages to date). Sewage disposal in smaller villages is traditionally by means of draining sewage to an absorption pit; larger villages tend to also have septic tanks. A study conducted for the Ministry of the Interior by Mather and Kundu in 1984 found a very high incidence of absorption and soakaway pit failure[18]. The following major concerns where identified as a consequence of these failures:

- health risks for the rural population;
- contamination of surface waters; and
- contamination of ground water supplies.

In the mountain region, a number of villages (66) are located within the catchment area of the reservoir from which the drinking water is abstracted.

An implementation programme is under development to provide collection and treatment systems for agglomerations of more than 200 people, and for villages with a population less than 2000 people located within the catchment areas of water supply, as well as for villages facing severe sewage problems. The estimated total capital cost of constructing suitable sewage collection and treatment systems for all identified rural villages (about 124) in the Republic of Cyprus is 180.7 million ECU. The corresponding recurring costs are 8.4 million ECU.

Of the 370 identified villages 28 have populations in excess of 2,000; none of the villages have populations in excess of 10,000. The estimated total capital cost of constructing suitable sewage collection and treatment systems for the rural villages with populations between 2,000 and 10,000 people is 79.9 million ECU. The corresponding recurring costs are about 3.2 million ECU.

The above figures will probably underestimate the actual costs of the schemes (see Annex A).

Collection systems and treatment plants have already been constructed for about 20 of the 370 identified villages and agglomerations, of which two systems are for villages with populations between 2,000 and 10,000. The total (actual) capital expenditure to date amounts to approximately 24.7 million ECU. The recurring costs associated with the systems currently in place are 1.1 million.

Sources of Waste Water Not Covered in Above Schemes

A number of industries (about 100) and villages in the greater areas of Nicosia and Larnaca and not covered by the above schemes, formerly tankered their sewage and effluent to lagoons situated near the village of Potamia in the Nicosia District, and near the village of Kelia in the Larnaca District. The operation of these lagoons had been causing serious environmental problems, e.g. pollution of watercourses and sub-strata. In December 1993, the Government decided to proceed with construction of a Central Waste Water Treatment Plant (CWWTP), to treat all the above waste water. The plant provides tertiary level treatment for domestic and industrial waste water streams. The capacity of the plant is 2,200 m^3 per calendar day with an equivalent population of approximately 55,000 people.

The total capital cost of the CWWTP, which has already been incurred, was 19.7 million ECU. The plant has been operational for just over a year and current recurring costs are about 0.6 million ECU per annum.

Individual Industries

Four wineries in Limassol currently discharge their effluent directly into the sea, adversely affecting the waters between Limassol's two harbours. The estimated capital costs of providing suitable

[18] Cited in Fenco MacLaren Inc. (1995) Rural Sanitation Study. Prepared for the Ministry of the Interior, the Department of Town Planning and the Department of Water Development.

collection and treatment facilities for these four wineries is 4.8 million ECU. The estimated recurring cost of these facilities is 234,000 ECU per annum.

The Kofinou Central Slaughter House and the adjacent Comet Farm Rendering Plant also require a waste water treatment plant. At present the effluent from both plants is discharged into the same pond system. The estimated capital cost of a suitable collection system and treatment plant is 0.6 million ECU. The recurring costs are 0.03 million ECU per year.

There are approximately 100 to 125 small factories not covered by the CWWTP or any other scheme, all of which will require some form of waste water treatment plant. An 'order of magnitude' estimate of the associated capital cost ranges between 324,000 ECU and 1.1 million ECU. The estimated recurring cost ranges between 18,600 ECU and 60,200 ECU[19].

About 20 of these factories will be required to install some form of monitoring equipment to measure 'key' parameters. These units will cost between 3,200 and 8,000 ECU each (i.e. a total capital cost of between 64,000 and 160,000 ECU).

In the absence of further data, however, it is not possible at this stage to establish whether treatment plants at these sites are required under the UWWTD (e.g. what proportion are agro-food industries), or any other aspects of the environmental *acquis* (e.g. it is possible that action may be required under the Groundwater Directive or the Nitrates Directive – see below).

4.1.2. The Nitrates Directive 91/676/EEC

About the Directive

This Directive has the objective of reducing water pollution caused or induced by nitrates from agricultural sources, and preventing further such pollution. The Directive covers the storage and use of fertilisers containing nitrogen, effluents from animal husbandry, procedures for agricultural management, and waste water treatment. The Directive places restrictions on fertiliser use, and sets maximum permissible nitrate levels in drinking water. Geographical areas are 'zoned' according to their vulnerability to nitrate pollution.

Member states determine the waters affected by, or susceptible to such pollution, and also the areas known to feed the aforementioned waters. Together these are defined as 'vulnerable areas'. A list of vulnerable areas must be forwarded to the Commission, and reviewed at least every four years, in addition, an action plan for the vulnerable areas must be implemented. This plan must contain measures aimed at preventing the spread of fertiliser containing nitrogen, and limiting the spread of effluent from animal husbandry.

In order to ensure a general level of protection against pollution for all waters, a code of good agricultural practice is to be voluntarily implemented by farmers. If necessary member states will ensure the education of, and provide information to, farmers in order to promote the implementation of the code.

Existing Situation and Cost Implications

A Regulation exists for the protection of groundwater (see Groundwater Directive below), however, there is no legislation that specifically relates to nitrates. Waters affected by, or susceptible to (nitrate) pollution, and also areas known to feed the aforementioned waters and thus contribute to their pollution, have yet to be identified. At present some monitoring is carried out, but it is not possible at this stage to say whether this is sufficient. The establishment and notification of 'vulnerable areas', and the need for potentially increased monitoring activity, will have an institutional cost burden.

Representatives of the Environment Service expressed concern over rising nitrate concentration in rural areas coming from three sources. These are:

[19] A grant scheme exists to help industries cope with the capital costs of new effluent treatment plant. Once a treatment plant has been constructed, the investor must submit the technical and economic details of the plant for Governmental review, following which, an appropriate cash grant is awarded. Details of the proposed grant scheme are provided in Annex A.

- intensive agriculture (use of fertiliser);
- animal husbandry (mostly piggery efluents); and
- industrial waste water disposal.

The use of fertilisers, from import to application, is subject to holistic control and 'codes of best practice'. For example, the Department of Agriculture currently operates a "best practice" programme for farmers (e.g. consisting of multi-day workshops run annually by the Department). Also, the same department has prepared a draft "code of conduct for good agricultural practice". It is not possible to say at this stage, whether these programmes are sufficient with respect to the requirements of the Directive, and thus if additional costs will be incurred, especially where additional training of staff is required. Training needs in the water quality sector as a whole are estimated to cost 0.02 million ECU (see Annex D).

Currently, manure is widely used as fertiliser. Preliminary plans have been put forward, however, built on the experiences of member states, for the appropriate collection, treatment and disposal of pig slurry[20]. Details of these plans are presented in Annex A. The total capital cost of an 'aerobic' treatment plan and an 'anaerobic' treatment plan is 18.5 and 21.9 million ECU respectively. The corresponding recurring costs of each plan are 3.6 and 1.9 million ECU.

A pilot scheme was developed for a large pig unit of 300 sows. This scheme consists of an aerobic treatment plant, which has been in operation for three years. Unit recurring costs for the pilot scheme for a typical year are considerably less than the unit recurring costs given above, possibly indicating the actual recurring costs of aerobic treatment may be less than 3.6 million ECU.

Once a scheme to deal with the problem of pig slurry has been finalised, the Government plans to make cash grants available to pig units in order to subsidise the capital costs of the treatment facilities, and thereby encourage the take up of the scheme. The proposed grant scheme is described in Annex A.

Other sources of livestock manure were not 'flagged' as problem areas. However, this is not to say that they are in full compliance with the requirements of the Directive; further investigation is required.

Nitrate pollution problems as a result of industrial activity may be addressed, in part, as a result of some of the measures discussed under the UWWTD. Without further investigation however, it is not possible to establish the extent to which this is the case.

4.1.3. The Dangerous Substances Directive 76/464/EEC

About the Directive

This Directive establishes a framework for the elimination or reduction of pollution by certain specified dangerous substances in inland, coastal and territorial waters. A distinction is drawn between two lists of substances which are harmful to the aquatic environment. The most toxic, persistent and bio-accumulatable substances are contained in List I (the 'black list'). List II contains relatively less harmful substances, known as the 'grey list'. The intention is that member states should take steps to eliminate pollution by List I substances, and reduce pollution by those in List II.

The elimination of pollution by List I substances is accomplished by means of formal limit values set by the Council, which emissions of the substances should not exceed. These limit values are specified by means of subsidiary 'daughter' directives. Discharges liable to contain List I and List II substances must be authorised by the competent authority in the member state. List II substances, require member states to establish pollution reduction programmes based on quality objectives for receiving waters, and subject to implementation deadlines.

[20] The disposal of slurry from these pig units is recognised by the Government as a serious problem; especially regarding the potential contamination of ground and surface waters.

Existing Situation and Cost Implications

A system of prior authorisation for discharges already exists. This system covers (some) List I and List II substances, and prohibits the discharge of (some) List I substances. It is anticipated that some minor institutional reform costs will be incurred in expanding and strengthening the current system, e.g. establishing an inventory of List I substance discharges.

Until the current system of prior authorisations is fully harmonised with the requirements of the Directive it is not possible to approximate the likely infrastructure costs of compliance, e.g. for those industries whose discharges do not comply with emission standards. It is also possible that instances of non compliance may be addressed through the implementation of measures discussed elsewhere in this section.

4.1.4. The Drinking Water Directive 80/778/EEC

About the Directive

This Directive relates to the quality of water destined for human consumption and aims to safeguard human health by establishing strict standards for the quality of drinking water. Member states have to monitor drinking water quality and take the necessary steps to ensure compliance with the mandatory standards. In the annexes the parameters and parametric values, patterns and frequencies of analysis, and methods of analysis are specified.

Existing Situation and Cost Implications

All sources of drinking water supplied for domestic use in the Republic of Cyprus are subject to regular monitoring operated by the Ministry of Health in co-operation with the Water Development Department. In general, the quality of drinking water is considered good, and compliant with WHO and EU standards. The monitoring programme may need to be strengthened, e.g. increasing the frequency and number of parameters monitored in rural areas (where water tends to be abstracted via boreholes). This may involve a minor institutional cost burden.

4.1.5. Surface Water for Drinking Water Abstraction Directive 75/440/EEC

About the Directive

This Directive was adopted to set quality standards to protect surface water used for public supply, and to ensure that the water receives proper treatment before distribution. The Directive sets out imperative standards, and also guideline standards which member states should aim to achieve, for water for public supply which is to be given different levels of treatment. Three groups of limit values are set, corresponding to the models for purification treatments. The groups relate to the physical, chemical and microbiological characteristics of the water. Group A1 thus only requires simple treatment and disinfection before use, A2 requires normal physical treatment such as filtration and disinfection before use, and A3 requires extensive treatment. Water below A3 standards should only be abstracted for drinking water supply in 'exceptional circumstances'. The grade that any water achieves depends on the concentration of forty- four parameters, which are referred to specifically, and twenty two others on which guidance is given.

Member states are required to take water samples regularly, and surface waters are considered to be in conformity with the quality objectives when 95 % of samples taken comply with the values specified.

Existing Situation and Cost Implications

A sampling and monitoring programme is carried out by the Development Department and the Ministry of Health, to ensure that the quality of surface water intended for abstraction of drinking water is maintained. Again, this programme may need to be strengthened incurring relatively minor institutional costs.

Due to the increasing demand for water on the Island, there are concerns over whether supply of drinking water can be maintained in full compliance with the mandatory quality objectives of the

Directive. For example, in order to ensure full compliance, drinking water may need to be provided by desalination plants, as opposed to being abstracted from increasingly 'poorer' quality surface water sources. Due to differences in unit costs, this will have a (net) cost burden, which may not necessarily have been incurred in the absence of having to comply with the Directive. This issue is explored further under the (proposed) Water Framework Directive below.

4.1.6. Freshwater Fish Directive 78/659/EEC

About the Directive

This Directive seeks to protect or improve the aquatic environment through measures to protect waters supporting freshwater fish against pollution. It achieves this through making provision for the designation of rivers and other fresh waters by member states, setting limit values for specified parameters related to the suitability of water for stated kinds of fish life, and sampling to ensure that water quality is maintained at the required standards.

Member states are under no obligation to designate a particular water body. Within waters which are designated, the aim of the Directive is to protect or improve water quality, and hence the capacity of the water to support either a natural diversity of indigenous species, or species the presence of which is judged desirable for water management purposes. A division is drawn under the Directive between salmonid waters and cyprinid waters. For both, member states are to set values for the physical and chemical parameters listed in an Annex to the Directive such that imperative values shall be no less stringent than specified. They should try to reach the guide value standards set out in the Annex.

Having designated the waters as salmonid or cyprinid, member states are to establish programmes in order to reduce pollution and ensure that designated waters conform with the specified values within five years of designation. Conformity with the specified values is deemed to have been realised when 95 % of samples of most parameters meet the stipulated levels, though differing criteria apply in respect of temperature, dissolved oxygen and suspended solids.

Existing Situation and Cost Implications

Protection is effected through the Water Collection and Fiseries Laws. Monitoring of water quality is carried out by the Water department and Fisheries Departments.

4.1.7. The Shellfish Waters Directive 79/923/EEC

About the Directive

This Directive sets the water quality standards for shellfish waters. It applies to coastal and brackish waters designated by member states as needing protection or improvement in order to support shellfish life and growth. Member states have no duty to designate shellfish waters, but those they do designate are subject to quality parameters listed in the Annex. They must achieve standards no less stringent than those specified as imperative values, and try to achieve the guide value standards. With respect to organohalogenated substances and metals, the parameters are to be those established under the Dangerous Substances Directive.

Conformity with the Directive is deemed to have been achieved when samples show conformity of 100 % in the case of organohalogenated substances and metals, 95 % in the case of parameters for salinity and dissolved oxygen, and 75 % in the case of other parameters listed in the Annex. Derogation from the Directive is permitted by member states in the event of exceptional weather or geographical conditions.

Existing Situation and Cost Implications

No information directly relevant to this directive is available at present. It is noted however that no such waters exist in Cyprus.

4.1.8. The Groundwater Directive 80/68/EEC

About the Directive

The Groundwater Directive provides two lists of substances, which are similar to those provided under the Dangerous Substances Directive[21]. Member states have to take the necessary steps to prevent the introduction into groundwater of List I substances by prohibiting all direct discharges and subjecting to prior investigation any disposal or tipping which might lead to indirect discharge, and taking appropriate measures to prevent any other indirect discharge. For List II substances, member states must limit their introduction into groundwater by making all direct discharges, and disposal or tipping which might lead to indirect discharges, subject to prior investigation, and by granting authorisation for discharge on the condition that all technical precautions for preventing groundwater pollution are observed. Excepted from the Directive are domestic effluents from isolated dwellings and discharges found by the competent authority to contain List I or II substances in such small concentrations as not to present a danger.

Authorisation for the disposal of materials which might lead to a direct or indirect discharge of List II substances, or an indirect discharge of List I substances, must be granted for a limited period only and reviewed at least every four years. Competent authorities in member states are bound to monitor compliance.

Existing Situation and Cost Implications

The Control of Water Pollution (Measures for the Protection of Underground Waters) Regulation 1996 provides for the protection of groundwater. Groundwater boreholes used for domestic supplies are regularly monitored and in the opinion of the Environment Service, it is of good quality. However it is anticipated that some institutional reform costs will be incurred in expanding and strengthening the current system of authorisations to discharge, which is not fully in line with the standards required in the Directive.

The magnitude of additional infrastructure compliance costs (e.g. as a consequence of license holders no longer being able to discharge some restricted substances) will be dependent, to a large extent, on adherence to the requirements of the UWWTD and the Nitrates Directive. If the measures outlined above are implemented, then no additional infrastructure expenditures are foreseen to comply with this Directive.

4.1.9. Bathing Water Directive 76/160/EEC

About the Directive

This Directive concerns the quality of bathing waters and seeks to protect both the environment and public health by maintaining standards for water used for bathing. For the purposes of the Directive, bathing water is defined to mean 'all running or still fresh waters or parts thereof, and sea water, in which bathing is explicitly authorised by the competent authorities of the member state, or in which bathing is not prohibited and is traditionally practised by a large number of bathers'.

The Directive requires that member states set quality standards for each designated bathing water. In practical terms, the most significant of the quality standards are those relating to the bacteriological content of the water, and in particular the coliform values indicating the degree of sewage contamination of the waters.

The quality standards for designated bathing waters must be no less stringent than the imperative values set out in the Annex, and member states must try to observe the guide values also set out in the Annex. In exceptional circumstances derogations may be permitted, based on plans for the management of the water within the area concerned. The Directive may also be waived in respect of certain parameters because of exceptional weather or geographical conditions or because the water undergoes natural enrichment.

[21] Groundwater is defined to mean all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.

Monitoring samples should be taken at places where the daily average density of bathers is highest. Sampling should begin two weeks before the start of the bathing season, and local investigations of ambient conditions should be carried out and repeated periodically. Additional sampling should take place if there are any grounds for suspecting that there is a decrease in water quality. Bathing water is deemed to conform with the relevant parameters where samples of the water meet the parametric values for the water quality for 95 % of the samples in respect of imperative values, and for 90 % of samples in other cases, except for certain coliform parameters in respect of which conformity is set at 80 %.

Existing Situation and Cost Implications

The Fisheries Regulation includes standards and prohibitions for substances contained in discharges to, and the quality of, the sea. The Ministry of health currently monitors the microbiological quality of the marine environment (there are about 158 monitoring stations) and the results are submitted to the Fisheries Department which carries out the re-writing of chemical and biotic parameters. The results of the sampling are available to the public and selected organisations (e.g. to CYMEPA, who prepare the Blue Flag Report). In general, the coastal waters of the Republic of Cyprus are of very high quality, with the exception of the (non-bathing) harbour areas of the main coastal towns; in particular, Limassol where four wineries directly discharge into the sea. Also, pollution from non-point sources occasionally causes some minor problems of a temporary nature.

In general, the monitoring programme will need to be strengthened, e.g. changing the frequency of sampling, thereby incurring minor institutional costs.

Again, the magnitude of additional infrastructure compliance costs will be dependent, to a large extent, on adherence to the requirements of other water quality Directives, namely, the UWWTD. In other words, if the measures required to comply with the UWWTD are implemented, then no additional infrastructure expenditures are foreseen to comply with this Directive.

4.1.10. The (Proposed) Water Framework Directive COM (97) 49

About the Directive

This Directive is proposed to achieve sufficient provision of drinking water, sufficient provision of water for other economic requirements, protect the environment and alleviate the adverse impacts of flooding and droughts. It will absorb and integrate older legislation such as the Surface Water Directive, and Fish and Shellfish Water Directives and the Groundwater Directive, allowing them to be repealed.

The environmental objective of the Directive is to achieve 'good status' for all ground and surface waters by 2010. To this aim, it establishes river basin management based on an assessment of the characteristics of the river basin; monitoring of the status of its surface and groundwaters; definition of quality objectives and the establishment of programmes of measures to achieve the defined objective. However, the administrative structure to achieve this river basin management is left to the discretion of the member states.

The programme of measures will have to follow the above- mentioned combined approach, using the setting of emission limit values and water quality standards. In this context evidence of the full implementation of existing EU emission limit value legislation has to be provided i.e. the UWWTD, Nitrates Directive, and Dangerous Substances Directive.

Further, member states will have to ensure that services to water users are paid at full cost recovery prices (basically prices for water supply and waste water collection and treatment).

Existing Situation and Cost Implications

Institutional Reform

The river basin management institutions required in the (proposed) Water Framework Directive will be new to the Republic of Cyprus, although some of the elements required to establish such plans exist in various forms at present. As shown in Annex A, for example, in addressing the water supply-demand imbalance in the Republic of Cyprus, the Water Development Department currently identify domestic, industrial and agricultural 'users', generate forecasts of future supply and demand, and formulate a water resource management strategy (albeit not at a river basin level). Also, various forms of abstraction and discharge 'licence' systems exist at present. Nonetheless, the capabilities of the future 'Water Entity' will need to be expanded and strengthened.

An estimated 5 to 6 additional 'technical' level staff, at a cost of 72,600 ECU per annum, will be required to strengthen current monitoring practices in response to the additional demands being placed on the Department of Water Development by the other Directives discussed above. The additional institutions required by the 'Framework Directive' will result in the creation of additional posts, although the exact number is not known at present. As a result of the unique geography of Cyprus, over a hundred, or less than ten river basin plans might be required, depending on the final definition of a river basin adopted by the Directive; the implications for staffing requirements therefore varies considerably.

Further institutional reforms will be required to implement full cost recovery pricing systems. For the most part (see Annex A), full cost recovery prices are not charged to 'users' at present. In some of the proposed rural and urban central sewage collection and treatment plant programmes, for example, the Government subsidises the additional cost of providing tertiary level treatment over and above that of providing secondary level treatment.

Infrastructure Costs

Two of the principle objectives of the Directive relate to the:

- sufficient provision of drinking water; and
- sufficient provision of water for other economic requirements.

In the absence of further action, and given the current and future water supply-demand imbalance faced by the Island, failure to achieve these objectives is likely (in fact, these objectives are not met at present). At the same time, placing increasing demands on current water resources may compromise compliance with 'Good Status' in all groundwaters and surface waters. Under the current proposal, member states are required to undertake the necessary measures to achieve 'Good Status' of waters (GSW). In the case of Cyprus, this may involve providing 'new' sources of water. The Department of Marine has plans for securing additional water supplies. These are outlined in Annex A.

The estimated total annual cost of the entire desalination plant programme is 35.6 million ECU. The plant at Dhekelia is already operational, therefore additional future annual expenditure amounts to 22.3 million ECU. The estimated capital costs of other on-going and proposed works is 357.73 million ECU; of which 53.7 per cent (or 192 million ECU) relates to continued works and 46.3 per cent (165.6 million ECU) relates to proposed works. The recurring costs of the investment programme are 7.1 million per year.

It is not possible to say which, if any, of these measures will be required to achieve the GSW, whether they represent least-cost solutions, or if they can be considered as a required expenditure under the Directive. These points will need to be addressed at a later stage. At this stage, all that can be said is that in the absence of the above outlined investment programme, compliance with the objectives of the proposed Water Framework Directive is unlikely.

4.2. Summary of Cost Analysis for Water Quality

The full results of the cost analysis for those Directives where major infrastructure investments are required are summarised in Table 4.3. The estimated investment costs of compliance with the environmental *acquis* directives with respect to Water Quality are summarised in Table 4.4.

The institutional implications of complying with the 'water quality' Directives mainly relate to enhancing and strengthening current monitoring and enforcement practices. Relative to the investment needs, the required institutional modifications will have a minor cost burden. The 'best estimate' of additional staff costs is 0.08 million ECU per annum. Training needs in the water quality sector are estimated at 0.02 million ECU, which represents a non-recurring cost (see Annex D).

Table 4.3 Summary of Results for Water Quality Sector (million ECU[1997])

	Capital Cost	Recurring Cost	Annualised Capital Cost[1]	Total Annual Cost
Compliance Measures in Place	19.7	0.6	1.6	2.2
Future Compliance Measures[2]	**865.8**	**20.0**	**72.5**	**92.5**
Other Measures[3]	31.9	3.3	2.7	28.3[4]

Note:
[1] The capital recovery factor used to determine the annualised capital costs is 0.08375 (r = 3%; n = 15 years).
[2] Required (relevant to environmental acquis) investments yet to be made.
[3] Future investments, which relate to 'water quality', but cannot strictly be related to the environmental *acquis*.
[4] Includes the total annual cost of the desalination plants yet to be built (i.e. 22.3 million ECU).

Table 4.4 Summary of Investment Needs for the Water Quality Sector (million ECU[1997])

Measures	Existing Directives						Proposed
	Ref. 91/271/EEC	Ref. 91/676/EEC	Ref. 76/464/EEC	Ref. 75/440/EEC	Ref. 80/68/EEC	Ref. 76/160/EEC	Ref. COM(97)49
Compliance Measures in Place:							
CWWTP	19.7		*[1]		*	*	
Future Compliance Measures:							
Urban collection systems and STPs	656.1		*		*	*	
Rural collection systems and STPs:							
pop < 2,000	100.8			*	*		
pop > 2,000	79.8			*	*		
STPs for Wineries	4.8					*	
STPs for Meat Rendering	0.6				*		
STPs for Pig Slurry		20.2					
Sub-total	**845.6**	**20.2**	*	*	*	*	
Other Measures:							
STPs for 'other' industries	0.7	*	*		*		
Desalination plants				*			n/a[2]
Planned water supply infrastructure				*			31.2
Sub-total	0.7	*	*	*	*		31.2

Notes:
[1] Implementation of identified measure may also contribute to compliance with this Directive.
[2] Only total annual cost data is available.

5. Waste Management

5.1. EU Legislation and Compliance Issues

The relevant environmental *acquis* directives with respect to Waste Management are listed in Table 5.1.

Table 5.1 Waste Management: Directives of the EU Environmental *Acquis*

Reference	Title
75/442/EEC	Framework Directive on Waste
91/689/EEC	Hazardous Waste Directive
89/429 & 89/369/EEC	Waste Incineration from New and Existing Installations
94/67/EEC	Hazardous Waste Incineration
COM (97) 105	Proposed Landfill Directive
78/176 & 82/883/EEC	Disposal of Titanium Dioxide Waste
94/62/EC	Packaging and Packaging Waste
75/439/EEC	Disposal of Waste Oils
96/59/EC	Disposal of PCBs and PCTs
91/86/EEC	Batteries and Accumulators Containing Dangerous Substances
86/278/EEC	Sewage Sludge Used in Agriculture
259/93/EEC	Shipment of Waste

5.1.1. The Framework Directive on Waste

About This Directive

This directive provides a legal framework for the avoidance, management and disposal of waste as set out in the Commission's Waste Management Strategy. Member states must encourage the prevention or reduction of waste and its harmfulness by encouraging the development of clean technologies, technical product improvements, and disposal techniques. They must also encourage the recovery of waste and its use as an energy source.

Member states must also prohibit the abandonment, dumping or uncontrolled discharge of waste and establish an integrated and adequate network of disposal installations taking account of the BATNEEC. As part of this, national competent authorities must draw up waste management plans covering the types of waste to be recovered or disposed of, technical requirements, special arrangements for particular wastes, and suitable disposal sites or installations.

In accordance with the polluter pays principle, the costs of waste disposal must be borne by the holder, or the previous holder, of the waste.

Existing Situation and Cost Implications

In general, there is little conformity between the Republic of Cyprus and the requirements of the environmental *acquis* in this sector. Most of the principal waste directives remain unimplemented in Republic of Cyprus law, although some elements are partially present. There is, therefore, a real need for both legislation and, more important, the necessary infrastructure to support it at local and national levels. For example, there is no integrated system for waste management, and most of the rules governing the collection, transport and disposal of waste are fragmented and dispersed across a number of separate laws and regulations, each of which is overseen by a different authority, with differing responsibilities.

A study was commissioned in 1993/94 by the Government of the Republic of Cyprus, to serve as an input to the development of a national waste management plan for municipal solid waste.[22] Details of the study are summarised in Annex B. As part of the study, three waste management plans (scenarios) were developed to deal with forecast waste arisings in 2007[23], and compared to a reference scenario, which reflects current practices.[24] Each of the scenarios developed differed in approach and strategy, but aimed to comply with the Framework Directive on Waste as well as the standards demanded by specific Directives in this sector. The main difference between the scenarios is the degree and method of waste treatment (involving combinations of landfill, incineration and biogas) and the level of recycling. The total investment needs and (net) recurring costs of each scenario were also estimated.

Waste Management Plans

In summary, scenario I (the reference case) is a model of the current situation projected to the year 2007. The estimated capital and recurring costs are 8.2 million and 4.6 million ECU (per annum) respectively.

Scenario II represents a situation where the existing collection system is maintained, but a low level of recycling activity is initiated including the establishment of several processing facilities. As regards the disposal of waste, four new (sanitary) landfills are included. The estimated capital and recurring costs are 48.5 million and 10.9 million ECU (per annum) respectively.

For the treatment of municipal waste, scenario III includes three incinerators. There is still some disposal *via* landfill, however, and three new landfill sites are proposed. The same level of recycling activity in Scenario II is maintained. The estimated capital and recurring costs are 144.8 million and 17.3 million ECU (per annum) respectively.

Scenario IV includes three agricultural based biogas facilities in place of the incinerators, there is also a higher level of recycling activity. Some landfill capacity is still required, with three new landfill sites proposed. The estimated capital and recurring costs are 69.8 million and 10.4 million ECU (per annum) respectively.

While the scenarios were developed with the waste management Directives of the EU environmental *acquis* in mind, it is not clear whether they actually guarantee compliance with all the required standards. For example, only in scenario IV are portions of the organic waste stream separated and diverted from landfill; the level of recycling activity is also the highest. In contrast, only in scenario III is the total mass of waste landfilled significantly reduced (see Annex B). Hence, some combination of scenarios III and IV probably represents a 'best estimate' of the costs of providing the necessary infrastructure required to comply with the environmental *acquis* in this sector.

Two key uncertainties should be noted:

- Firstly, representatives of the Environment Service expressed some reservations over the direct applicability of the above scenarios to the Republic of Cyprus. These reservations mainly relate to: the age of the data set (i.e. 1993/94); the simplified nature of the waste forecasts; the completeness of the waste strategies; and the feasibility of actually implementing the measures described. There is thus some uncertainty as to whether the estimated costs are truly representative of those required to provide a suitable waste management strategy.
- Secondly, the scenarios concern household waste only from residential and tourist areas, i.e. they exclude MSW from industrial sources, hospitals, etc. A complete future waste management plan should also take account of the excluded waste streams.

[22] Carl Bro Environment and NV Consultants (1994) Recycling of Municipal Solid Waste in the Main Urban and Tourist Centres of Cyprus.

[23] The assumptions underlying the forecasts are presented in Annex B, and include growth in tourist demand.

[24] Most municipal waste is disposed of in landfills, of which there are five currently operating. No other treatment facilities exist. Waste from rural areas is often disposed of locally. The landfills are owned, run and maintained by the municipalities. However they serve more than the local area, with 75% of the population of the Republic of Cyprus being served by the five landfills. Moreover, the landfills are not constructed according to EU standards, for example they have no protective measures regarding leachate.

For the purposes of this report, however, the estimates should provide a reasonable approximation – the right order of magnitude – of the costs involved.

Institutional Requirements

Current institutions will also need to be substantially strengthened (and modified) to provide the necessary support for the (new) waste management infrastructure (e.g. in terms of monitoring, permitting, reporting, etc.). To illustrate the type of institutional changes required, at present "…waste services charges are paid by households, commercial and industrial premises directly to municipalities, according to the type of property served. Each municipality however, is free to set the magnitude of the charge, and tends to recover more than the costs of services provided (in order to supplement municipal budgets which are often in deficit)…"[25]. As a result, equivalent households in the same or different areas, can pay different charges for the same service. In other words, user charges do not reflect the costs of waste management practices, and thus do not send the correct price signals to users of these services. Such practices will need to change to conform with the 'polluter pays' principle.

No separate estimates are available at present of additional staff requirements for this sector; an estimated additional 20 posts are needed to strengthen Government capabilities across several sectors, including waste, at an annual cost of about 0.5 million ECU (see Annex D). Training needs for existing staff are estimated at about 15,000 ECU (again, see Annex D). In recognition that this is a problem sector, the implications as regards institutional reform should be investigated further as part of any follow-up work.

5.1.2. Packaging and Packaging Waste

About This Directive

This Directive aims to harmonise national packaging waste management measures and minimise environmental impacts associated with packaging waste, avoiding the erection of barriers to trade within the EU. It covers industrial, commercial and domestic waste of all materials and establishes recovery and recycling targets. These must be met by 2001, and are that 50 to 65% should be recovered, and 25 to 45% recycled.

Re-use, recycling and other forms of recovery (including incineration with energy recovery) are accepted as equally valid methods of recovery. Recycling can include reprocessing and organic recycling, but not incineration.

Existing Situation and Cost Implications

The magnitude of additional infrastructure compliance costs will be dependent, to a large extent, on the nature of the final national waste strategy adopted by the Government. The cost of providing some recycling capacity for packaging waste is included in the infrastructure expenditures identified under the Framework Directive on Waste. The waste stream data however, are not dissaggregated enough to assess whether the targets set by this Directive are achieved. Further analysis is required before additional compliance costs, if any, can be estimated.

5.1.3. Hazardous Waste

About This Directive

The aim of this Directive is to formulate a common definition of hazardous waste and introduce greater harmonisation of the management of such waste. It identifies what constitutes hazardous waste and requires that hazardous waste management plans be published by the competent authorities requiring registration and identification of every site where hazardous waste is delivered, and packaging and labelling according to set standards when such waste is collected, transported and stored.

[25] Carl Bro Environment and NV Consultants (1994) Recycling of Municipal Solid Waste in the Main Urban and Tourist Centres of Cyprus

The competent authorities have a responsibility to inspect installations producing and receiving such waste, and also means of transporting the waste.

Existing Situation and Cost Implications

At present the Republic of Cyprus does not possess the facilities required for the holistic collection and treatment of hazardous waste. Legislation and corresponding institutions are also not sufficient to ensure compliance with the Directive. As a result, the current uncontrolled disposal of hazardous waste constitutes a threat to the environment and public health, with ground and surface waters most threatened. In some cases, for example, solid and liquid hazardous wastes are disposed of together with other waste at public landfill sites, or discharged into absorption pits at source.

A study was conducted by the Swedish consultancy SWECO, in collaboration with the Geological Survey Department, in 1993-94. The study provided an "…inventory and recommendations for the minimisation, management, and local and central treatment of hazardous waste, as well as proposals for a legal and administrative framework…"[26], all in line with the requirements of EU Directive 91/689/EEC.

In total, approximately 345,000 tonnes of hazardous waste were generated in 1993/94, of which about 8,000 tonnes were solid. Specifically, "…the largest quantities of effluents containing hazardous compounds were generated at the bleaching and dyeing plants, tanneries and at metal plating and aluminium anodising plants…"; whereas "…solid hazardous waste, such as contaminated packaging, ashes and sludge, were generated at pesticides manufacturing plants, hospitals and at bleaching and dyeing plants…". Household generation of hazardous waste, was equivalent to approximately 1.5 kg per inhabitant per year, consisting mainly of "…pesticides and flammable solvents, with car batteries, mercury and cadmium batteries, electrical equipment, thermometers etc…".

Since this study was undertaken, a number of industries have installed their own treatment plants. In addition, a communal plant has been put into operation in the Limassol district, and more recently, a new plant started operating outside Nicosia, treating industrial waste originating from the Nicosia and Larnaca industries. (Compliance with relevant Directives at these plants will need to be checked, which may have cost implications.) Much of the waste treated in these two plants falls within the hazardous waste total identified by the 1993 study. As a result of actions taken since the 1993 study, the hazardous waste remaining to be treated is currently estimated at around 2,500 tonnes per year, most of which is solid waste which goes to landfill, or waste which requires incineration. Current 'best estimates' of hazardous waste production, still requiring treatment after suitable internal reduction or pre-treatment, are given in Table 5.2.[27]

[26] SWECO study 1993-94 report
[27] Waste oils are treated separately below.

Table 5.2 Hazardous Waste Production in the Republic of Cyprus (1998)

	Quantities to be Treated (tons/year)	**Composition** (% of total)
Flammable substances	650	26
Hospital waste	500	20
Heavy metal waste	400	16
Pesticides, Pharmaceutical products	650	26
Ashes and Cinders	200	8
Miscellaneous waste	100	4
TOTAL Hazardous waste	2,500	100

Since most industries in the Republic of Cyprus are small, central treatment was identified in the SWECO study as the most cost-effective hazardous waste management solution, with internal measures introduced and monitored at the enterprises to reduce the amounts of waste.

Hazardous Waste Treatment Plant

Based on a recent Government appraisal, the estimated capital and recurring cost of a central hazardous waste treatment plant, conforming to EU standards, are 6.9 million ECU and 1.2 million ECU (per annum) respectively. These costs are summarised in Table 5.3.

Table 5.3 Costs of Hazardous Waste Treatment Plant (CY £[1997])

Capital costs	Expropriation	500,000
	Access roads	200,000
	Electricity	30,000
	Telephone services	30,000
	Buildings	180,000
	Laboratories	150,000
	Machines	300,000
	Incinerator	2,800,000
	Fencing	20,000
	Cooling machines	10,000
	Tractor	100,000
	TOTAL	4,320,000
Recurring costs	(per year)	750,000

Institutional Requirements

To facilitate compliance with the Directive, at a minimum a licensing system is required for the collection, transport (including packaging and labelling), storage and disposal of hazardous waste. Suitably trained personnel are also required to inspect installations producing and receiving such waste, and also the modes of transporting the waste. The cost of additional personnel and training were identified under the Framework Directive on Waste.

The control of waste from (some) industrial sites will also need to be integrated into the permitting system for industrial facilities under the IPPC Directive.

5.1.4. Disposal of Waste Oils

About This Directive

This Directive aims to create a harmonised system for the collection, treatment, storage and disposal of waste oils, allowing member states to indemnify companies for the unrecovered costs of collecting and disposal of waste oils. Priority is given to regeneration of waste oils, then combustion, and lastly to destruction, controlled storage or tipping.

Any undertaking disposing of waste oil must obtain a permit from the competent authority, and those collecting waste oils must be registered and supervised. The discharge of waste oils to waters and drainage systems is prohibited.

Existing Situation and Cost Implications

Cyprus currently generates about 5,300 tons of total waste oil each year, of which 4,000 tons are made up of 95% used automotive lubricating oils and 5% industrial oils. These volumes originate from about 1,200 to 1,300 different premises. Approximately 1,300 metric tons of waste fuel oil also arise from port operations. The fate of waste oils in the Republic of Cyprus is summarised in Table 5.4.

Table 5.4 Waste (lubricating) Oil Potential

	Tons/year	%
Exported waste lubricating oil	2,600	60.5%
Unrecoverable	150	3.5%
Illegal burning	1,000	23.3%
Unaccounted	550	12.7%
TOTAL	4,300	100%

Source: Proplan and Alfa Oils (1997)

The rate of increase in waste oil production is estimated to be about 100 tons/year.

Waste Oil Collection

A study recently conducted for the Government of the Republic of Cyprus concluded that "…the percentage collection rate of waste oil is quite high, and there is no reason to think that large quantities of used oils are entering the environment…".[28] For example, about 40% of the oil imported is consumed in engines, and of that about 3.5% is estimated to be lost in the environment as 'unrecoverable'. This takes the form of unused waste oil, discarded oil filters, and illegal dumping.

Of the total 4,300 tons of waste oil which is considered to be recoverable, 60% of it is recovered by a private firm Garona Trading Ltd. In 1995 Garona accounted for 90% of the exports of waste oil (2,517 tons).

Although the present collection system does work, and the recovery ratio is high (only between 5 and 13 % of the potentially recoverable quantity overall remains statistically unaccounted for), there is no formal framework for waste oil management, and there are imperfections associated with the system, in particular with regard to the requirement that oil should not be burned. Garona estimates that close to 1,000 tons is illegally burned a year.

Overall, in order to consolidate and further manage the waste oil collection system, the study suggests a series of measures to ensure the collection efficiency and reliability is maximised. Some level of quality control would also maximise the value of the used oil. Finally, there is a need for environmentally and economically sound disposal options. These measures, combined with a public

[28] Proplan and Alfa Oils (1997) Feasibility Study for the Management of Waste Oils in Cyprus. Ministry of Commerce, Industry and Tourism.

education programme, enforcement of existing laws, and the establishment of a formalised infrastructure of registration licenses and controls, would provide most of what is needed for the environmentally acceptable management of used oils. The Council of Ministers has recently approved the study and commencement of implementation is soon expected.

Waste Oil Recycling

The fundamental problem with recycling used oils is that it is only economic when the price of primary energy sources exceeds a certain level, i.e. when it is higher than the cost of collection of waste oil, and its preparation to the specification of the fuel that it is destined to replace. The Proplan and Alfa Oils study estimates the establishment of a re-refining plant to produce base oils from used oils, would cost between 0.6 million ECU and 1.6 million ECU, depending on the process selected, and that does not include the costs of collection. At present the quantities collected are just on the limit of feasibility for re-refining, but this might be an option in the future.

The following options were also identified:

1. reprocessing to boiler fuel and distribution to the industrial market; and/or
2. refining to lubricant base stock; and/or
3. burning in cement kilns.

The capital cost of option 1 is 0.4 million ECU; 0.7 million ECU for option 2; and 0.2 million for option 3. The corresponding recurring costs are approximately negative 93,000 ECU, negative 250,000 ECU and negative 226,000 ECU. The consultants favour option 2 because, among other things, it conforms with the spirit of the Directive, has the potential to yield wider benefits to the economy and has a better pay-back than option 1.

In addition to the above infrastructure needs, institutional changes are required to, for example:

- provide provisions for the collection, storage, segregation, labelling and for obligations to deliver to a licensed waste oil collector; and
- establish a licensing system for collectors and register generators.

In meeting these institutional requirements the Government will incur costs. No data was available from the Cypriot Authorities or other studies to estimate the likely magnitude of these costs however. Note that waste oils in Cyprus also include oils from ballast and bilge waters from ships. These are not covered by the cost estimates provided.

5.1.5. The Proposed Landfill Directive

About This Directive

This Directive will require all wastes to be treated prior to landfill, and co-disposal will be phased out. Prices for landfill disposal must cover the costs of closing the landfill site, and its management, and must cover 50 years of 'after closure care'.

The proposal also aims to reduce the quantity of biodegradable municipal waste sent to land fill, and methane from new and existing landfills will have to be collected and used or flared. In the absence of site specific data, it is not possible to estimate the cost of providing methane reduction facilities. These costs will need to be assessed at a later stage.

Existing Situation and Cost Implications

The magnitude of additional infrastructure compliance costs will be dependent, to a large extent, on the nature of the final national waste strategy adopted by the Government of the Republic of Cyprus. The cost of closing unsuitable landfill sites (the design and management of existing sites does not meet the standards of the Directive) and providing (new) sanitary landfills is included in the infrastructure expenditures identified under the Framework Directive on Waste.

5.1.6. Municipal Waste Incineration

About This Directive

These Directives apply parallel sets of requirements and restrictions on new and existing municipal waste incineration plants. They regulate permitting, design, equipment, operation and reporting, and set three levels of emission limit values for certain substances, and limit values an a programme of phased improvements of existing plants in a set time limit. There are also extensive requirements for monitoring, inspection and reporting by the operators.

Existing Situation and Cost Implications

No municipal waste incinerator exists in the Republic of Cyprus at present. Nonetheless, the implementation of a national waste management strategy (see the Framework Directive on Waste) will have some (minor) cost implications, mainly with respect to institutional reform. For example, at present no mandatory emissions values are defined, there are also no monitoring requirements, and inspection and reporting procedures need to be strengthened. Nonetheless, provisions exist in the Atmospheric Pollution Control Law for controlling emissions from incinerators, and a competent authority (the Ministry of Labour) exists to oversee the set up of incineration plants and issues permits.

It is not foreseen that compliance with this Directive will involve additional infrastructure expenditures to those already identified above; the incinerators included in the 3 waste management scenarios are costed with this Directive in mind.

5.1.7. Hazardous Waste Incineration

About This Directive

This is a daughter directive to the Waste Framework Directive, and requires that member states set and enforce operating conditions and emission limit values for hazardous waste incineration plants by means of permits. These permits are only granted if the incineration plant is designed, equipped and operated in such a manner that environmental pollution prevention requirements, in the form of emission limits, have been met. The permit must also state the type and quantity of hazardous waste being incinerated.

Hazardous waste incineration plants must be operated to achieve the maximum level of incineration possible, and the plant operators must have a comprehensive description of the waste before they can accept it.

Existing Situation and Cost Implications

Again, it is not foreseen that compliance with this Directive will involve additional infrastructure expenditures to those already identified above; the central incinerator was costed to comply with the standards set out under this Directive.

The institutional implications of complying with this Directive are similar to those outlined for the Municipal Waste Incineration Directives.

5.2. Summary of Cost Analysis for Waste Management

The full results of the cost analysis for those directives where major infrastructure investments are required are summarised in Table 5.5. The estimated investment costs of compliance with the environmental *acquis* directives with respect to waste management are summarised in Table 5.6.

The institutional implications of complying with the 'waste management' directives mainly derive from the need to provide a suitable licensing/permitting system for the collection, transportation (including packaging and labelling), storage and disposal of waste (including all disposal facilities), and the associated monitoring, enforcement and reporting. Relative to the investment needs, the required institutional modifications will have a minor cost burden. The 'best estimate' of additional staff costs is 0.5 million ECU per annum; however this relates to strengthening Government capabilities across several sectors, one of which is waste. Training needs in the waste management sector are estimated at under 0.02 million ECU; this is a non-recurring cost.

Table 5.5 Summary of Results for Waste Management Sector (million ECU[1997])

	Capital Cost	Recurring Cost	Annualised Capital Cost[1]	Total Annual Cost
Compliance Measures in Place	-	-	-	-
Future Compliance Measures[2]	**69.2 - 144.2**	**7.3 – 14.2**	**5.8 – 12.1**	**13.1 – 26.3**

Note:
[1] The capital recovery factor used to determine the annualised capital costs is 0.08375 (r = 3%; n = 15 years).
[2] Required (relevant to environmental acquis) investments yet to be made.

Table 5.6 Summary of Investment Needs for the Waste Management Sector (million ECU[1997])

Measures	Existing Directives						Proposed
	Ref. 75/442/EEC	**Ref. 91/689/EEC**	**Ref. 89/369/EEC**	**Ref. 94/67/EEC**	**Ref. 94/62/EC**	**Ref. 75/439/EEC**	**Ref. COM(97)105**
Compliance Measures in Place:							
None							
Future Compliance Measures:							
Waste management Infrastructure:							
Scenario I	8.2						
Scenario III and IV	69.8–144.8						
Difference	61.6-136.6		*		*		*
Hazardous waste plant	*	6.9		*			
Waste oil re-processing plant	*	*				0.7	
Sub-total	**61.6-136.6**	**6.9**	*	*	*	**0.7**	*

Notes:
***** Implementation of identified measure may also contribute to compliance with this Directive.

6. Industrial Pollution Control and Risk Management

6.1. EU Legislation and Compliance Issues

The relevant environmental *acquis* directives with respect to Industrial Pollution Control and Risk Management are listed in Table 6.1.

Table 6.1 Industrial Pollution Control and Risk Management: Directives of the EU Environmental *Acquis*

Reference	Description (Title)
96/61/EEC	Integrated Pollution Prevention and Control Directive
84/360/EEC	Air Pollution from Industrial Plants Directive[1]
88/609/EEC	Large Combustion Plants Directive
96/609/EEC	Seveso Directive
COM (69) 538	Proposed Directive on VOC Emissions from Industry

Notes:
[1] Will be replaced by the IPPC Directive in 2007.

6.1.1. Integrated Pollution Prevention and Control (IPPC)

About This Directive

The IPPC Directive aims to achieve integrated prevention and control of pollution to air, water and land, arising from a range of industrial activities, to ensure a high level of protection of the environment as a whole.

All the activities covered by the Directive require a permit, which imposes emission limits, and contains measures designed to ensure that the following requirements are met. All appropriate preventative measures are to be taken against pollution, in particular through the application of Best Available Techniques (BAT); no significant pollution is to be caused; waste production is to be avoided; energy is to be used efficiently; measures are to be taken to prevent accidents and measures are also to be taken on cessation to avoid pollution risk.

Permits must set limits taking into account the potential for transfer of pollution from one medium to another. The limits must be sufficient to prevent breaches of any environmental quality standards. The permits must be considered periodically, and updated where necessary.

These requirements apply to 'new' installations from October 1999 and 'existing' installations from October 2007.

Existing Situation and Cost Implications

The Integrated Pollution Prevention and Control (IPPC) Directive is partially implemented in the Republic of Cyprus law in that a system exists for co-ordinating licenses of emissions to air and water[29]. However, there are many requirements of the Directive which are not implemented. The main ones are: licensing procedures, for example, the application of Best Available Technique (BAT), refusal of permits in the case of non-compliance, etc; and notification requirements for changes in operation, results of monitoring, etc.

[29] About 20 to 25 installations are estimated to fall within the scope of this Directive; these installations are already subjected to a permitting system.

A LIFE (1998) project was recently approved (with a budget of 340,000 ECU), which will partially aid in developing the institutions required to comply with the Directive[30]. Note: the cost of this project is not included in the final compliance cost estimates.

The estimated cost of providing (preliminary) training for existing (Government) staff on the requirements of this Directive is 18,900 ECU (see Annex D).

At this stage, however, it is not possible to provide further estimates of additional compliance costs, associated with the IPPC Directive. This is an area in urgent need of further investigation.

6.1.2. Large Combustion Plants

About This Directive

This Directive applies to combustion plants with a thermal output of 50 Megawatts (MW) or more, and sets limits on the emissions of certain pollutants into the air. The aim is to reduce emissions of SO_2 , NO_x from existing plants and SO_2 , NO_x and dust from new plants by a combination of controlling emissions from existing plants, and strict emission limits on new ones.

Member states have to draw up programmes for the phased reduction of total annual emissions from existing plants. For new plants, they should take appropriate measures to comply with fixed emmission limit values. Also, licences for construction or operation must include conditions for compliance with emission limit values for SO_2, NO_x and dust, and appropriate conditions for waste gases.

Where a new plant is likely to have a significant effect on another member state, the other member state must be consulted under Directive 85/337/EC.

Existing Situation and Cost Implications

Presently, there are two facilities in the Republic of Cyprus that fall within the scope of this Directive; the 360 MW oil/steam power station at Dhekelia and the 180 MW oil/steam power station at Moni. Both these plants are operated by the Electricity Authority of Cyprus (EAC). The EAC also plans to establish a new power station at a site near Vasilikos on the south coast. The Vasilikos power station will be built in three phases; the first phase, expected to be operational in the year 2000, consists of 2 x 130 MW heavy fuel oil fired units. Two further phases, comprising 2 x 120 MW units, will bring the total installed capacity to 740 MW by the end of 2008. Further details are found in Annex C.

To comply with this Directive, abatement equipment is needed at Vasilikos power station; multi-cyclones are required to reduce particulate emissions and low NO_x burners and recycling fans need to be installed to reduce emissions of NO_x. The corresponding costs are 0.27 million and 2.80 million ECU (1997). Total recurring costs are estimated to be between 4 and 6 per cent of the investment costs, i.e. between 0.12 million and 0.18 million ECU per annum. Flue gas desulphurisation (FGD) units are also required in order to meet EU limit values for SO_2. The cost of these installations is estimated using data from the UK (see Annex C). The estimated capital cost of an FGD installation for Phase 1 at Vasilikos is between 52.2 million and 79.4 million ECU (1997); the recurring costs range between 7.7 million and 10.0 million ECU (1997). Alternatively, better quality fuel, with low sulphur content may be considered.

Sulphur abatement is also required at Dhekelia power station in order to comply with 88/609/EEC. (While SO_2 abatement is also required at the Moni power station, the associated costs have not been estimated, as the power station is due to be gradually retired over the next ten years.). The estimated capital cost of an FGD installation for Dhekelia is between 72.3 million and 109.9 million ECU (1997); the recurring costs range between 10.7 million and 13.8 million ECU (1997).

[30] One of the main objectives of this project is the development of an integrated management and control system within the Ministry of Labour and Social Insurance, which will develop and implement an integrated management and control system, concerning chemical substances and preparations, industrial wastewater and VOC emissions, which will be source oriented, and focus on prevention. The project will include the establishment of a detailed source inventory, the development of Data Bases and Geographic Information Systems (GIS). Pollution prevention measures (BAT) will be formulated for each area concerned and a plan for continuous monitoring after completion of the project established.

In addition, abatement measures will need to be implemented at Dhekelia to reduce NO_x emissions from all units, and particulate emissions from the last unit (which was commissioned after 1987). The estimated capital cost is between 5.8 million and 11.7 million ECU (1997) for NO_x abatement, and between 0.18 million and 0.37 million ECU (1997) for particulate abatement (see Annex C). Total recurring costs are estimated to range from 0.24 million and 0.72 million ECU per annum.

Two important points regarding the above estimates should be noted:

- Firstly, the abatement options considered may not necessarily represent the least-cost measures available to the EAC in order to reduce the pollutants covered by the Directive. For example, it is possible, and likely, that switching to a low sulphur gas oil may be more cost-effective. This option was discussed with the EAC, but was not considered practically feasible.
- Secondly, the identified abatement options may reduce emissions levels beyond those required by the Directive, or not reduce them enough.

It is not possible to resolve either point in the absence of further, more detailed analysis.

The institutional implications of complying with this Directive are similar, and for the most part are already addressed, under the Air Quality Framework Directive (Chapter 3). The exception is the need to establish a system for generating (annual) emission inventories and programmes to reduce emission levels to agreed targets for existing plants. The appropriate authority will incur some (minor) costs in implementing these mechanisms. Relevant data is not available to estimate the magnitude of these costs however. Note that the Electricity Authority of Cyprus has conducted a study which has shown that switching to low sulphur content fuel oil provides the least cost solution which is practically feasible.

6.1.3. 'Seveso' Directive on Control of Major Accident Hazards

About This Directive

The Seveso Directive contains a set of obligations for industrial plant operators, national authorities and the Commission aimed at identifying and controlling the risks of major accidents from industrial installations. The 'old' Directive (82/501/EEC) will be replaced in 1999 by the 'new' control of major accident hazards involving dangerous substances Directive (96/82/EEC).

The new Directive has a broader scope, and strengthens the safety management and emergency planning requirements on certain industrial plants. Provisions for inspection and control by competent authorities are reinforced, and a new provision introduced which requires that the Directive's objectives are taken into account in land-use planning.

An establishment falls within the scope of the new Directive when the presence of specified dangerous substances is in sufficiently large quantities to create a major accident hazard. Installations covered by the Directive, and which are located close to each other, have to co-operate in averting risks.

Industrial facilities that do fall under the Directive will have to prepare a safety report and internal emergency plan, the national competent bodies must also prepare a plan, co-operating across borders where appropriate. Where such plans are deficient, use of the installations must be prohibited.

Existing Situation and Cost Implications

It is estimated that about 12 industrial sites will be subject to the requirements of this Directive. There are some provisions in existing legislation, e.g. there are some procedures for the prevention of accidents and the protection of workers. These are in no way sufficient however, to ensure compliance. The following (additional) institutional activities are required to comply with the Directive: major accident prevention policy; drafting of emergency plans; mechanisms for information exchange; a programme for inspections; a registration and notification system, etc.

The implementation of these activities will, in turn, have cost implications for both the responsible Government Authority and the operators of the affected installations, in terms of additional staff and/or training of existing staff. No estimates of the associated costs are available at this stage.

With the exception of the (new) blast proof control room to be built at the Cyprus Petroleum Refinery, no major investments are foreseen to achieve compliance with this Directive, at this stage. The estimated cost of the control room is 1.7 million ECU (see Chapter 3).

6.1.4. Industrial Emissions of VOCs

About This Directive

This is a proposal for a directive limiting the emissions of volatile organic compounds due to the use of organic solvent in certain industrial activities. The objective is to reduce emissions from stationary sources, and thereby reduce tropospheric ozone. The proposal aims to cut emissions at least 50% by 2010 compared to 1990 levels, for some twenty main types of solvent using activities.

Targets will be reached by means of emission limit values to be achieved by appropriate abatement technologies or by substitution solutions.

Existing Situation and Cost Implications

The Factory Inspectorate identified one industry, consisting of three (printing) plants, which will be required to reduce VOC emissions under this directive. Printing processes emit significant quantities of VOC. Abatement options include end-of-pipe technologies, e.g. incineration after-burners, carbon adsorption, or the use of water based inks. One of the works has already installed an after-burner, at a cost of 248,300 ECU (1997). Recurring costs are typically around 5 percent (i.e. 12,500 ECU per annum). If the other two plants were also to install after-burners, an additional 0.5 million ECU would need to be spent; associated recurring costs are 25,000 ECU per annum.

It should be noted that after-burners are not necessarily the most cost-effective option; due to the reuse value of the recovered solvent, the cost of carbon absorption is about 25 per cent less per tonne of VOC abated than either water based inks, or incineration[31]. The applicability of abatement options depends on the printing process itself however, e.g. water based inks cannot be used in heatset web offset printing. Further investigation is therefore required to improve the accuracy of the estimated costs; in the mean time they represent an upper bound of the costs involved.

[31] AEA Technology (1997) Emission Inventories of GHGs and Ozone Precursors. Second year report for DG XI.

6.2. Summary of Cost Analysis for Industrial Pollution Control and Risk Management

The full results of the cost analysis for those directives where major infrastructure investments are required are summarised in Table 6.2. The estimated investment costs of compliance with the environmental *acquis* directives with respect to Industrial Pollution Control and Risk Management are summarised in Table 6.3.

The institutional implications of complying with the directives of this sector mainly derive from the need to expand and strengthen institutional activities. Concerning the IPPC Directive, for example, changes are required to facilitate the application of Best Available Technique (BAT), the refusal of permits in the case of non-compliance, etc; and notification requirements for changes in operation, results of monitoring, etc. With respect to the Seveso Directive the following (additional) institutional activities are required: major accident prevention policy; drafting of emergency plans; mechanisms for information exchange; a programme for inspections; a registration and notification system, etc. As far as the Large Combustion Plant Directive is concerned, there is a need to establish a system for generating (annual) emission inventories and programmes to reduce emission levels to agreed targets.

The estimated cost of providing (preliminary) training for existing (Government) staff on the requirements of directives in this sector is 18,900 ECU (mainly for IPPC). Further estimates of additional compliance costs associated with the IPPC Directive are not available at present. This is an area where there is an urgent need for further investigation.

Table 6.2 Summary of Results for Industrial Pollution Control and Risk Management Sector (million ECU[1997])

	Capital Cost	Recurring Cost	Annualised Capital Cost[1]	Total Annual Cost
Compliance Measures in Place	0.25	0.01	0.02	0.03
Future Compliance Measures[2]	**135.8-206.6**	**18.8-24.7**	**11.4-17.3**	**30.2-42.0**

Note:
[1] The capital recovery factor used to determine the annualised capital costs is 0.08375 (r = 3%; n = 15 years).
[2] Required (relevant to environmental *acquis*) investments yet to be made.

Table 6.3 Summary of Investment Needs for the Industrial Pollution Control and Risk Management Sector (million ECU[1997])

Measures	Existing Directives			Proposed
	Ref. 96/61/EC	**Ref. 88/609/EEC**	**Ref. 96/82/EEC**	**Ref. COM (69) 538**
Compliance Measures in Place:				
VOC incinerator (1 printing works)				0.25
Future Compliance Measures:				
Vasilikos power station:				
SO_2 abatement	*	52.2 – 79.4		
NO_x abatement	*	2.8		
Particulate abatement	*	0.27		
Dhekelia power station:				
SO_2 abatement	*	72.3 – 109.9		
NO_x abatement	*	5.8 – 11.7		
Particulate abatement	*	0.18 – 0.37		
Refinery (blast proof control room)			1.70	
VOC incinerator (2 printing works)				0.50
Sub-total	*	**133.6-204.4**	**1.70**	**0.50**

Notes:
***** Implementation of identified measure may also contribute to compliance with this Directive.

7. Other 'Key' Directives

There are several other groups of EU directives which have not been considered in the previous Chapters of this report, but which will clearly need to be implemented if the Republic of Cyprus is to comply with the environmental *acquis*. All of these will entail some level of implementation costs, which may include (very minor) capital goods. It is more likely that they will involve recurring expenditures, for example, costs associated with institutional strengthening, such as staff training, increases in staff numbers, and administrative reform. In other words, there will be costs involved with the establishment and maintenance of the necessary enforcement and monitoring systems, which are a prerequisite of successful implementation. The legislation which falls into this category is the 'horizontal' legislation, including access to environmental information and environmental impact assessment; and legislation relating to nature protection, including habitats and wild birds.

At the time of writing this report, no information is available from which estimates of the costs of complying with the environmental *acquis* in the following areas can be made: noise, chemicals, genetically modified organisms, and nuclear safety. The share of these areas in the estimated total cost of the Republic of Cyprus's compliance with the *acquis* as a whole, however, will be very minor. Their omission at this stage is therefore unlikely to have a noticeable impact of the overall costs involved.

7.1. Horizontal Directives and Compliance Issues

The relevant environmental *acquis* directives with respect to Horizontal legislation are listed in Table 7.1.

Table 7.1 Horizontal: Directives of the EU Environmental *Acquis*

Reference	Description (Title)
85/337/EEC	Environmental Impact Assessment Directive
90/313/EEC	Access to Information Directive
91/692/EEC	Reporting on Implementation of Environmental Directives

7.1.1. Access to Information

About This Directive

The Directive on the freedom of access to information on the environment requires that information held by publicly accountable bodies is made available to the public on request. The information must be provided in a given time scale, and where it is denied, there is a right of appeal. Member states must also publish state of the environment reports periodically.

Existing Situation and Cost Implications

Article 3 of this Directive has, to a limited extent, been implemented in the laws on the Control of Water Pollution and Air Pollution in which there are provisions for public access to Registers which should contain details and information relating to permits granted. Applications for discharge consents are placed in the official Gazette which can be viewed by any interested party on request to the licensing authority. The results of air quality monitoring are published regularly in some detail.

It is anticipated that only minor institutional reform costs will be incurred in expanding the scope of the current recording/reporting systems, and in producing the additional reports to comply with the requirements of the Directive, e.g. a comprehensive annual report on the state of the environment. The cost of additional staff and training to meet the needs of this Directive are considered below under the EIA Directive.

7.1.2. Environmental Impact Assessment (EIA)

About This Directive

This Directive requires that before a government body gives consent for development projects likely to have significant effects on the environment, an assessment of the possible environmental impacts is carried out. Those projects identified in Annex I must always be subject to an environmental impact assessment, while those in Annex II only require an assessment when certain criteria are met. These criteria are determined by the individual member states.

The developer has to supply the relevant information to the competent authority in the form of an environmental impact statement. Various statutory consultees have to be consulted, and environmental authorities and the general public must be given an opportunity to comment before the decision is taken as to whether the project should go ahead.

The original Directive on the assessment of the effect of certain public and private projects on the environment has been amended by Directive 97/11/EC, which must be in force by March 1999. The amendments aim to overcome the problems with the original Directive, in particular with reference to the type of project subject to assessment and the information which must be included in an assessment.

Existing Situation and Cost Implications

The Republic of Cyprus does have a system requiring that an EIA be undertaken for all 'major public development projects and private development projects' before the necessary funds are released by the Planning Bureau or planning consent is given. However, there is no comprehensive legislation, which fully implements the EIA Directive (85/337/EEC as amended) into National law. Also, the present system in the Republic of Cyprus does not fully comply with the Directive and would, therefore, need altering. Specifically, a different basis for the determination of whether an EIA is required would be necessary, (currently the financial cost of a project is one of the criteria used as a screening criteria). In addition, Annex I is only partially in place; provisions for scoping are minimal and there is no formal requirement for public notification and participation, and transboundary effects. There is at present no provision for Annex II projects to be subject to EIA. These omissions represent some of the more costly elements of EIA, in terms of resources required.

Table 7.2 shows that between 1991 and 1998, 260 EIA-like studies were conducted in the Republic of Cyprus, of which 188 were preliminary studies and 72 were full studies. Of the studies conducted, the most expensive was for a motorway project, costing about 128,000 ECU. However, on average, a full 'private' sector EIA costs around 32,000 ECU; in contrast, a full 'public' sector EIA costs between 64,000 ECU and 80,100 ECU. The divergence in costs between 'private' and 'public' EIAs may be reflected in part by the fact that projects in each sector are processed differently. For 'public' projects (as mentioned above), the EIA is carried out by the Planning Bureau. EIAs of 'private' projects are carried out by a Technical Committee chaired by the Director of the Environment Service. Moreover, it is only 'public' projects that require a public hearing.

Table 7.2 EIA Studies in Cyprus: 1991 to 1998

Year	Preliminary EIA	Full EIA	Total Studies
1991	1	3	4
1992	9	5	14
1993	10	13	23
1994	66	13	79
1995	32	11	43
1996	39	6	45
1997	22	14	36
1998	9	7	16
Total	188	72	260

Source: Environment Services, MANRE

Once the more stringent screening requirements of the EIA Directive take effect, it is anticipated that about 20 more projects per annum will be subjected to full EIAs. In line with the current trend, it is anticipated that the majority of these studies will be conducted by the 'private' sector. Therefore, the recurring cost of conducting the additional studies is about 0.64 million ECU per year.

Of course, processing the additional EIAs will impose some administrative burden on the Government. Moreover, new elements will need to be introduced into current procedures, e.g. increased public notification and participation, etc. Consequently, additional staff will be required and the knowledge of existing staff will need to be up-dated. No separate estimates are available at present of additional staff requirements for this sector; an estimated additional 20 posts are needed to strengthen Government capabilities across several sectors, including 'horizontal' legislation, at an annual cost of about 0.58 million ECU (see Annex D). Training needs for existing staff are estimated at about 21,900 ECU (again, see Annex D).

7.2. Nature Protection and Compliance Issues

The environmental *acquis* directives with respect to Nature Protection are listed in Table 7.3.

Table 7.3 Nature Protection: Directives of the EU Environmental *Acquis*

Reference	Description (Title)
92/43/EEC	Habitats Directive
79/409/EEC	Wild Birds Directive

7.2.1. Habitats and Wild Birds Directives

About These Directives

The Directive on the conservation of natural habitats and of wild fauna and flora aims to maintain the biodiversity of the member states by conserving natural habitats. This will be achieved by establishing 'favourable conservation status' for habitats and selected species identified as being of EU interest, defined by reference to factors such as species population dynamics, trends in the natural range of species and habitats, and the area of habitat remaining.

'Natura 2000', an EU ecological network will be established, with each member state producing a list of the sites in their territory they consider to be of EU importance. Sites identified on this list will be subject to protection obligations to avoid deterioration of habitats. This will include assessing any plans or projects which are likely to have significant effects on sites. The ecological coherence and

landscape features of these sites should be taken into account when policies about land use planning are drawn up.

Member states must also strictly protect the listed animal and plant species, including the prohibition of deliberate collection, capture or killing of all these species or the deterioration or destruction of their breeding sites.

The conservation of wild birds Directive aims to protect migratory wild birds and their habitats. Member states are obliged to maintain populations of all naturally occurring bird species in the wild in the EU by means of the preservation, maintenance or re-establishment of a sufficiently diversity and area of habitats.

For species listed as vulnerable species, as well as migratory species, member states are required to take particular measures to conserve their habitats by, among other things, designating Special Protection Areas (SPAs). Wetlands are given special mention in this context. The protection regime for SPAs is defined under the Habitats Directive.

The Directive also requires member states to prohibit deliberate killing, capture, deliberate destruction, damage to nests and eggs, taking of eggs, disturbance during breeding, and keeping of birds whose hunting/capture is prohibited. The sale of wild birds, including parts and derivatives, is generally prohibited.

Existing Situation and Cost Implications

The Republic of Cyprus has a range of habitats, more than 1,900 plant, 25 mammal and 357 bird species. In addition, there are reptiles, amphibians, fish and butterflies. Quite a substantial number of these are endemic. Much data on flora and fauna has been collected during the preparation of the Ecological Chart of Cyprus, with other information being systematically collected for 'flagship' species, such as the moufflon, turtles, and certain raptors.

There are two major ways in which legal protection is offered for flora and fauna in Cyprus, these are: by means of development controls through the Town and Country Planning legislation; and by restrictions on activities such as hunting through the Game and Wild Birds legislation. In addition, Forest and Fisheries Law (and the relevant Regulations) makes certain provisions, and species and habitat management programmes are run by the Republic of Cyprus Departments of Forestry and Fisheries.

Implementation of the Habitat and Wild Birds Directives is partially achieved; for example there are certain restrictions on harmful activities in respect of protected species and habitats. However, restrictions do not appear to be strictly enforced, and there are a number of areas which are not addressed at all, including the designation of Special Areas of Conservation, the procedures applicable to such areas in terms of potentially harmful plans and projects, and the establishment of appropriate monitoring and surveillance systems and response actions. In these areas, some conflict is likely. The problem is exacerbated by the increasing pressures on flora and fauna resulting from development, tourism and from hunting. Additional resources are likely to be required, both for improving enforcement, and providing infrastructure (e.g. capacity buildings for enforcing the CITES Convention).

Protection of marine habitats and species is covered by stricter legislation than the terrestrial equivalent, and is also more strictly enforced.

A LIFE (1998) project was recently approved (with a budget of 318,250 ECU), which will partially aid in developing some of the institutions required to comply with the Habitats Directive[32]. The estimated cost of providing (preliminary) training for existing (Government) staff on the requirements of the directives in this sector is 19,000 ECU (see Annex D). The estimated additional 20 posts needed to

[32] The objective of the project is to provide the information required for the establishment of a 'conservation zones' network' in Cyprus, within the European Ecological Network "Natura 2000". Specifically, the project will produce: a national list of special areas of conservation (SACs); a database containing the Standard Data Forms for the SACs in an updateable and reproducible form that is compatible with the NatRef forms; and a national archive for ecological data for Cyprus.

strengthen Government capabilities across several sectors, mentioned above, also includes nature protection legislation.

At this stage however, it is not possible to provide further estimates of additional compliance costs associated with these Directives (relevant data is not available). This is an area in urgent need of further investigation however, given the potential magnitude of additional direct and indirect costs arising from, for example, taking land out of economically productive activity, or limiting its potential for production in order to maintain carrying capacity, either as a protected area, or for Habitats as a corridor within the Natura 2000 system. Furthermore, given the relatively large number of hunters on the island, it is likely that there will be a cost burden associated with modifying the existing hunting policy to comply with the Wild Birds Directive.

7.3. Summary of Cost Analysis for Other 'Key' Directives

Compliance with the 'horizontal' legislation and legislation relating to nature protection, is not anticipated to require any capital investments of note.

Once the more stringent screening requirements of the EIA Directive take effect, it is anticipated that about 20 more projects per annum will be subjected to full EIAs; the estimated recurring cost of these additional studies is 0.64 million ECU per year.

Compliance with the directives considered above will impose an additional administrative burden on the responsible Government Authorities. An estimated additional 20 posts are needed to strengthen Government capabilities across several sectors, including 'horizontal' legislation and legislation for nature protection, at an annual cost of about 0.58 million ECU. Note: this also includes estimates of additional staff required to comply with the waste management sector of the *acquis*. The estimated cost of providing (preliminary) training for existing (Government) staff on the requirements of directives in this sector is 40,900 ECU (a non-recurring cost).

It is likely that compliance with the nature protection legislation will have additional (direct and indirect) cost implications; relevant data is not available at present to estimate the magnitude of these costs however. Given their potential size, this is an area in urgent need of further investigation.

8. Summary of Cost Analysis

The primary objective of this study is to provide 'order of magnitude' estimates of the capital (non-recurring) costs and recurring costs of harmonising environmental management and protection practices in Cyprus with the main requirements of the EU environmental *acquis*. Due to a lack of accessible data relating to the north of the island however, it has only been possible to undertake the analysis for the Republic of Cyprus. A summary of the cost analysis is presented in this Chapter.

A preliminary (qualitative) assessment of the potential benefits accruing from the required investment programme has also been undertaken.

8.1. Best Estimates of the Cost of Approximation

8.1.1. Financial Requirements

Best estimates of the cost of approximation of EU environmental legislation in the Republic of Cyprus are presented in Table 8.1. This table pulls together and summarises the cost data included in the previous Chapters. All costs are expressed in ECU, in 1997 prices.

An estimated 1,117.7 to 1,263.5 million ECU is needed to provide the necessary infrastructure and related capital equipment to comply with the environmental *acquis*. If these investment costs are amortised over a fifteen year period at a 3 per cent real discount rate, the annual capital requirement is between 93.6 and 105.8 million ECU, the mid point being 99.7 million ECU. Of course, annualised costs are sensitive to the capital recovery period and the discount rate. As the discount rate increases, the annualised capital cost rises (*ceteris paribus*); and as the period over which the capital is recovered increases, the annualised capital cost decreases (*ceteris paribus*).

The total annual compliance cost, i.e. the annualised capital costs plus the associated recurring costs, ranges from 141.5 to 166.5 million ECU (the mid-point is 154 million ECU). By far the majority of these costs relate to the water quality sector (60.1 per cent); the IPC and risk management, waste management, and air quality sectors account for 23.4 per cent, 12.8 per cent and 2.9 per cent, respectively. The share of other 'key' directives in total annual costs is less than 1 per cent, although this is slightly misleading as the cost analysis is incomplete in these areas at present.

Not included in Table 8.1 is the (non-recurring) cost of training existing (Government) staff to implement the institutions required to comply with the *acquis*. This was conservatively estimated at 233,700 ECU, spread over about three years.

Table 8.1 Summary of Cost Analysis by Sector (million ECU[1997])

Sector	Capital Cost	Recurring Cost	Annualised Capital Cost[1]	Total Annual Cost
Air Quality:				
Compliance Measures in Place	0.8	n/a	0.07	>0.07
Future Compliance Measures[2]	**46.9**	**> 0.6[5]**	**3.9**	**> 4.5**
Water Quality:				
Compliance Measures in Place	19.7	0.6	1.6	2.2
Future Compliance Measures[2]	**865.8**	**20.0**	**72.5**	**92.5**
Other Measures[3]	31.9	3.3	2.7	28.3[4]
Waste Management:				
Compliance Measures in Place	-	-	-	-
Future Compliance Measures[2]	**69.2 – 144.2**	**7.3 – 14.2**	**5.8 – 12.1**	**13.1 – 26.3**
IPC and Risk Management:				
Compliance Measures in Place	0.25	0.01	0.02	0.03
Future Compliance Measures[2]	**135.8 – 206.6**	**18.8 – 24.7**	**11.4 – 17.3**	**30.2 – 42.0**
Other 'Key' Directives:				
Compliance Measures in Place	-	-	-	-
Future Compliance Measures[2]	-	**1.22[6]**	-	**1.22**
Total:				
Compliance Measures in Place	20.75	0.61	1.69	2.30
Future Compliance Measures[2]	**1,117.7 – 1,263.5**	**47.9 – 60.7**	**93.6 – 105.8**	**141.5 –166.5**
Other Measures[3]	31.9	3.3	2.7	28.3[4]

Note:
[1] The capital recovery factor used to determine the annualised capital costs is 0.08375 (r = 3%; n = 15 years).
[2] Required (relevant to environmental acquis) investments yet to be made.
[3] Future investments, which relate to 'water quality', but cannot strictly be related to the environmental *acquis*.
[4] Includes the total annual cost of the desalination plants yet to be built (i.e. 22.3 million ECU).
[5] This is definitely an underestimate as recurring cost estimates were not available for a number of measures.
[6] The total cost of the 20 new (Government) posts is included here, and not in other sectors.

8.1.2. The Scale of the Investment Needs

The impact of the necessary investments on the economy of the Republic of Cyprus will depend to a large extent on the timing of the investment programme. Although consideration of the time phasing of the investment programme was not a requirement of the terms of reference of this study, it should be noted that the present value of the estimated total compliance costs will vary considerably according to how the capital programme is implemented over a set time period, and how short this period is.

Annualised investment needs, when expressed as a percentage of GDP, account for 1.50 per cent. This figure is less than the investment needs for the CEECs, but considerably higher than the needs of the Cohesion countries (0.2 per cent of GDP)[33]. The difference in annualised capital costs per capita between the Republic of Cyprus and the CEECs is even more pronounced; 134 ECU per capita for the Republic vs. 1,168 ECU per capita for the CEECs. Details of the comparison are given in Table 8.2 below.

As far as individual sectors are concerned, the investment needs of 'water' in the Republic of Cyprus, expressed as a percentage of GDP, are approximately similar to those estimated for the CEECs.

Table 8.2 Annualised Capital Costs of Approximation
Note that figures in this table refer to total population of the island of Cyprus.

	Annualised Capital Cost[5]	**ECU / capita[1]**		**% of GDP[2]**	
	million ECU	Rep. Of Cyprus	CEECs[3]	Rep. of Cyprus	CEECs[3]
Air:[4]					
Future Needs	18.25	25	<463	0.27	<1.07
Water:					
Future Needs	72.5	97	486	1.09	1.12
Waste:					
Future Needs	8.95	12	~156	0.13	~0.36
Total[6]	99.70	134	~1,168	1.50	~2.90

Notes:
~ Approximately
[1] Based on estimated population of 744,609 in 1996.
[2] Based on estimated GDP for 1996 of 6,652.9 million ECU.
[3] EDC (1997) Compliance Costing For Approximation of EU Environmental Legislation in the CEEC.
[4] Includes the costs from the IPC and risk management sector.
[5] Based on the mid-points of the ranges given in Table 8.1. Costs related to other 'key' directives are not included.
[6] Figures given as in original report; some figures do not add correctly.

As Table 8.3 illustrates, estimated total annual compliance costs (i.e. annualised capital costs plus recurring costs) are 152.8 million ECU, which corresponds to 205 ECU per capita, or 2.30 per cent of GDP. In per capita terms, total annual compliance costs are only slightly more than the average per capita figure for the EU 15 (just over 13 per cent greater). However as a percentage of GDP, the total annual compliance costs for the Republic of Cyprus are more than twice as high.

[33] EDC/EPE (1997) Compliance Costing For Approximation of EU Environmental Legislation in the CEEC.

Table 8.3 Total Annual (Capital & Recurring) Costs of Approximation
Note that figures in this table refer to total population of the island of Cyprus.

	Total Annual Cost[5]	ECU / capita[1]			% of GDP[2]		
	million ECU	Rep of Cyprus	CEECs[3]	EU[3]	Rep of Cyprus	CEECs[3]	EU[3]
Air:[4]							
Future Needs	40.6	55	34	29	0.61	1.60	0.14
Water:							
Future Needs	92.5	124	n/a	90	1.39	n/a	0.53
Waste:							
Future Needs	19.7	26	29	60	0.30	1.30	0.32
Total	152.8	205	n/a	179	2.30	n/a	0.99

Notes:
[1] Based on estimated population of 744,609 in 1996.
[2] Based on estimated GDP for 1996 of 6,652.9 million ECU.
[3] EDC (1997) Compliance Costing For Approximation of EU Environmental Legislation in the CEEC.
[4] Includes the costs from the IPC and risk management sector.
[5] Based on the mid-points of the ranges given in Table 8.1. Costs related to other 'key' directives are not included.

8.2. Potential Benefits of Investment Programme

Compliance with the EU environmental *acquis* will inevitably improve the quality of the natural environment in Cyprus for all those who 'use' it. In this section a preliminary assessment of the benefits of these improvements is reported. For the purpose of this study however, the discussion is purely qualitative, i.e. the magnitude of the benefits is not estimated.

Compliance with the *acquis* will mainly benefit Cyprus through:

- reduced levels of air pollution;
- reduced levels of water and ground contamination; and
- the provision of suitable sanitation capacity.

All of these will result in the protection of the natural environment, and, directly and/or indirectly, improve the welfare of Cypriots and tourists alike. Compliance will also require a co-ordinated approach to all the aspects listed above in contrast to the present piecemeal legislation and control. This overall view will have benefits in terms of increased efficiency, as well as with respect to the integration of environmental protection.

8.2.1. Reduced Air Emissions

Compliance with a number of the Directives of the *acquis* will provide institutions and infrastructure to control and reduce emissions of various pollutants, from both stationary and mobile sources, including emission of:

- particulates (dust);
- sulphur dioxide (including secondary aerosols);
- nitrogen oxides (including secondary aerosols);
- carbon monoxide;
- benzene;
- carbon dioxide;

- methane;
- nitrous oxide;
- volatile organic compounds; and
- ozone (in terms of the precursors: nitrogen oxides and volatile organic compounds).

There is strong evidence in the literature linking some of the above pollutants, either directly or indirectly, to adverse effects on human health including cases of acute and chronic mortality, as well as numerous non-fatal forms of respiratory illness. Equally, there are well-established links between several of the pollutants and material corrosion, reductions in crop yields, impaired visual range and ecosystem damage. Lessening any of these adverse impacts will result in improvements in the welfare of Cypriots and tourists, for example in terms of increased crop yields as ground level ozone is reduced; reduced expenditures on building maintenance and cleaning resulting from lower concentrations of particulates; health care savings; increased productivity as incidences of respiratory illnesses resulting from secondary aerosols are reduced, etc. Furthermore, reduced levels of dust will improve visibility, which, in turn, will improve the experience of tourists.

To illustrate the potential magnitude of the benefits to be realised, studies for the UK have estimated that the benefit of every tonne of SO_2 abated is 7,390 ECU (1995 prices), in terms of reduced impacts on human health, materials and crops. Unit damage cost estimates also exist for all the other pollutants listed above.

8.2.2. Reduced Water Pollution and Ground Contamination

Water Quality

Historically, industrial effluent is managed by the source industry and disposed of in absorption pits and lagoons. The operation of these disposal sites has been causing serious environmental problems, in particular pollution of watercourses and sub-strata. Likewise, the current practice as regards domestic sewage (at least for those properties not currently connected to a central collection system) is to use septic tanks and absorption pits. In rural areas in particular, there is a high incidence of absorption pit and soakaway failure. This not only presents a health risk to the exposed population, but also results in the contamination of surface waters and ground water supplies. There are also concerns over the (nitrates) pollution of groundwater from agro-chemicals and the disposal of animal waste, in particular pig slurry.

The planned infrastructure investments to comply with the directives in the water quality sector of the *acquis* will reduce, if not eliminate, these adverse impacts. The primary benefit, of particular importance for Cyprus, is that this will protect already scarce sources of potable water. This is likely to result in financial benefits (cost savings) for those organisations that supply potable water and a welfare gain for end-users (by avoiding losses in consumer surplus through forced reductions in consumption or higher prices). Of course, minimising the contamination of watercourses and compliance with the Drinking Water Directive will also have health benefits. At the same time, reducing the adverse impacts identified above will serve to protect natural habitats (in particular wetlands and estuaries) which have a value to society.

The four wineries in Limassol currently discharge their effect directly into the sea, thereby adversely affecting the stretch of water between the harbours. Preventing these discharges will not only benefit marine life, but will also improve the aesthetics and odour of the harbour. Again, this will result in an increase in economic surplus.

In addition, compliance with the Bathing Water Directive will ensure that the Island's bathing waters are maintained at a high standard, with the obvious benefit to the tourist industry.

Waste Management

Compliance with the waste management directives of the *acquis* will have several benefits including some with direct and indirect economic spin-offs. Currently landfill represents the only disposal route for MSW. Existing landfill sites, however, are not sanitary i.e. they have no protective measures regarding leachate. In addition, the current collection and disposal system means that collection workers may be exposed to uncontained waste, which represents a health hazard. Implementation of a

national waste management strategy like those identified previously, will eliminate both these concerns. This will also serve to protect water courses (the benefits of which were outlined above) and reduce any possible adverse health effects in workers (again, the value of which was roughly outlined above). Benefits are also likely to accrue from reduced visual intrusion and odour in urban and tourist areas. There are also benefits associated with moving away from the current reliance on landfill as the sole disposal route, e.g. landfill consumes land and makes it inappropriate for certain types of development in the future.

Experience in the EU has shown that the establishment of a recycling sector, including the creation of collection, separation, and processing facilities, has some positive economic spin-offs in terms of employment creation and multiplier effects. Depending on market structure, the potential also exists for cost savings within domestic industries that can utilise recycled material processed domestically, or recovered on site.

The current uncontrolled disposal of hazardous waste also constitutes a threat to the environment and human health; at present some hazardous wastes are mixed with the MSW. The construction of the hazardous waste treatment plant and establishment of a management plan should eliminate these adverse effects with benefits similar to those outlined above.

Compliance with the Waste Oil Directive, not only protects the environment and conserves a non-renewable resource, but also provides the opportunity for financial gains for those that recycle the oil and those that consume it (assuming the price differential between used and virgin is in their favour).

8.2.3. Capacity Provision

Compliance with the water quality and waste management sectors of the environmental *acquis* may have indirect benefits for the tourist industry by enabling the growth of tourism at a faster rate than would be possible otherwise. The future tourist capacity of Cyprus is limited, to some extent, by the current sanitation infrastructure. While plans exist for the provision of central sewerage collection systems and treatment plants and the infrastructure to implement a MSW management strategy, the cost of these investments is prohibitive. As a result, the capital investment programme may not take place fast enough to have the required sanitation and waste disposal infrastructure in place to meet the forecast growth in tourist arrivals. However accession to the EU, and compliance with the acquis will require the capital investment programme to be implemented must faster than it otherwise would. In these terms, a potential real benefit of compliance is the difference between the economic surplus generated by the time path of tourist arrivals with and without the Republic of Cyprus's accession to the EU (see Figure 8.1). In the same way, compliance will also ensure the protection of drinking water supplies for the growing numbers of tourists.

Of course, improvement in the overall quality of the environment may attract tourists itself, and certainly would not deter them from visiting Cyprus.

Figure 8.1 Time Path of Tourist Arrivals With and Without Cyprus's Compliance to the *Acquis*