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National Evaluation Report for Cyprus

Main Report

Directorate General Regional Policy

A report submitted by



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EXECUTIVE SUMMARY

See separate document.

1 OVERVIEW AND HORIZONTAL ISSUES

1.1 Country overview

Cyprus is a Mediterranean island situated in the Middle East. There are 780,133 (July 2005 est.) people living in Cyprus and the population growth is 0.54% (2005 est.). 77% are Greek Cypriots, 18% Turkish Cypriots and 5% others. (CIA Factbook).

The climate in Cyprus is Mediterranean, semi-arid with hot, dry summers and mild winters except in the mountains where it is cool and snow is frequent. There is almost no rainfall between May and September. The total land area comprises 9,250 sq km. However, due to the unsolved conflict with the Turkish occupied north, 3,355 sq km of the island are not yet within the EU. Nevertheless, the EU recognises only one state and the whole island acceded to the EU and thus every Cypriot with a Cyprus passport has the status of a European citizen. However, the Acquis Communautaire does not apply to the northern part of Cyprus until the conflict is solved. The water area of Cyprus comprises 10 sq km and the coastline is 648 km long. The landscape consists of a plain in the centre and is mountainous in the North and South, the area is partly covered with forests; in 2001 7.79% of the area was arable land and 4.44% were covered by permanent crops. (CIA Factbook).

Measure	2004	Trend 1995/2004	Trend 2003/2004
<i>GDP per capita</i> ^{*1}	\$20,300 (est.) 16,536.7€		
<i>GDP in PPP</i> *	\$15.71 bn (est.) 12,79 bn €		
<i>GDP at current market prices</i>	7,292.1 mn Cyp**, 12.72225€		
<i>GDP growth rate</i>	3.2%*; 3.8%** at constant prices		
<i>Population</i> **	749,200	656,300	730,400
<i>In urban areas</i> **	520,000 (69.4%)	446,900 (68.1%)	505,900 (69.3%)
<i>In rural areas</i> **	229,200	209,400	224,500
<i>Number of households</i> **	247,700	202,400	238,800
<i>Unemployment rate</i>	3.2%* ² ,		

¹ Note: In this report currencies are given in the original where these concern reports, etc, that have been produced at given times in order that currency fluctuations are not opaque in any conversion to Euros.

² Percent of the labour force that is without jobs

	5.2%*** (2004), 3.5%** ³ (2003)		
<i>Foreign Direct Investment</i>	\$1.22 billion (2004), 0.99bn€, 9% of GDP in 2003****		

* Data taken from CIA Factbook

** Republic of Cyprus - CyStat

*** European Union - EuroStat

**** Norwegian UN Association General et al.

Economy

The economy of the Greek part of Cyprus is highly developed. Tourism and financial services are the most important branches of the service sector. They provide 76% of the GDP (agriculture 4.1%; industry 19.9%). The main industries are food and beverage processing, light chemical industry (pharmaceutical), metal products, cement and gypsum production, ship repair and refurbishment, textiles, wood, paper, stone, and clay products. The main exports are agricultural products, pharmaceuticals, cement, clothing and cigarettes. The Turkish Cypriot economy is less developed and very much dependent on Turkey for its international isolation (only recognised by Turkey). Almost half of the work force is in agriculture and the government service. (CIA Factbook)

Although the agricultural sector contributes only a small amount to the GDP, this sector is still very important for the Cypriot economy. The number of people employed in the agricultural sector has declined continuously since Cyprus' independence from the UK in 1974. In 2004 only 7% were employed in this sector, whereas in 1994 around 16% worked in the agricultural sector. The main crops are citrus fruits, olives, grapes, potatoes, melons, wheat and barley. The production is however vulnerable due to climate, especially droughts. (Republic of Cyprus – MANRE 2004). After 10 years of drought with a negative effect on agriculture, from 2001-03 precipitation was high. (CIA Factbook)

Fisheries, being a relatively new sector is now a major production area. In 2004 the production from fisheries and aquaculture was 5053 tonnes (1553 tonnes from fisheries). Inshore fisheries were 639 tonnes. (Republic of Cyprus – MANRE 2004).

³ Registered unemployed

Administration and Politics

Cyprus is divided into 6 administrative districts: Famagusta, Kyrenia, Larnaca, Limassol, Nicosia and Paphos. The Turkish Cypriot area's administrative divisions include Kyrenia, all but a small part of Famagusta, and small parts of Nicosia and Larnaca. The Turkish Cypriot parts are not eligible for EU structural and regional funds. (CIA Factbook)

The political system is unicameral (house of representatives - Vouli Antiprosopon) and the head of the state is also the head of the Government, currently being Tassis Papadopoulos. The seat of the vice president and 24 seats in the parliament are currently vacant as they are being reserved for Turkish Cypriots. (CIA Factbook)

State of the environment

The major environmental problems in Cyprus are droughts, forest fires, water shortage and pollution, waste, coastal degradation and loss of biodiversity. The small size of the island, the dry climate and intense pressures from tourism, etc, result in problems highly specific to the country (though shared with some other Mediterranean areas such as Malta).

However, in recent years the state of the environment has improved due to new legislation in the Greek part. The Turkish part shows more environmental problems than the Greek part, although some pressures (eg tourism) are less. (Republic of Cyprus – MANRE 2004/ CIA Factbook)

Being an island Cyprus is also exposed to sea level rise from climate change and together with other small island states (AOSIS), Cyprus was very active promoting international climate policy and the ratification of the Kyoto Protocol.

State of the environment infrastructure

Compared to many new Member States Cyprus has some good environmental infrastructure. However, there is a significant gap in the infrastructure needs for waste disposal and some waste water treatment and collection. Water provision can be problematic in some areas, although significant investment has been made. Considerable investment has been made in the management of natural hazards. However, further development of renewable energy is desirable.

1.2 Status of implementing the EU environmental Acquis

The World Bank supported Cyprus in adopting EU environmental standards field by preparing an Environmental Review and Action Plan in 1993. The EU also financed studies and projects aiming at harmonisation. (Republic of Cyprus – MANRE 2004). The Environmental chapter was opened in December 1999 and closed in December 2002.. The administrative capacities were adjusted and staff was recruited and trained.

The transposition of horizontal legislation was complete and in line with the *acquis* at the time of accession. In the field of water most laws were in line with the *acquis*. Legislation

regarding waste management were mostly in line with the acquis. The transposition of the air quality acquis was in line with the acquis. In the field of industrial pollution and risk management the legislation in place were in line with the acquis. There were some problems with large combustion plants and national emission ceilings. The nature protection policy of Cyprus complies with international and European standards. (European Commission 2003)

For the treatment of urban waste water a transition period until 31 December 2012 and for recovery targets of the packaging waste directive a transitional period until 31 December 2005 were agreed. There were some problems with the sulphur content of liquid fuels and a transition period for air pollution from large combustion plants was accepted until 1 May 2005. (European Commission 2004a; European Commission 2003). Thus the only transition period still currently in place concerns the urban waste water treatment Directive.

1.3 Environmental Policies, Strategies and Planning

The Ministry of Agriculture, Natural Resources and Environment (MANRE) is the responsible ministry for agriculture, fisheries, water management, veterinary services, forestry, meteorology, geology and environmental protection. The Environmental Services is responsible for the transposition and implementation of European Environmental legislation.

Cypriot environmental policy has been mainly driven by its international obligations and the need to harmonise their policy with the EU acquis communautaire, together with national priorities over issues such as security of water supply.

Cyprus signed and ratified among others international agreements such as the Cartagena Protocol (Biosafety, No.7(III)/2003), the Montreal Protocol (Ozone layer, No. 9(III)/2001) and the Kyoto Protocol (Climate Change).

Due to the harmonisation with the acquis communautaire, Cyprus environmental policy has been revised completely and more than three hundred Directives and Regulations and a number of action plans of the Environmental Chapter were transposed. The Environment Service managed to comply with most of the European acquis for the environment (Republic of Cyprus – MANRE b).

In line with the harmonisation to European Environmental Policy, Cyprus adopted many new legislations and legal acts. The Framework Law on the Environment and the Protection of Nature covers the environmental principles and all relevant fields. (MEDiterranean ACTION)

Horizontal

As horizontal legislations, the law for the assessment of the environmental impacts (No.57 (I)/2001) was implemented in 2001 and the Aarhus Convention was signed and ratified. (Republic of Cyprus – MANRE b)

Industry

In the field of industrial pollution, the Integrated Pollution Prevention and Control directive was implemented by a law regarding the regulation of waste (No.56(I)/2003), which also cover air and water pollution control issues, aspects of noise, energy, soil rehabilitation, accident prevention, and best available techniques are also covered.

The implementation of EMAS was financed by the EU “Life” Programme. (Republic of Cyprus – MANRE b)

Nature conservation

The law on the protection and management of nature and wildlife (No.153(I)/2003) protects certain species of fauna and flora, includes management plans, the assessment of environmental impacts from projects and programmes in areas of special interest and the control of the release into the environment of alien species. Cyprus also prepared a Natura 2000 list and completed the national ecological database of Cyprus, "BIOCYPRUS" that are in line with the Natura 2000 criteria. (Republic of Cyprus – MANRE b)

Waste

The law on the Management of Solid and Hazardous Waste (No.215 (I)/2002) was adopted in December 2002 and followed by special regulations. It covers prevention and reduction of waste generation and includes the requirement for authorisation for the management of waste.

Cyprus also prepared a strategy for the management of waste, including an integrated and rational approach, which is adapted to the needs and particularities of Cyprus.

Regarding used oils and PCBs/PCTs a Law on the Control of Pollution of Waters and Soil (No.106(I)/2002) that regulates their disposal and two regulations on the management of used oils (Order 637/2002) and the regulations on PCBs and PCTs (Order 636/2002) were approved. The system for the collection, storage, transport and treatment of waste includes the "polluter pays" and "the producer responsibility" principles and the producer/importer is responsible management and handling of used oils. Additionally two regulations (Regulation of Good Agricultural Practices (Act 407/2002) and Regulation on the use of sludge in agriculture (Act 517/2002)) cover sewage treatment plants. The law on the Control of Pollution of Waters and Spoils covers also animal waste.

The law on the Control of Pollution of Waters and Soil covers the disposal of hazardous waste from industrial units and the law on the Solid and Hazardous Waste regulates their overall management.

The issue of batteries and accumulators is covered by the regulation on batteries and accumulators (Order 82/2003).

The Packaging and packaging waste directive is transposed by the law (No.32 (I)/2002), which aims at preventing and reducing the impacts of packaging and packaging waste and sets re-use, recover and recycling targets. (Republic of Cyprus – MANRE b)

Water

Regarding the protection of the surface and ground waters and the soil from human and industrial activities, the law on the Control of Pollution of Waters was adopted (No.13 (I)/2004).

Waste water treatment and the disposal of industrial waste into the sea are also covered by the laws on the Control of Pollution of Waters and on Sewage Systems. This law aims also at preventing the pollution of groundwater by agricultural substances such as fertilisers or animal waste. Additionally a Code of Good Agricultural Practices was approved that promotes a more environmentally friendly farming and includes training measures for farmers on this as well.

The drinking water directive and the bathing water were transposed and are in line with the Acquis. (Republic of Cyprus – MANRE b)

Air

Cyprus has transposed EU legislation regarding the protection of air quality (framework Directive and daughter Directives). A “Life” Programme for the implementation of the noise directive was also approved by the EU and two legislations were adopted: Act on Noise from equipment for use outdoor (Act 535/2003), law on Noise from household appliances (No 192(I)/2002). (Republic of Cyprus – MANRE b)

1.4 Overview of national environmental expenditure

For overall public environmental expenditures no up-to-date data are available⁴.

Environmental Protection Expenditures in Industrial Enterprises in 2003 was estimated at £15.5 mn⁵ (around 0.23% of the GDP). In 2002 £19.4 mn or 0.31% of the GDP were invested in Environmental Protection and £10.9 mn or 0.18% in 2001.

The biggest part of expenditures, £14.2 mn (non-metallic minerals accounts for £3.7 mn, manufacturing of food and beverages for £3.2 mn and manufacturing of refined petroleum products for £2.9 mn) were made by the manufacturing industries, compared to £1.1 mn by the mining and quarrying industries, and £0.2 mn by electricity and water enterprises.

Most of the expenditures were spent on air emissions £6.4 mn, followed by £4.0 mn for the monitoring, treatment and disposal of waste. For the treatment of wastewater £3.7 mn were spent, the protection of soil and groundwater and the protection of natural resources

⁴ Note the recent report from Eurostat ‘Environmental Protection Expenditure in Europe by public sector and specialised producers 1995-2002 - Issue number 10/2005’ has data for most Member States, but all data tables are blank for Cyprus.

⁵ Note that £1 CY is worth €1.72

cost £1.3 mn and the abatement of noise and vibrations £0.1 mn. (Republic of Cyprus – Ministry of Finance, Statistical Service CYStat).

1.5 Insights on past programming/funding

Cyprus has received financial aid since 1978, especially for SME, Environment, Energy and Transport. During this time, € 210 Million were made available under the form of loans (152 M€), grants (51 M€), and risk capital (7 M€). Cyprus received financial assistance also from the LIFE Programme.

Under Financial Regulation 555/2000 the total amount allocated to Cyprus for the period 2000-2004 was €57 million. Projects financed under this supported harmonisation and included the following areas: Internal Market (Indirect Taxation and Customs, Free Movement of Goods), Justice and Home Affairs, Environment, Employment and Social Affairs. Also a number of projects were undertaken involving both the government and Northern Cyprus communities, such as the rehabilitation of parts of the walled city of divided Nicosia. Most of the projects were implemented under the Decentralised Implementation System. The following table shows the money spent in environment related issues.

Financing Memorandum - National Programme for Cyprus in environment related issues			
Project	Year	EU contribution in M€	Total budget in M€
Environment: Waste-water technical studies	2001	1.60	11.5
Environment: Fire prevention in Akamas	2001	0.50	11.5
Agriculture: Agri-environmental Rural Development	2002	0.400	11.5
Environment: Air Pollution Monitoring System of Cyprus	2003	1.00	11.8
Environment: Upgrading the Solid Waste Management System	2003	1.30	11.8

Source: DELCYP c. http://www.delcyp.cec.eu.int/en/eu_and_cyprus/caid_prog_1.htm

Transition Facility 2004 invested in environment related issues	
Project	EU contribution in €
Preparation of management plans for NATURA 2000 sites	900,000
Development of integrated Water Monitoring Programmes	736,000

Source: DELCYP c. http://www.delcyp.cec.eu.int/en/eu_and_cyprus/caid_prog_1.htm

The Rural Development Programme for the Republic of Cyprus 2004-2006 (agriculture) was financed with € 74.8 million from EU (European Agriculture Guarantee and Guidance Fund" (EAGGF) approved by STAR committee) and € 8 million national contribution (national public funding of € 69.08 million and by € 14.42 million additional State Aids). It is expected that the private sector will contribute another € 33.91 million. The emphasis is on the improvement of infrastructure and the competitiveness of the rural economy of the country, strengthening and diversification of rural areas and protection of the environment. (European Union 2004)

The European Investment Bank co-financed priority investment projects in the fields of transport and environment und small-scale projects in the fields of urban infrastructure and rural development with a sum of 80 Mio. EUR. (European Union 2005)

The EU decided to give financial assistance also to North Cyprus for economic development, to promote trade with the northern part and bring it closer to the Union. Pre-accession aid accounting €12Mio were agreed. (European Commission 2005)

Cyprus received financial assistance also from the MEDA programme. Among others Cyprus was part of SMAP 2000 - Mediterranean Urban Waste Management Programme, including the countries Egypt, Jordan and Spain. The projects total costs were 908.480€, the EC contribution 720.840€. The project Middle East Desalination Research Centre (MEDRC) is also a cooperation programme among regional countries and aims stimulation research in the field of desalination. (DEL CYP c)

There are currently several twinning projects running in Cyprus in fields including the Structural Funds, state aids, metrology, insurance and asylum. Cyprus was also eligible for PHARE programme. (DEL CYP c)

Structural assistance (2004-2006, in millions of EUR, at current prices)									
Objective 1	Ob. 2	Ob. 3	Interreg	Urban	Equal	Leader+	Fisheries	Cohesion fund	Total**
0	28.02*	21.95	4.30	0	1.81	0	?	53.94	113.44

* Of a total cost of 58.69 million.

** Including the "Fisheries" programme. Distribution of expenditures by sector: agriculture, rural development and fisheries (67.5%); urban revitalisation (30%); other (2.5%).

Source: European Commission a: *Structural Funds Programmes in Cyprus. Factsheet* (europa.eu.int/comm/regional_policy/atlas/cyprus/factsheets/pdf/fact_cy_en.pdf)

The impacts of EU funding on the Cypriot economy have been examined in some detail by Blake et al (2003) and are worth considering in detail here. The authors used Computable General Equilibrium (CGE) models of the economy to quantify and compare the impact of EU accession in relation to tourism, including the specific impact of EU funding. Given the importance of this sector to the economy, this represents an important area for analysis.

Firstly, the authors stress that the EU regional funding received is small compared to the temporary budgetary compensation, which was €112.3 million in 2006. Of course, such compensation is not targeted at any particular activity, but its overall economic consequences need to be recognised. The authors also note that EU funding is a significant source of welfare gain in Cyprus, although it does represent less than half of the total welfare gain identified. They also argue that there are improvements in productivity in sectors such as electricity, water and transport.

The limited financial assistance in environmental areas has, however, been important and this is seen, for example, in the development of waste water treatment systems and support for waste management. This has been important seed money for these areas.

Structural Fund documents

The existing documents relating to the Structural Funds cover the period 2004-2006. Separate documents exist for Objective 2 and Objective 3 funds (Cyprus not being eligible for Objective 1).

The Single Programming Document for Objective 2 does provide a detailed analysis of the issues and funding priorities for these funds. Detailed information is provided for the economy, demography, infrastructure, environment, etc, for each Objective 2 area, with separate analyses for rural and urban areas.

The rural areas covered under Objective 2 are the Western Rural Area and the Eastern Rural Area. Together they constitute 89.8% of the government controlled area. This is, in effect, the whole non-urbanised area.

The discussion of the environmental situation in the rural areas (section 1.3.8 of the document) is poor. It provides an adequate summary of the importance of biodiversity in rural areas. However, the only mention of waste water or solid waste issues is a statement that there is ‘inadequate disposal of liquid and solid waste’. There is no analysis of the nature of the problem.

The Objective 2 urban area includes a large part of Nicosia Municipality and the whole of Ayios Dometios Municipality. Thus, together, with the rural areas the total population within Objective 2 areas is 212,327 (31% of the total Cyprus population). The Single Programming Document (section 1.4.8) barely comments on important environmental infrastructure stating that the ‘area is served by a sewage system while collection of solid waste is at a satisfactory level’. This provides no information on the adequacy of the waste water collection. As will be seen in later chapters of this report, it is not the collection of waste that is the problem, but how it is disposed. Disposal/treatment is not mentioned in this part of the Single Programming Document.

The document continues by undertaking a SWOT analysis for the different areas. For the areas, environment is identified as a ‘risk’. It states:

‘While there are no documented existing threats from any human activities currently (at least in rural areas), any intensive form of economic development could potentially

threaten the valuable and fragile environment. Therefore any programme should be carefully planned to take this variable into account, especially since environmental riches consist one of the most important developmental advantages of the area’.

While it is important to stress the fragility of the environment and that development should take it into account, it is odd to suggest that no data exist on threats from human activities in rural areas. Threats, as will be seen, arise from a range of activities causing impacts ranging from water pollution from agriculture to forest fires.

As a result the priority areas identified in the Single Programming Document do not focus on environmental improvements (where these are listed, this largely relates to physical improvements to housing, etc, and not to investments in environmental services).

The Single Programming Document for Objective 3 description indicates that the focus is on the promotion of employment and the ‘upgrading’ of human capital.

Overall, therefore, the Single Programming Documents provide little concrete analysis of environmental problems to be addressed in Cyprus. There is, therefore, clearly a need for a more detailed analysis in future planning documents. How far environmental priorities compared to other development issues should be address is, however, outside the scope of this work.

The 2003 Cohesion Fund strategic framework document provides further information on the environment. This document justifies possible funding largely in relation to acquis implementation (noting that this is pre-accession) and prioritises:

- Water supply
- Management of urban, industrial and hazardous waste
- Collection, treatment and disposal of sewage

The document, however, briefly discusses water supply, which demonstrates that it is not a drinking water problem. The primary areas of concern are water treatment and municipal and hazardous waste management. The current status and problems in each are described and the importance of these sectors both in terms of acquis compliance and overall environmental and social benefits is stressed and prioritised.

1.6 Public Private Partnerships (PPP)

While there has been quite some discussion about the importance of PPP in Cyprus, there has been little actual development in this area. In 2005, the first PPP deal was signed by the government, involving a 25-year concession to finance and develop two airports, at Larnaca and Paphos. The winning consortium was Hermes Airports, which is owned by a group of Cypriot and international companies, including Bouygues Batiment International, EGIC Projects, YVR Airport Services, Aer Rianta International, Cyprus Trading Corporation and Aeroport de Nice Côte D’Azur. The project will cost about €550m, and the consortium has been working on putting

together a long-term debt package, led by ING, Royal Bank of Scotland, Société Générale and WestLB⁶.

The use of the approach for environmental infrastructure is not yet evident. In most cases such investments are public (central, local government, water boards, etc), with some private investment on energy issues. There is clearly the scope for more PPP in Cyprus than is currently the case. However, it will be seen in the following sections that with significant investment in some areas, the scope for further investment using PPP is limited. It is unclear if the approach is practicable in the development of waste management facilities (given the role of local government). However, there certainly should be further scope in energy infrastructure, including renewable sources.

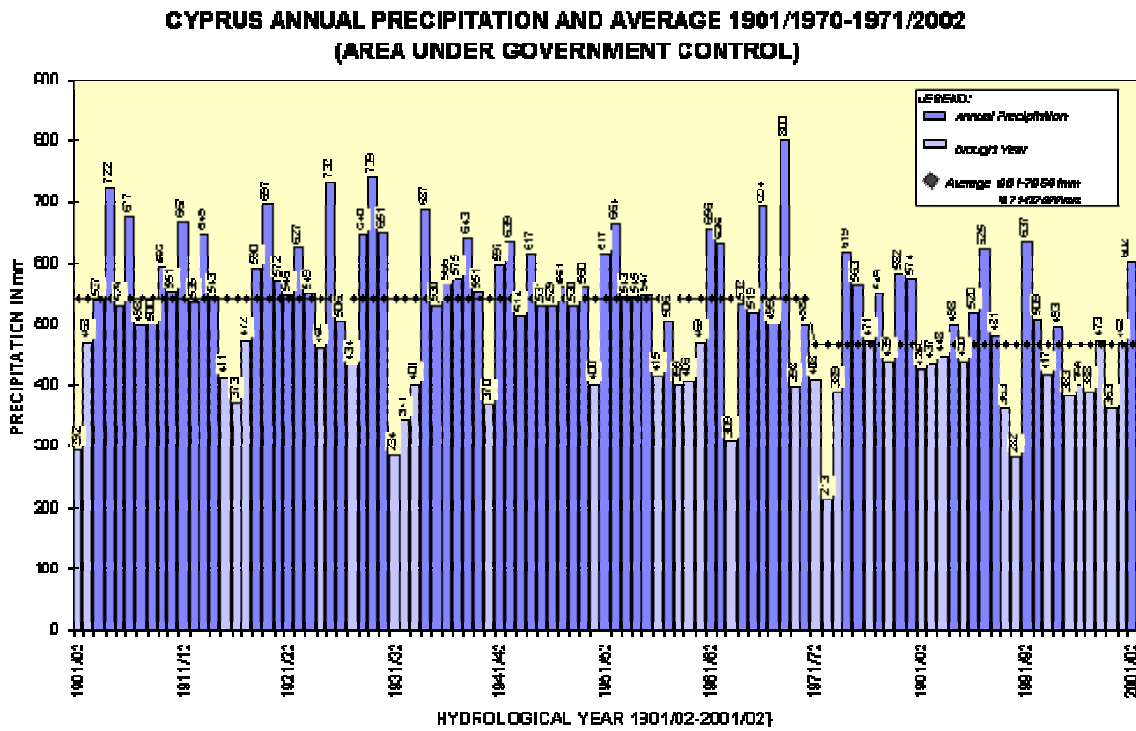
⁶ http://www.fdimagazine.com/news/fullstory.php/aid/1662/The_power_of_attraction_.html

2 WATER SUPPLY

2.1 Current situation

Cyprus suffers from severe water stress. The water scarcity in North Cyprus is even more severe. There, plans exist to ship water via tanks or build a pipeline from Turkey to the Turkish occupied area.

The problem with water shortage is due to low precipitation and few surface- and groundwater storage. Mean annual precipitation is 460ppm (1970-2000). In the 1990s Cyprus suffered from extreme droughts, however, in the early part of this decade rainfall was higher. In order to face this problem, studies regarding desalination plants, dams, canals, pumping stations, reservoirs, irrigation networks and borehole schemes were made and projects undertaken. (Nicolaou et al. 2003)



Source: www.emwis-cy.org/Data_Management/Major_Dams_Storage/Cyprus_Annual_Precipitation_and_Average.htm

Drought remains a problem. Thus 2006 has proved to be the second driest year in 19 years. The worst was in 1991. However, dam capacity has since increased so that in May 2006 there was 129.7 million m³, representing 47.4 per cent capacity. However, even with this extra capacity, farmers have been warned that they will receive only 20 per cent of their irrigation allocation this year for seasonal crops, but there is expected to be no problem for public water supply. This is due to 26 million m³ being available from desalination plants. Thus even in a drought year drinking water supplies are safe. It is important to stress this

point as it is the result of a systematic programme of infrastructure investment. However, continuing drought could affect such supply if problems persist for a much longer period.

On the basis of conclusions reached within the context of a recent study carried out by the Water Development Department in cooperation with the Food and Agriculture Organisation of the United Nations, the mean precipitation of the period after 1970 (1971 – 2000), is lower than the mean precipitation of the older period (1917-1970). This reduction ranges, in various regions of Cyprus, from 10% to 25%, with an average of around 20%. The bigger reduction has been observed in the Troodos Mountains. This reduction resulted in a significant reduction of available water resources on the island. The decrease in the mean annual inflow to the dams varies between 24% and 58%, with an average of around 40%. That is to say Cyprus has now roughly 40% less water than had been assumed based on pre-1970 records.

In April 2006 the Government announced additional subsidies for extraction:

- Subsidies to drill a borehole for watering gardens increased from CY£200 to CY£300.
- To connect a borehole to toilets funding increased from CY£200 to CY£300.
- To install a system for recycling semi-clean water, funding increased from CY£400 to CY£600.

This is done to encourage consumers to use non-potable waters for non-potable uses. (source Water Development Department 10 May 2006).

Already before joining the EU, Cyprus managed water demand with measures such as improved irrigation systems, water metering, rising block tariffs, water saving campaigns, subsidies, programmes to reduce distribution losses, education and many more. (EMWIS 2005)

Water resources and infrastructure

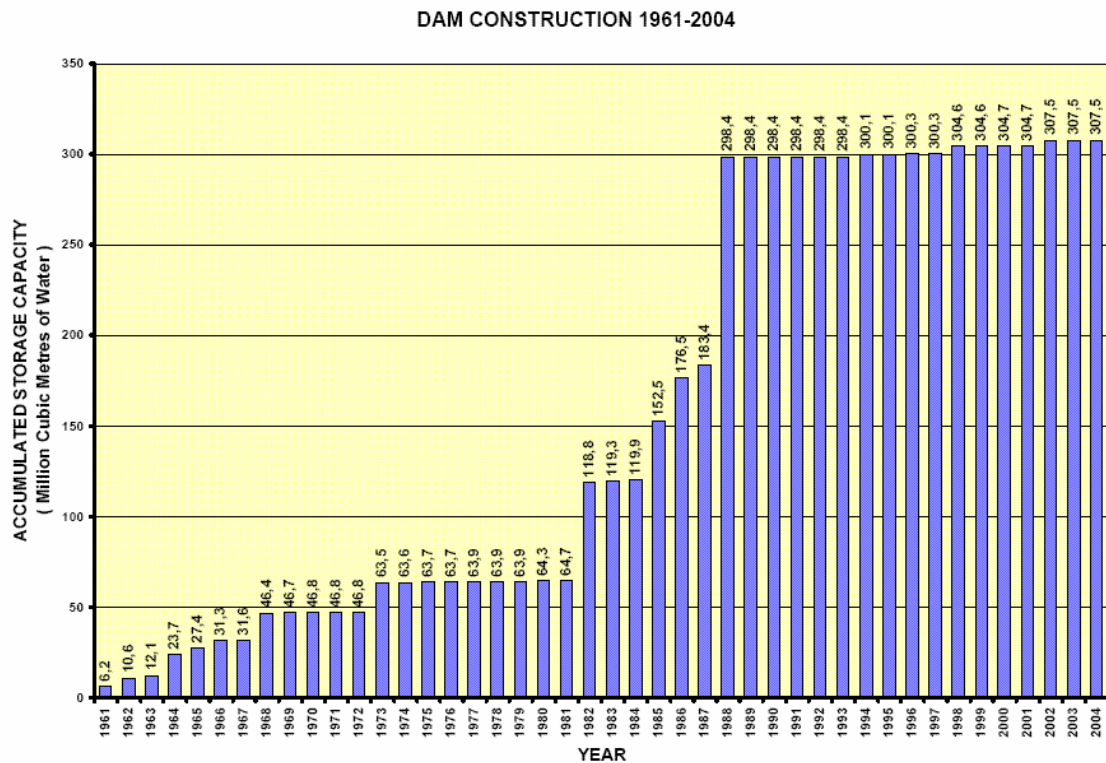
Cyprus' water resources are divided into surface resources, groundwater resources, wastewater treatment plants and desalination plants. The amount of water in the Government controlled area totals 2.670 MCM, but only 370 MCM are available, the rest (86%) evaporates. The ratio of surface to ground water is 1.75:1. (WDD website) Surface and groundwater resources are threatened by seawater intrusion and have declined due to overuse. For a long time groundwater was the main source for drinking water and irrigation purposes. Nevertheless, this issue is being addressed with the help of international organisations and Cyprus has expanded desalination plants and wastewater treatment plants. (Republic of Cyprus – MoI, Press and Information Office). However, rational water management is still necessary. For example, much water gets lost during transportation, which still needs improvement.

The following table outlines the key statistics relating to water supply and demand.

Type of investment	Physical Indicators
--------------------	---------------------

Water supply (general issues)	Connection rate to drinking water supply (%)	100%
	Unit water supply (lts /inh/day)	390 M ³ /year1998/inh (withdrawal) 979 M ³ /year2002/inh (natural renewable water resources) (WRI 2003)
	Total drinking water demand households (million m ³)/year	For 2001 Household (inc. tourists) 58.0 MCM/yr
	Total drinking water demand industry (million m ³)/year	Agricultural use 156.4 MCM/yr Industrial use 0.8 MCM/yr Animal Husbandry 0.8 MCM/yr Total 216.0 MCM/yr <i>See table below</i>
	Water price (EURO/ltr) cents/c.m.	33c/m ³ for households, 20 c/m ³ for industry, 13 c/m ³ animal husbandry, 7 c/m ³ for agriculture (Getimis/Markantonis 2003). Prices below cost recovery levels.
Reservoirs (eg to store surface waters and/or groundwater)	Volume in reservoirs (million m ³)	327.5m m ³ (2004) in dams, 370MCM all
	Associated period of water reserve (days)	With 327.5 Mm ³ and annual use of around 216 Mm ³ , this gives around 17 month reserves
Drinking water 'production' plant - ground/surface (quality)	Drinking water production capacity - by source (million m ³ /year) (groundwater, surface water, other)	<i>See tables further below.</i>
	Connection rate to drinking water supply (% population or households connected to systems)	100%
	Geographical variation (min % - max %)	0
	Continuity of supply (hours/day)	24h/day
Water loss minimisation	Water losses (% of volume and million m ³)	~20%, 10 million m ³ in transportation, 86%, 2.300 MCM overall due to evaporation
Monitoring	Drinking water sampling points – meeting drinking water quality standards (%)	Generally compliant
Metering (eg households)	Households with metering public water supply (%)	Universal, all houses are connected to water pipes (100%)

Cyprus has around 108⁷ earth fill or rock fill and gravity dams, for its less than 10,000 sq km one of the highest densities in Europe. The water storage capacity of the dams is 327.5 M m³ in 2004 (only 6 MCM in 1960) (Nicolaou et al. 2003). Since 1988 the storage capacity of dams has been rather stable, the differing values of available water can be explained by the varying precipitation in the last years (EMWIS). After several dry years (below 500ppm), 2001/2002 rainfall exceeded 600ppm again. This rapid rise in dam construction and capacity is described in the following figure.



Source: www.emwis-cy.org/Data_Management/Major_Dams_Storage/Dam_Construction_EN.pdf

Apart from the construction of dams, the other major new initiative in Cyprus has been to supply drinking water through the use of desalination of sea water. The first desalination (Dhekalia) plant started to operate in April 1997 and has a nominal capacity of 40,000m³ per day, the second (Larnaca) has been operating since April 2001 and has a nominal capacity of 52,000m³ per day. The two units produce 30-33 MCM of water every year. The two desalination plants secure the water in the areas Nicosia, Larnaca and the free area of Farmagusta, where need is 35-40 MCM per year. (EMWIS, WDD). The total estimated annual cost of the full desalination programme was originally Eur 35.6 million, with the estimated capital costs of Eur 357.73 million (DG Env 1999). The two desalination plants were constructed by self-finance method (by private companies). The Government will buy a minimum quantity of desalinated water over the first ten years. After this time it belongs to the Government. The Government can also buy the plant before that date. The selling price for the first plant is 54 Cy cents/m³ and the second 39.9 Cy cent/m³. The price difference is explained by the newer technology.

⁷ Whole Island

In 2002 about 3M m³ of treated sewage effluent was used for agriculture and landscape irrigation. It is estimated that by the year 2012 approximately 30M m³ of treated wastewater will be available for irrigation. (Klohn 2002)

These two major developments (dams and desalinisation) have radically changed the available water supply as indicated in the following table.

Available Water Potential/ Type of Water Resource (quantity in Mio Cubic Meters MCM)

Year/ Water Resource	1997	1998	1999	2000	2001	2002
Dams	63.7	33.0	67.4	52.7	62.4	151.0
Deposits	2.0	2.0	2.0	2.0	2.0	2.0
Pumping	129.1	129.1	129.1	129.1	129.1	129.1
Desalination	6.4	11.0	13.1	13.1	24.9	30.0
Wastewater Treatment	0	2.0	3.0	3.0	1.7	4.0
Total	201.2	177.1	214.6	199.9	220.1	316.1

Source: Republic of Cyprus. Water Development Department (Getimis/Markantonis 2003)

The Major Water Development Works, such as the Southern Conveyor, Vasilikos-Pendaskinos, Pitsilia, Paphos and Khrysokhou, as well as some other smaller works were constructed to improve water distribution, including agricultural development, the domestic water supply of towns and villages as well as the development of many other sectors of the economy depend.

In conclusion, the infrastructure is good and sufficient and the connectivity to good drinking water is 100%. There is not considered to be a problem with the distribution system. An overall picture of the current infrastructure is given the following figure.



Source: [www.emwis-cy.org/Documentation/Maps/Water/Major Water Works.htm](http://www.emwis-cy.org/Documentation/Maps/Water/Major_Water_Works.htm)

2.2 Drinking Water demand

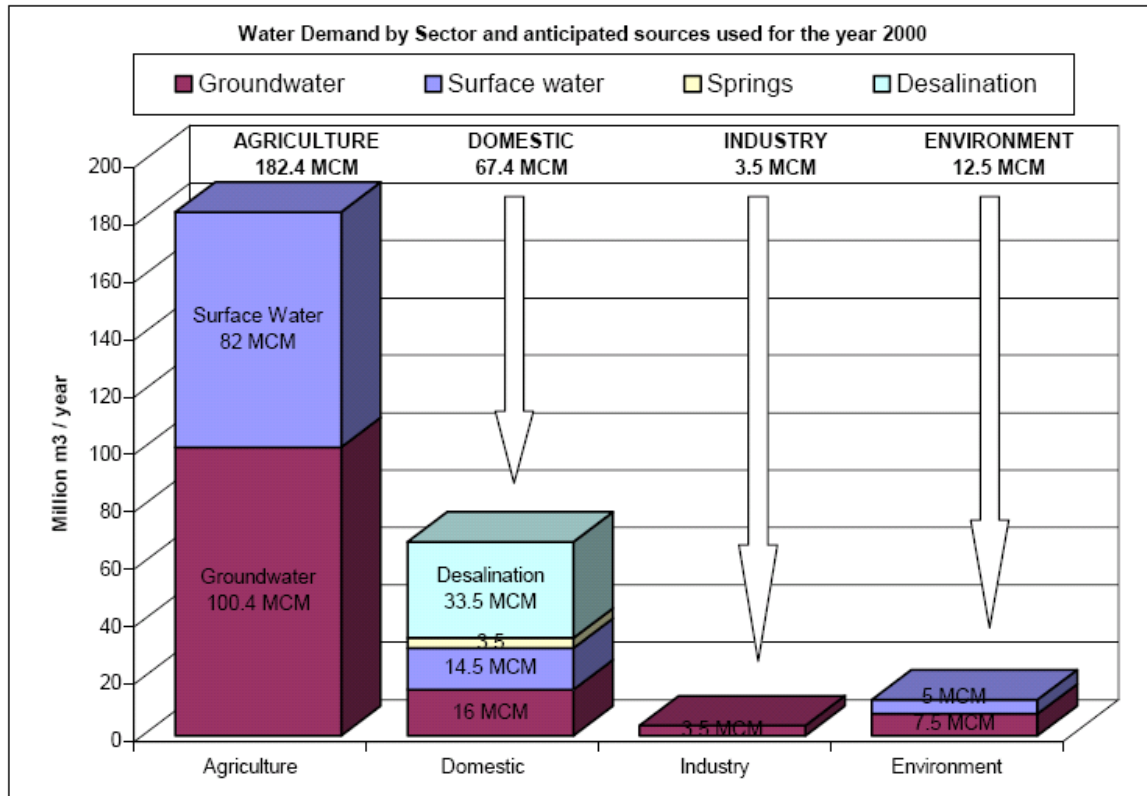
Today the total water demand in Cyprus amounts to 265.9 million cubic meters annually. It is estimated that by 2020, water demand for all purposes in Cyprus will increase to 313.7 cubic meters, mainly as a result of a rise in the use of domestic water and tourism development (Water Development Department and FAO, 2002).

The two main water-consuming sectors in Cyprus are irrigated agriculture and domestic use. Agriculture accounts for about 75% total water use, while the domestic sector accounts for almost 20% of water use (including tourism and environment/amenities with around 11%) and the industrial sector 6%. (Republic of Cyprus – MANRE a). Due to increasing tourism, the water demand of this sector is likely to increase. (Getimis/Markantonis 2003). Consumption of water in towns is provisionally estimated to have risen by 4.4% in 2003. (CYStats).

Table: Water Consumption/ sectoral use (quantity in Mio Cubic Meters MCM)

Years/ Sectoral Use	1995	1996	1997	1998	1999	2000	2001
Household use	45.7	48.9	44.8	42.7	48.2	47.9	58.0
Agricultural use	170.9	160.4	136.8	138.9	148.4	142.4	156.4
Industrial use	1.2	1.0	0.6	0.5	0.7	0.6	0.8
Animal Husbandry	1.2	1.0	0.6	0.5	0.7	0.6	0.8
Total	219.0	211.3	182.8	182.8	198.0	191.5	216.0

Source: Republic of Cyprus. Water Development Department (Getimis/Markantonis 2003)



Source: FAO WDD demand and supply PDF (Savvides et al., 2001)

In order to combat the dependency on weather (rainfall), wastewater treatment plants and desalination plants were built. The former is being used for irrigation and latter especially to satisfy water demand in urban and tourist areas. Awareness campaigns for a reasonable use of water were financed by the government in order to make the people sensitive for the water shortage problem. These campaigns for were quite successful (Republic of Cyprus 2002).

Drinking water quality

The drinking water quality in Cyprus generally complies with the European quality standards and WHO guidelines. All sources of water supplied for domestic use are regularly monitored for the chemical and bacteriological characteristics of water. (Republic of Cyprus 2002)

The use of ground water has been abandoned for domestic supply not only for its growing scarcity but also because of quality problems due to intensive agriculture and excessive use of fertilizers that resulted in nitrate pollution of many aquifers or because of direct sewage disposal in adsorption pits. (Klohn 2002) Another problem is seawater intrusion.

An inventory stated that only 7 installations may contain dangerous substances and that only the “Polemihia” dam and the “Garillis” river may have a problem. Following the

requirements of the nitrates directive, the designation of nitrate vulnerable zones and the waters affected by nitrate pollution has been completed. A relevant Order and an action programme were signed by the Minister. An Order for the action programmes for the NVZ's has also been approved by the Minister. Regarding the urban wastewater, a transition period was agreed on until 31 December 2012, including intermediate targets. (DEL CYP a).

Drinking water quality is not, therefore, considered as a key problem. Though tap water quality is good, many Cypriots prefer to buy bottled water.

Water prices

The water prices have been stable since 1994 and thus do not reflect the real/full costs. Intentions to change the prices were not approved. In 2000 the WDD proposed a new water tariff of 51 cents/CM, which would reflect the overall costs (including environmental) and would mean neither gains nor losses for the supplier. The last increase was in 1994, thus the compounded equivalent annual increase is only 7.3 percent. Previous increases in prices were of the same order i.e., 5.6% and 5.5% in the years 1990 and 1994 respectively. The increase of prices would be high, but justified with the fact that a normal family pays three times as much for electricity per year and almost four times for telephone. (Socratous 2000). The liberalisation of different service sectors will change this situation and it is expected that the costs will increase.

Note that water prices vary from district to district or city to city. In Nicosia people pay much more for water than in other towns. Residents in Nicosia, for example, pay 30 cents per cubic metre for the first 20 consumed while those in the Famagusta area get the first 15 cubic metres free and those in Limassol pay just 6 cents a cubic metre for the first 40 used. Looking at households in Ayia Napa and Paralimni in the Famagusta district where water is the cheapest in Cyprus one can see that water pricing has indeed an influence on the consumption. Here the consumption has shot up the most since the end of water rationing in 2001.

There is resistance to increasing water prices from communities and it is expected that these will not rise in line with operating costs (unless a radical shift in opinion occurs). However, given that the water supply is publicly owned, the community will pay for the services in any case through taxation (though not according to use). The concern over charges suggests that, at least for some, they would act as a behavioural incentive for conservation. Politically the balance in funding arrangements could prove correct to combine environmental, economic and social considerations.

Water pricing examples:

District	Fixed standing charge	Cy£ Per cubic metre
Nicosia	Cy£2.40 for every two month	30 cents/m ³ for 1-20 m ³ , 45 c/m ³ for 21-40 m ³ , 70 c/m ³ for 41-50 m ³ , 90 c/m ³ for 51-60 m ³ and CY£1.10/ m ³ for >60 m ³
Larnaca	Cy£3.50 for every two months	15 cents/m ³ for 1-20 m ³ , 35 c/m ³ for 21-40 m ³ , 55 c/m ³ for 41-50 m ³ ,

		75 c/m ³ for 51-60 m ³ , and 90 c/m ³ for >60 m ³
Famagusta	Cy£5 for every three month	0 cents/m ³ for 1-15 m ³ , 45 c/m ³ for 16-30 m ³ , 55 c/m ³ for 31-45 m ³ , 60 c/m ³ for 46-60 m ³ , 75 c/m ³ for 61-75 m ³ , and 90 c/m ³ for >76 m ³
Paphos	Cy£5 for every three months	5 c/m ³ for 1-30 m ³ , 22 c/m ³ for 31-60 m ³ , 55 c/m ³ for 61-75 m ³ , 79 c/m ³ for 76-90 m ³ , and 94 c/m ³ for > 90 m ³
Limassol	Cy£6 for every four month	6 c/m ³ for 1-40 m ³ , 11 c/m ³ for 41-80 m ³ , 22 c/m ³ for 81-120m ³ , 40 c/m ³ for 121-160m ³ , and 56 c/m ³ for >161 m ³

Source: Data taken from Kyriakides 2001

Bulk Water Prices/ Sectoral Use (Cyprus Pounds/ cubic meter m³)

Sectoral uses	Prices in 2002 in Cy£
Agricultural (irrigation)	7 cents/m ³
Animal Husbandry	13 cents/m ³
Industry	20 cents/m ³
Households	33 cents/m ³ ⁸

Source: Republic of Cyprus. Water Development Department (Getimis/Markantonis 2003)

As the water bill is a minor budget for most Cypriots (60 CyP per year), an increase of prices would be socially feasible.

For only 50% of overall consumed water could be water of lower grade quality, the Department of Water Development is subsidising private boreholes (cost €1.500, Government gives €350 as a subsidy) or the recycling of “grey water” for watering the garden and/or for the operation of the WC’s (connection between borehole and WC costs a €550, of which €350 can be subsidy) in households. This measure saves 2.0 million cubic meters per year of drinking water. This measure saves between 30% and 65% drinking water conservation.

Another development in Cyprus is to separate lightly polluted or Grey Water from baths, showers, hand or wash-basins and washing machines from heavily polluted or Black Water from WC’s and kitchens. Thus, it can be treated accordingly. This development was tested between 1997 and 1998 after five years of research and is now subsidised by the Government (installation for a 1 cubic meter per day production costs €1.400; subsidy of €700 is given). This scheme conserves 30% to 45% of the per capita water consumption of drinking water. (Monacelli 2005)

⁸ Varying from district to district see table above

The EU Water Framework Directive calls for the irrigation water tariff to be increased from Cy£ 0.0631 per m³ to full cost recovery at about Cy£ 0.30 per m³. The critical point are social, environmental and economic effects of full cost recovery. As the FAO has stated: “Water policy for the agricultural segment may consider a number of incentives and disincentives to conciliate water availability with demand and to ensure that adequate food security and rural targets are achieved in exchange for the substantial subsidy the segment is receiving. The matter is complicated by the traditional two-tiered nature of water rights: users of government owned water systems pay the established tariff, while owners of “old” water rights and wells do not pay. Under such circumstances, an increase in water tariffs in the public systems is bound to encourage further overexploitation and mismanagement of groundwater.” (FAO WDD PFD)

Although the industry uses only a minor part of Cyprus water reserves, it could be encouraged as well to use low quality water or to invest in water saving measures.

Apart from awareness campaigns that have already been launched, financial incentives and disincentives respectively should be introduced to use low quality water for purposes where a high quality is not necessarily needed.

Institutional issues⁹

At the national level the Ministry of Agriculture, Natural Resources and Environment (MANRE) and within this the Water Development Department is responsible for water issues, such as water resources assessment and development, water resources management, implementation of water laws and water related environmental issues. The Ministry of the Interior (MoI) is responsible for borehole permits and water rights registrations. The MoI also provides the Director of the Urban Water Boards (UWB) that plays a role in national water management policy. (Getimis/Markantonis 2003)

The water boards are semi-governmental, they are responsible for the water supply in towns. There are also private firms carrying out the water supply in towns. For the water supply in villages and rural areas, the municipalities and community boards are responsible. There are a number of water purification plant (Choirokoitia, Tersefanou, Kornos, Limassol, and Asprokremmos) and desalination plant at Dhekelia and Larnaka. (CYStats)

The water sector is still in state hands. The liberalisation and privatisation process in Cyprus is ongoing. For the first period only 35% will be privatised. (Getimis/Markantonis 2003). According to the liberalisation perspective of Cyprus, Public Private Partnerships (PPP) are promoted but not yet applied. This is part of the design-build-operate-finance (DBOF) strategy led by the Ministry of Finance and the Central Service Committee under the chairmanship of the Permanent Secretary of the Planning Bureau. (Neocleous 2002, quoted from Getimis/Markantonis 2003).

There are plans to put all water issues under the National Water Entity. The National Water Entity would be responsible for the whole water cycle whose functions will include

⁹ for more detailed information please look here www.emwis-cy.org/Institutions.htm

abstraction licensing, levying of fees and production, treatment and delivery of bulk water. The law for the reorganisation of institutions still needs to be approved by the House of Representatives. (EMWIS). The idea of merging the Water Boards and the Water Development Department to form a single body has been around for decades but never being approved before. (Kyriakides 2001) In 2005 a law to reorganise the water system has been drafted (s. further down chapter about institutional issues).

The institutions (MANRE and local Boards) have proved efficient at delivering investment programmes for water supply, with a clear identification of need and implementation of projects. Funding has been secured and objectives delivered and the planning has been effective with sufficient personnel, etc.

2.3 Experience of previous investment programmes

Funding for water supply projects has largely been driven from within Cyprus.

The project “Development of an Integrated Monitoring and Early Warning System to sustain the Quality and Multifunctionality of Surface Water” focused on the water supply problem of Cyprus. The total budget was 1,201,388.38 € and the Life contributed 556,502.58 € in 1995. (European Commission b)

The completion of significant projects over a number of years to the point where there is security of supply at adequate quality has resulted from close co-operation between national and local government. It has required a long-term strategic view and success in this area bodes well for success in other areas.

2.4 Needs for the future

Water scarcity and droughts were, and still are, a serious problem for Cyprus. The objective of the Water Development Department is to guarantee continuous water supply and a high drinking water quality that complies with EU standards. The main legislations enacted are the water and soil pollution control law of 2002 and the water protection and management law of 2004.

Drinking water supply is stable throughout the year now (24h/day without restrictions) and also provides enough water in high seasons when pressure on water is higher due to tourism. Nevertheless, Cyprus could be affected in case of serious droughts for most water supply is provided by surface and groundwater. In the last years and decades more dams were built and their storage capacity increased. The two desalination plants already built through public funds secure the water supply of the two regions Lefcosia and Larnaca.

The EU-Drinking water directive was implemented successfully; drinking water generally complies with European standards. The environmental quality was improved in so far that the groundwater aquifers are prevented from saltwater intrusion due to other sources for water supply. This appears to be sustainable for the future. The environmental impact of dams should be explored and maybe their effect on biodiversity.

Future demand

The population will increase in coming years to 810,000 in 2010 and 850,000 in 2020. The number of households is likely to increase as well, on the one hand because of the increasing population on the other hand because households will be smaller in future and more single households could be possible as well like it is also in other European countries. The trend is that population and households grow more in urban areas than in rural areas. This will be enhanced by an increase in tourism in coastal areas. However, agricultural demand is not expected to increase significantly (and will be supported by re-use of treated waste water (see next section)).

The total water demand is likely to increase in Cyprus. Especially in the tourism sector, which already consumes 5% of water, an increase is expected due to a growing number of tourists. In 2000 each tourist spent 465l per capita per day. Compared to this, Cypriots spent only 215l in towns and 180l in villages per capita per day. The average water demand per capita per day in Cyprus is thus above the average use of water per capita per day in the EU (150l). This could partly be because water loss is added to the per capita consumption. The water consumption in the tourism sector is expected to be 8% of the total consumption in 2010 and around 10% in 2020. The absolute amount of water needed for tourism is expected to double from 14.1 M m³ to 30.8 M m³.

The water demand for households will only slightly increase from 53.4 Mm³ in 2000 (20% of the total water demand) to 63.2 in 2010 (21.7%) to 73.5 Mm³ in 2020 (23.4%). As the population is increasing less than the water demand, the per capita use will increase slightly according to the prediction. The per capita water demand (including water loss) varies from region to region. In Nicosia the daily water use per capita is 150l, in Larnaka 162l, in Limassol 215l and in Paphos 222l. In villages the water demand is less than in cities and only 144l. Note that in Paphos the water loss is 30%. (Savvides et al 2001)

Also in the industrial sector an increase is expected from 2% of the total water demand in 2010 and 2.2% in 2020 from today 1.8%.

The water demand for agricultural use will remain stable for no growth in this sector is expected.

Results from the LSE study provide further information on the future development of the agriculture sector (see table below). Recent behaviour in the sector has been variable (significant increases and decreases from year to year). However, there are future predictions of steady growth. Interestingly, if the estimates of CYStat are correct, such development will occur without an increase in water demand. However, demand in any one year is linked to climate and drought conditions not only increase demand, but limit supply. Thus even with conservation measures, use of alternative sources (e.g. from WWT works), etc., water supply will remain a problem for agriculture in some years. Indeed this is seen in 2006, although while restrictions are in place for agriculture, drinking water supplies are considered secure.

Year	GVA in Agriculture (millions 2000 Euro)	Growth rates (%pa)
95	356.6	n/a
96	353.2	-0.95

97	309.4	-12.39
98	329.8	6.59
99	365.1	10.7
00	347.1	-4.94
01	364.2	4.92
02	383.7	5.37
03	392.5	2.27
04	414.9	5.27
05	427.9	3.14
06	450.5	5.29
07	472.2	4.8
08	491.9	4.17
09	511.6	4.01
10	530.5	3.69
11	545.2	2.78
12	558.9	2.5
13	571.6	2.27

In 2002 3 million m³ of treated sewage were used for agricultural and landscape irrigation. It is estimated that until 2012 the recycled water could be 30 million m³. (FAO WDD PDF) The government encourages using greywater and recycled water instead of drinking water for irrigation for agriculture and environment in order to relieve pressure on surface and groundwater.

There are already two desalination plants in Cyprus in use, which provide water for domestic use. On the one hand this secures the water supply, on the other hand desalinated water is much more expensive to produce than the user charges cover. The domestic water tariff is Cy£ 0.335 per m³, the cost of desalinated water Cy£ 0.62 per m³. Another disadvantage is the need of energy for desalination process, which makes Cyprus more dependent on imported oil. (FAO WDD PDF)

The projected demands are summarised in the following table. This table is based on official analysis, in particular taking account of projected growth in tourism. This is generally accepted in Cyprus.

Table 2A: Forecast Annual Water Demand in 2020

	Estimate for 2013
Population (-)	2010 810,000 inh
2005 780,000 (COM)	2013 822,000 inh
2004 750,000 (Cystat)	2020 850,000 inh (EU COM Energy Transport)
	2012 785,000 inh (Cystats)
Households (-)	2012 260,000 CyStat
2004 247,7	2013 274,000 COM
Average size 3.01 (Cystat)	(average household size 3)
Unit water supply (l per inh. per	2000 195 l/inh/d

	Estimate for 2013
day)	2010 219 l/inh/d
Total domestic water demand (million m ³ per year)	2000 53.4 M m ³ 2005 58.4 M m ³ 2010 63.2 M m ³ 2013 66.3 M m ³ 2020 73.5 M m ³
Total industrial water demand (million m ³ per year)	2000 3.5 M m ³ 2005 5 M m ³ 2010 6 M m ³ 2013 6.3 M m ³ 2020 7 M m ³
Total drinking water demand (million m ³ per year)	2000 265 M m ³ 2005 277.8 M m ³ 2010 290.5 M m ³ 2013 297.4 M m ³ 2020 313.7 M m ³

2.5 Priority assessment

There are already many purification plants existing in Cyprus. Drinking water quality is generally good and complies with EU standards and WHO guidelines.

Most (85%) drinking water comes from surface water including dams. All sources of water supplied for domestic use are regularly monitored for the chemical and bacteriological characteristics of water.

Most water infrastructure in Cyprus is quite new, eg desalination plants, waste water treatment plants, dams. The water connection rate is 100%. There is still a high loss of water in the water distribution networks, mainly in rural areas, which should be improved. Defective pipes have to be detected and replaced. (FAO WDD PDF). So far, the costs for the leaks are covered by the water boards. As water is so cheap, it does not affect the budget of the citizens. However, due to the scarcity aspect, this should urgently be improved.

In conclusion, the considerable investment that has taken place in improving water supply in recent years in Cyprus means that there is not a major priority for future investment in the immediate future, especially for major infrastructure. Thus the summary table below indicates a ‘zero’ priority in most areas. However, there is a need for ensuring full metering and ensuring improved water prices. However, this is a wider policy issue, rather than a matter for European level investment.

Field	Type of Investment	Ranking
Water Supply	Reservoirs	0
	Drinking water production plant	0

Transport (inc leakage) - long	0
Transport (inc leakage) - local	0
Metering	1

3 WASTE WATER TREATMENT

3.1 Current situation

Cyprus has a very extensive programme in place for central sewage systems and waste treatment plants and the reuse of treated effluent. However, there are still some gaps in the infrastructure.

In the government controlled areas, the first large WWTP began operating in Limassol in 1995. There are now 25 main WWTPs in Cyprus. These WWTPs cover the four major greater urban areas and some large tourist centers (Nicosia, Limassol, Larnaca, Paphos and Agia Napa – Paralimni) serving 45% of the urban population and 12% of the rural population. There are also about 175 smaller WWTPs which are located at specific facilities such as hotels, military bases, hospitals and universities. In addition there exists a program for the construction of WWTPs in 28 large rural centres (having a population of more than 2000) and in sensitive mountain villages, by the year 2012. The rural population represents 30% of the total island population. This population resides in 370 communities, most of them having a population less than 2000 of residents. Centralized Sewerage Networks, now serve 12% of the rural population. In the remaining rural areas the traditional methods for Sewage disposal are absorption pits and septic tanks.

Nicosia has a fully operating central sewerage system and the central sewerage system for the greater area of Nicosia is under preparation. The coastal towns of Limassol and Larnaca have central sewerage systems and tertiary level treatment plants. Similar systems were still under construction in 2002 for the coastal town of Paphos and the important tourist centres of Paralimni and Ayia Napa. A large number of private biological treatment stations exist, most of them are installed in hotels and other tourist facilities, some in refugee settlements, hospitals and military camps. In most of villages in rural areas, central sewerage systems already exist or under construction. (Republic of Cyprus 2002)

The harmonisation programme, to be completed by 2012, includes the four greater urban areas of Nicosia, Limassol, Larnaca and Paphos, the two tourist resorts of Agia Napa and Paralimni and 38 rural agglomerations with population equivalents of more than 2,000. For the development of these activities, detailed studies for 28 of the rural agglomerations were included in the harmonisation programme, and €1 million was been secured from the EU. At the same time, the installation of sewerage systems in smaller rural agglomerations that do not come under the harmonisation programme (with population equivalent less than 2,000) but face sewage problems, is also being addressed.

The septic waste from some treatment systems is disposed in stabilisation tank systems. Tanker trucks bring the sewage waste water and industrial waste water to a treatment plant. High quality effluents from the treatment plant are used for irrigation in agriculture, environment and amenities, and the recharge of aquifers. The Government covers all the costs for tertiary treatment systems in all urban waste treatment systems and subsidises the installation of small tertiary biological treatment units in rural areas to 75-85%. (Republic of Cyprus 2002).

Especially in summer during the tourist season, Cyprus faces problems with sewage treatment because, in part, the WWT plants have insufficient capacity to deal with the increasing sewage water. (Hazou 2005)

Cyprus has six Sewerage Boards: Nicosia, Larnaka, Limassol-Amathus, Paphos, Paralimni-Ayia Napa and Agros. Each is responsible for the development of sewage collection and treatment and for the collection of any charges associated with this. For example for the Sewerage Board of Limassol – Amathus, construction of the central sewerage system began in 1992. The development of the network has continued in sections since then. The public sewerage network covers more than one third of the Board's area. Its length is 300km and it mainly consists of gravity and force main pipes (20km).

Surface water quality

A Decree from 1993 prohibits direct discharges to surface waters and indirect discharges need a permit with specified terms and conditions. (Republic of Cyprus 2002). Water quality information (surface and groundwater) are not in EEA databases for Cyprus. However, MANRE has noted that surface fresh water is most at risk from agricultural pollution – nitrates, boron and pesticides. Wastewater is largely discharged to the sea. Bathing water quality is important for Cyprus, given its tourist industry, and is largely good.

Since 2000/2001 monitoring and measurement methods were adopted for surface and ground water. The ambient quality standards and measurement methods were adopted for mercury, cadmium, hexachlorocyclohexane and other dangerous substances. Especially surface and groundwater near industrial areas are monitored. (Republic of Cyprus 2002).

State of infrastructure

According to the Street and Buildings Law, all dwellings must have a septic tank and an absorption pit, which is pumped out and transported to a sewage treatment plant when being full, unless it is connected to the sewage collection system.

Collection of sewage in the urban centres and major tourist areas is the responsibility of the Sewerage Boards, which are publicly owned. In rural areas limited sewage collection currently exists. In smaller villages disposal is traditionally via septic tanks, but these can result in considerable levels of pit failure.

Of the 370 identified villages, 28 have populations above 2,000, and none above 10,000. A programme is currently underway to provide collection and treatment systems for rural areas.

Thus overall, Cyprus has 44 agglomerations >2,000 population equivalents, p.e., generating in total 725,000 p.e. pollution load. Eurostat provides data for the percentage of population connected to waste water collection systems, but data for Cyprus are limited to 1999 and 2000, with 33 and 35 % respectively.

The Tersephanou Water Treatment Plant and the Tersephanou-Nicosia Conveyor, which constitute part of the second phase of the Southern Conveyor Project were inaugurated in April 2000. The Southern Conveyor Project is the most ambitious water development project ever undertaken in Cyprus. The Treatment Plant has a capacity of 60,000 cubic metres per day (potentially 90,000 cubic metres per day). The EIB and the Kuwait Fund for Arab Economic Development granted loans totalling 60 per cent of the total project cost of \$40 million.

The construction of the Paphos sewage collection and treatment system with stormwater drainage was assisted by a loan of €30 million from the EIB in 1997. In 2004 EIB lent €100 million for the Greater Nicosia Sewerage project, extending the sewerage collection system and treatment facilities.

Overall, the state of infrastructure for the main WWTPs is shown in the table below. This presents the main plants with their capacity, level of treatment and final reuse / discharge method, (MEDAWARE, 2004). Some examples of the wastewater treatment and reuse schemes are presented in brief below, (MEDAWARE, 2005).

Table. Urban Wastewater Treatment Plants (from Fatta et al, 2005).

Name	Wastewater Produced m³/yr	Treatment	Use
Nicosia Sewage Board	3,650,000	Secondary	Diverted to Pedieos River
Anthoupolis-Nicosia	127,750- (max 2.56 million)	Secondary	Stored in open Reservoir for evaporation
Larnaca Sewage Board	912,500 maximum	Tertiary	Landscape Irrigation
Agia Napa – Paralimni	2,500,000 maximum	Tertiary	Landscape-Forest
Limassol Sewage Board	3,000,000	Tertiary	Agriculture-Landscape of Hotels
Paphos Sewage Board	4,895,000	Tertiary	Agriculture
Bathia Gonia	803,000	Tertiary	Agriculture
Dhali-Nisou	182,500	Tertiary	Agriculture
Platres	73,000	Tertiary	Not operating-Agriculture
Carlsberg	146,000	Tertiary	Agriculture
Nicosia New Hospital	182,500	Tertiary	Not operating-Landscape
Limassol Hospital	47,450	Tertiary	Landscape
Alassa (new site village)	18,250	Tertiary	Agriculture
Palechori	73,000	Tertiary	Diverted to the River
Apostolos Loucas	25,550	Secondary	Used by the Agriculture Research Institute
Kofinou	65,700	Secondary	Agriculture
Zenon-Kamares II	109,500	Secondary	Landscape irrigation
Agglisides	365,000	Secondary	Agriculture
Kornos	25,550	Tertiary	Landscape Irrigation
Stavrovouni	25,550	Tertiary	Landscape Irrigation
Agios Ioannis	17,900	Tertiary	Landscape Irrigation
Malounda	7,300	Tertiary	Landscape Irrigation
Klirou	26,300	Tertiary	Landscape Irrigation
Kyperounda	109,500	Tertiary	Agriculture
Troodos	8,800		Landscape
TOTAL Maximum	19,829,850		

Examples of sewage collection and treatment developments (Dodou-Zachariou M., (2000), MEDWARE (2004) and Fatta, et al, 2005).

Nicosia

The existing sewerage system of Nicosia and the two WWTPs, cover a population equivalent of 125,000. By 2008 the needs of 265,000 population equivalent will be covered, and by 2012 the total needs of the area will be completely covered, serving 300, 000 population equivalent. The current systems of stabilization ponds will be upgraded to tertiary plant while the construction of a new treatment plant at Vathia Gonia, is also scheduled (see below).

Limassol – Amathus Sewage and Reuse Scheme

The first phase of the Limassol-Amathus the sewage scheme provided for a sewage collection system for approximately 50,000 population equivalent (and is designed to serve 70,000 population equivalent, and serves principally the south urban areas near the coast where the major tourist hotels are located. Its construction was completed in 1995. The second phase of the sewerage plan extends to the remainder of the Limassol-Amathus service area.

The secondary treatment was designed to produce an effluent with a 5-day biochemical oxygen demand (BOD) of 20 mg/l and total suspended solids (TSS) of 30 mg/l while the tertiary treatment was designed to produce effluents of BOD 10mg/l the Suspended Solids 10mg/l. The daily peak design flow of the sewage works rate is 56,400 m³/ day and the average daily flow is estimated at 17000 m³/day.

The Water Development Department of Cyprus decided to utilize 40% of reclaimed water for irrigation of agriculture crops within the boundaries of five villages located east of Limassol and the remaining 60% to be conveyed west to the Akrotiri Aquifer, for groundwater recharge and used indirectly for agriculture within this area, which is presently using fresh water resources. As a result of the severe water shortage that Cyprus faces, and all reclaimed water presently produced from the Limassol – Amathus sewage plant, is utilized for direct irrigation of agricultural land east of Limassol.

The reclaimed water is to be recharged into the aquifer throughout the winter period and shall be recovered by pumping as required for crop irrigation. The key elements of the scheme were pipelines from the treatment plant to the recharge basins, recharge facilities capable of recharging 2 million cubic meters (MCM) per month within the bed of Kouris River. The reclaimed water is delivered from a storage balancing reservoir within the wastewater treatment plant to storage reservoirs (Agios Georgios Alamanon and Moni of 14,600 m³ and 8200 m³ capacity respectively) and finally to the Five Villages Area, for irrigation of about 600 hectares of agricultural land.

Sludge in the primary and secondary settling tanks as well as in the aeration tanks is accumulated and then digested. This produces methane which will be used to generate electricity. The end product is used as a fertiliser in agriculture.

Larnaca WWTP

This is located at Meneou Area near the International Airport. The treatment plant has been in operation since 1995 and provides domestic wastewater treatment for 46,340 population equivalent. Currently, the WWTP serves only 36,000 population equivalent. The design capacity of the treatment plant is 8,500 m³/d. The treated effluent has been used for irrigation purposes since 2000. An average agricultural area of about 250 hectares is being regularly irrigated. The treated water is also used by hotels connected to Larnaca WWTP, and by Larnaca Municipality for the irrigation of gardens, parks and football fields during the summer season.

Paphos

In 2003 the WWTP in Paphos served approximately 60% of the total needs (55, 000 population equivalent). With the extension planned between 2004 and 2006, this will serve the broader area of Paphos (110,000 population equivalent).

Paralimni-Agia Napa

The sewerage needs of 65% of Agia Napa (25,000 population equivalent), as well as 70% of the Municipality of Paralimni (50000 population equivalent) are covered by this WWTP. The extension at Agia Napa WWTP, between 2004-2006, will serve 27,000 population equivalent, covering 80% of the population. With the supplementary plans that are going to be completed by the end of 2012, all of the needs will be covered (31,000 population equivalent). For the Municipality of Paralimni, the extension during 2004-2006, will cover the needs of the entire Municipality (70,000 population equivalent).

The central wastewater treatment plant in Vathia Gonia

The Central Waste Water Treatment Plant at Vathia Gonia is located near the village of Potamia and has been constructed to treat the domestic septage and industrial wastes originating in the Districts of Larnaca and Nicosia. Both domestic and industrial waste water is carried to the Treatment Plant by the licensed tankers of Nicosia and Larnaca Districts.

The capacity of the Treatment Plant is 2,200 m³ per day with a population equivalent of approximately 55,000 people. The recycled water which results from the treatment process is stored in a 284,000 m³ storage and balancing reservoir prior to being distributed, via a pumping main, header tank and a piped network, to irrigate approximately 500 hectares of land in the area of Potamia and Geri.

The secondary treatment of a typical activated sludge system is followed by tertiary treatment where effluent from the final settling tanks is pumped into four continuously back-washed tertiary sand filters and is chlorinated in a contact tank prior to being discharged to the treated effluent storage reservoir of a capacity of 284,000 m³. The excess sludge produced is disposed onto fields as a soil conditioner

Prices of the waste water service

The Sewage Boards charge for their services. This is highly variable. For example, the Sewage Board of Nicosia has imposed a tax of 0.3% of the value of a home based on 1980 prices. This is to finance infrastructure development.

Sewerage and drainage charges collected by the Sewerage Board of Limassol – Amathus are imposed on the immovable property's assessed valuation as at 1 January 1980 as determined by the Land and Survey Department. Sewerage service charges are imposed according to water consumption. The charge is 17 cents for every metric tonne for all premises connected to the sewerage system.

Institutional issues

The Ministry of Agriculture, Natural Resources and Environment (MANRE) is responsible for wastewater treatment. However, sewage collection and treatment is the responsibility of the sewage boards, as indicated above. These are publicly owned. Private investment is only appropriate for some industrial sources, eg wineries.

While Cyprus has expressed recent interest in public-private partnerships for some infrastructure development, there is, as yet, no such investment in the provision of waste water treatment. There seems now to be little scope for PPP investments in this area given that the future needs are largely related to collection systems and rural communities.

The primary institutional focus of investment are the Boards. These collect fees and direct development. While some might argue that greater centralisation could target investment more efficiently, the Boards do provide a strong link to local communities (and hence a direct link between fees and development, which is politically important). They have also proven effective in this management role. Therefore, the institutional capacity for the management of such investments seems sound.

3.2 Experience of previous investment programmes

Under the LIFE programme, Cyprus receives funding for the Development of Technical Documentation for the Collection and Treatment of Urban Waste Waters. Studies for sewerage networks and treatment plants for 28 communities were being prepared and the service contract implemented. Another project funded by the LIFE Programme was the “Development and Implementation of an Integrated System for the Control and Monitoring of the Urban Wastewater Treatment Plants in Cyprus.” (DELCYP a).

Cyprus has also received funding from other sources, including the EIB and bilateral support from Kuwait.

External funding has been important in delivering the infrastructure objectives for waste water management in Cyprus. However, there has also been a significant recourse to national funding sources, including the use of funds secured through charging schemes.

The financing of schemes has focused initially on meeting requirements for compliance with the acquis (principally in relation to the urban waste water treatment Directive, but also in relation to bathing waters). These developments have been important in protecting the important tourist sector.

It is important to stress, however, that programmes have not simply focused on delivering legal compliance, but have examined how they can help tackle other problems (such as re-use of water for agriculture) and examining wider issues (such as problems in rural communities). This adds value to the investments.

Institutionally the programmes have been relatively efficiently implemented. A primary role is for that of the local Boards, but the Government recognised the need for strategic contributions nationally. This combination has proved effective. The ‘step-wise’ approach to the development of collection systems was inevitable given the limitations available in funding at any one time.

3.3 Needs for the future

The European Commission’s report on bathing water quality for Cyprus for 2004 reports that the urban waste water treatment Directive is ‘under full implementation’. By way of derogation from Articles 3, 4 and, if sensitive areas have to be identified, 5(2) of Directive 91/271/EEC, the requirements for collecting systems and treatment of urban waste water shall not apply in Cyprus until 31 December 2012 in accordance with the following intermediate targets:

- by 31 December 2008, compliance with the Directive shall be achieved for 2 agglomerations (Limassol and Paralimni) with a population equivalent of more than 15 000;
- by 31 December 2009, compliance with the Directive shall be achieved for 1 further agglomeration (Nicosia) with a population equivalent of more than 15 000;
- by 31 December 2011, compliance with the Directive shall be achieved for 1 further agglomeration (Paphos) with a population equivalent of more than 15 000.

Central sewerage systems cover today part of the greater Nicosia, Limassol, Larnaka and Paphos as well as the tourist centres of Ayia Napa and Paralimni, thereby serving 45% of the population, which falls within the harmonisation programme of Directive 91/271. According to the harmonisation programme and planned investments¹⁰, this proportion is expected to rise to approximately 80% by the end of 2006 and to approximately 100% by the end of 2012, providing in parallel considerable quantities of treated water both for irrigation purposes and for recharge of aquifers.

The Government is promoting the construction of sewerage systems in all towns and important tourist centres which aim at the protection of the environment, the

¹⁰ Cyprus is committed to implement the harmonisation programme in the sewage sector by the end of 2012.

protection of public health and up-grading of the quality of life as well as the full utilisation of the treated effluent, which constitutes a significant part of the water resources of Cyprus.

So far, the construction of sewerage systems has been implemented in communities that face serious and immediate problems. Specifically, 25 small central sewerage systems are in operation today, 13 of which have sewage treatment plants, whilst an additional 3 are under construction. Out of these, 5 have a population greater than 2000 inhabitants and cover approximately 8% of the rural population that falls within the harmonisation programme with Directive 91/271.

According to a preliminary research that was carried out in 1998 by the Water Development Department, 96 out of the 350 villages (i.e. 51% of the rural population) face some sewage problem with the mountainous regions facing the biggest problems. For these villages, further investigation is required in order to establish the necessity for installing central systems.

In view of the high investment expenditure required to deal with the sewage problems, implementation is gradual, according to the priorities that have been set by taking into consideration the magnitude of the problem and the requirement to implement Directive 91/271 with regards to the collection, treatment and disposal of sewage.

According to Directive 91/271 which aims in protecting the water supply, every community with population equivalent exceeding 2000 persons should install and operate a central sewerage system with appropriate sewage treatment by 2012.

A relevant programme with time-schedule for implementation of the Directive covering the period 1999-2012 has been prepared by the Water Development Department.

The programme includes the four greater urban areas of Nicosia, Limassol, Larnaka and Paphos, 38 rural communities with population equivalent greater than 2000 persons as well as the two tourist areas of Ayia Napa and Paralimni.

For the small rural communities (with population less than 2000 persons) the implementation of sewerage systems is implemented on the basis of criteria that have been defined within the framework of the five year Plan for the development of the rural areas (Council of Ministers Decision No. 52.295 and date 30/8/2000) which includes amongst others, the implementation of sewerage schemes.

Currently about 20 MCM of treated wastewater are produced each year in Cyprus, of which 25 per cent is reused. It is estimated that by 2012 the amount of treated waste water will rise to 30 MCM per year. Reuse of waste water for agriculture is particularly important for Cyprus given its water supply issues (see above) and it is a guiding policy principle for the country, which has the slogan ‘Not a Drop of Water to the Sea’. However, there are some problems with extending such reuse to a major extent¹¹:

¹¹ Fatta, D., Skoula, I., Moustakas, C., Mentzis, A., Papadopoulos, A., Loizidou, M., Salem, Z. & Hameed, K. 2004. Existing situation, plans and policies for the wastewater reuse in agriculture in Cyprus, Jordan and

- The demand for water for agriculture exists largely in the summer, so that the Sewage Boards have to tackle the problem of water storage and disposal in the winter.
- There is no systematic monitoring of the use of the water, so that some inappropriate use might occur (e.g. onto leafy vegetables).
- There is a problem of disposal from small WWTPs in villages (particularly in the mountains), where there is a cultural resistance to the use of recycled water.

For example, it has been decided that no effluent from the city of Limassol can be discharged to the sea. Water that is not used for irrigation will be used for recharging the Akrotiri aquifer (so of the irrigation water being taken from wells fed by the recharge).

The Government's water policy is also focused on the exploitation of other non-conventional water sources such as recycled water, which replaces equal quantities of good quality water.

The harmonisation programme, to be completed by 2012, includes the 4 greater urban areas of Nicosia, Limassol, Larnaca and Paphos, the two tourist resorts of Agia Napa and Paralimni and 38 rural agglomerations with population equivalent of more than 2.000. At the same time, the installation of sewerage systems in smaller rural agglomerations that do not come under the harmonisation programme (with population equivalent less than 2.000) but face sewage problems, is also promoted.

The 1999 cost assessment report identified the following investment requirements

Board	Nicosia	Limassol	Larnaca	Aya Napa and Paralimni	Paphos
Sewage length required (km)	800	130-140	140	55	145
STP requirements	2, secondary, 37,000 m ³ /d	Incr capacity to 48,000 m ³ /d	1, tertiary, 8,500 m ³ /d	1, tertiary, 12,000 m ³ /d	1, tertiary, 8,000 m ³ /d
Total capital cost (£CY mill)	82	75	122	10	41
Recurring cost (£CY)	2,300,000 (2010)	1,294,147	1,245,000	?	?

Source: 1999 cost assessment report

The estimated investment requirements for implementation of the urban wastewater treatment Directive at the time were (Euro million) (1999 compliance cost report):

- 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
- STPs for other industries 0.7

However, since this time there has been significant investment in these areas. Thus the following projects identified within the indicated development objectives have been planned to be implemented during the period 2004-2006.

- Extension of network and operation of the sewerage system for the collection and treatment of sewage in the new areas of Greater Limassol - 55 million Euro (£32 million).
- Extension of the sewerage system of Larnaka - 18 million Euro (£10.7 million).
- Installation of a central sewerage system in the Greater Nicosia area – 97 million Euro (£56.6 million).
- Extension of the sewerage system of Ayia Napa – 5.8 million Euro (£3.4 million).
- Extension of the sewerage system of Paralimni – 7.7 million Euro (£4.5 million).
- Implementation of Phase B of the Paphos sewerage system - 45 million Euro (£26.3 million).
- Construction of sewerage systems in a number of communities with population equivalent greater than 2000 inhabitants - 53 million Euro (£25 million).

These projects cover much of the implementation of the UWWT Directive.

Further plans are set out in the following two tables (MEDWARE 2004). These indicate the recent and future objectives for urban and rural areas ensuring that all communities with a population equivalent of 2,000 or more will be connected to waste water collection and treatment facilities by 2012.

Table. Future plans for the urban areas (MEDWARE 2004).

Area	Year	Population Equivalent (PE)	%	Capacity of the Treatment Plant (m ³ /day)
Nicosia	2003	125000		22200
	2008	265000		42000 ⁽¹⁾
	2012	300000		50000 ⁽¹⁾
Limassol	2003	70000	40%	10500
	2004	90000	50%	13600
	2006	123000	68%	18500
	2012	180000	100%	28000

Larnaca	2003	36000	50%	8500
	2006	40000	60%	10000
	2012	67000	100%	17000
Paphos	2003	55000	60%	5500
	2006	110000	100%	11000
Paralimni-Agia Napa	2003	50000 (A)	70% (A)	12000
		25000 (B)	65% (B)	
	2006	70000 (A)	100 (A)	15500
		27000 (B)	80% (B)	
2012	31000 (B)	100% (B)	20000	

⁽¹⁾: *Mias Milias, Anthoupolis and Vathias Gonias WWTP*

(A): *Paralimni*

(B): *Agia Napa*

Table: Rural areas to be served by WWTP (MEDWARE 2004).

Area	Population	Population Equivalent	Type of project	Project completion year
Evrichou	819	1371	Connection with Kakopetria's Treatment Plant	After 2006
Temvria	541	805		
Galata	651	1413		
Korakou	499	604		
Sina Oros	233	398		
Kalliana	187	382		
P. Leukara	917	2003	Individual	After 2006
Pedoulas	191	1826	Common Treatment Plant	After 2006
Moutoulas	294	861		
Kalopanagiotis	287	1316		
Oikos	187	388		
Aradippou	11459	12395	Connection with the current Treatment Plant in Livadia	After 2006
Kiti	3141	3642	Connection with Larnaca's Treatment Plant	After 2006
Pervolia	1798	5554		
Dromolaksia-Meneou	6191	7538		
Athienou	4258	4675	Individual	After 2006
Akaki	2653	2851	Common Treatment Plant	After 2006
Astromeritis	2360	2567		
Peristerona	2098	2278		
Limbria	2167	2353	Individual	After 2006
Ipsonas	6430	7060	Common Treatment Plant	After 2006
Kolossi	3865	4024		
Episkopi	3105	3330		
Trachoni	3301	3442		
Erimi	1431	1656		

Lithrodontas	2622	3543	Individual	After 2006
Pegia	2359	5986	Individual	After 2006
Kornos	1862	2057	Individual	After 2006
Pissouri	1033	1878	Individual	After 2006
Kato Pirgos	1121	2001	Individual	After 2006
Poli Chrisochous	1892	3785	Individual	After 2006
Ormidia	3941	4385	Common Treatment Plant in Achna	By 2006
Xilotimbou	3443	3671		
Xilofagou	4981	5434		
Derinia	4945	5782		
Sotira	4258	4939		
Liopetri	3838	4123		
Frenaros	3306	3462		
Agorou	4002	4524		
Achna	1958	2363		
Acheritou	1649	1835		

The costs of sewage collection can be examined in further detail through the analysis undertaken for the provision of sewerage systems in Communities of the Ammochostos and Larnaca District. This addressed the provision of services to villages around this towns, i.e. Deryneia, Frenaros, Sotira, Liopetri, Acheritou, Avgorou, Xylofagou, Achna, Xylotymvou and Ormidia. It incorporates the construction of central sewerage systems, pumping stations and sewage treatment plants. The sewage will undergo tertiary treatment for the protection of the environment and for use of the recycled water for irrigation purposes. The collection and treatment cost for 10 villages is estimated at 53 million Euro. However, the analysis breaks down the cost by village (see table below).

Village	Population in 2001	Cost (Euro) (1000's)
Deryneia	4945	9634
Frenaros	3306	4796
Sotira	4258	4333
Liopetri	3838	6742
Acheritou	1649	2550
Avgorou	4002	4488
Xylofagou	4981	6606
Achna	1958	4027
Xylotymvou	3443	5093
Ormidia	3941	4493
TOTAL	26,979	52,762

In rural areas there are about 202,000 people in 370 villages (34% of the population). A survey found that 96 villages face sewage treatment problems, representing 51% of the rural population. The need is for construction of a piped sewage system with tertiary treatment at the end. The costs of doing this are about C£300-500 per inhabitant of these rural areas (average of around £80 million in total). The government has initially financed

C£54 million for 1999-2012 covering collection and treatment for 32 agglomerations with more than 2,000 pe. A further C£44 million is needed for a further 70 communities.

In conclusion, there are two primary needs relating to waste water management. The first is the completion of the collection systems in urban areas. The treatment systems are in place, but the collection system is not at its fullest extent. This development is necessary to comply with the acquis. Much of this is either currently under construction or planned.

The second is the improved collection of waste water for smaller communities. In strict terms this is not necessary to implement the acquis. However, it is not only of benefit to those communities (in terms of reducing risks to local health and environment), but it also contributes to providing water for re-use and, therefore, tackling problems of water supply for agriculture (see Chapters 2 and 6).

3.4 Priority assessment

The priorities are, therefore:

- Completion of the sewage collection system in municipal areas;
- Extension of the collection system in rural areas;
- Possible provision of additional treatment for some rural communities (although most is expected to go to the newly built treatment facilities).

As stated above, the principle effort for future funding consideration is provision of collection of waste water for rural communities. The current estimate of the cost of achieving this is €77 million. The existing (and forthcoming) network also incurs a recurrent cost. This will be of the order of €14 million per year. This is expected to be funded through charges.

The priorities are set out in the table below. This emphasises the importance of the collection systems in rural areas. The need for further STPs is less a priority and, indeed, lower technology solutions might be possible if further treatment is required in rural areas.

Sludge treatment and disposal has been developed significantly with the provision of new treatment facilities, with the aim at this stage of providing a soil conditioner for agriculture. However, there has also been consideration of further sludge treatment issues, such as using its digestion for methane energy production. This is currently at an early stage, but development of such facilities could contribute to targets for renewable energy sources and, therefore, have been given a score of ‘2’ to indicate that this should be considered further.

Issue	Ranking
New STPs	2
Renovation/upgrade STPs	n/a
New Sewerage collection	1
Renovtion/upgrade sewerage	n/a
Sewerage pumping stations	1
CSO upgrading	3

Sludge treatment	2
Sludge disposal	2

It is important to stress a complication on determining priorities in this area. Investment has been made in northern Cyprus (not covered in this report) for waste water treatment in Nicosia. With improved co-operation this now receives waste water from the south of the city and applies tertiary treatment resulting in 42,000 m³ of water a day for irrigation. Thus the south helps pay for treatment in the north, but the main cost of the plant is not included in southern budgets. Greater cross-border co-operation would necessitate a re-think on issues such as this and how projects are prioritised. Therefore, some flexibility is appropriate in the implementation of infrastructure development planning to take account of changes in this sensitive political situation.

4 URBAN SOLID WASTE

4.1 Current situation

In the progress report on the candidate countries, published in October 2002, the European Commission stated that waste management is "the most worrying issue in Cyprus" in terms of harmonisation. (Gardiner/Cameron – SDS 2003)

Cyprus relies on landfill for waste disposal. Many of the Cypriot landfills do not conform to EU requirements of Directive 99/31/EC. In the past there has been no control of the way they are managed or the waste that goes into them. (European Union 2001). This, for example, caused a serious risk of groundwater pollution due to uncontrolled waste disposal. In particular the administrative capacity for waste management requires attention. (European Commission 2005).

Average annual per capita production of solid waste is 470kg/year. The tourist sector contributes to a large proportion of waste arisings – and its seasonal nature means that arisings are not distributed evenly throughout the year. The following table describes the composition of waste arisings. It can be seen that biodegradable waste forms a significant proportion of total arisings and this is a particular challenge in meeting Landfill Directive targets. It can also be seen that arisings have grown significantly over recent years in absolute and per capita terms. This is a common trend across much of the EU, but in Cyprus it also reflects the increase in tourist waste production, whose population is not part of the per capita calculation.

Of the municipal solid waste generated, about 50,000 tonnes per year is recycled, the rest is landfilled. There is currently no other disposal route. However, consideration is being given to other disposal options, such as composting.

According to Resource it would be possible to process much of the municipal, commercial, industrial and agricultural waste produced in Cyprus to produce a solid fuel that would generate 40 to 50 megawatts of electricity per year, says the company. (Haglund 2001).

Table: Waste arisings, type of waste and disposal method trends in Cyprus (Cyprus Government Statistical Service accessed 2006).

-	<u>Indicator</u>	<u>Unit</u>	<u>1993</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>
MUNICIPAL SOLID WASTE											
	Total amount generated	1000 tonnes	n.a.	n.a.	421.34	433.06	448.32	457.56	469.59	490.14	500.02
	Per capita generation of waste	kg/person	n.a.	n.a.	637	646	660	666	677	699	704
	Amount collected for recycling	1000 tonnes	n.a.	n.a.	32.34	35.06	42.32	44.56	46.59	48.14	50.02
- by type of waste											
	Paper, paperboard and paper products	"	n.a.	n.a.	4.51	5.11	5.69	5.92	6.45	6.60	6.68
	Plastics	"	n.a.	n.a.	0.66	0.85	0.95	1.05	1.30	1.55	1.67
	Glass	"	n.a.	n.a.	1.58	1.58	0.46	0.43	0.50	0.60	0.72
	Metals	"	n.a.	n.a.	23.84	25.30	33.47	35.03	36.04	36.82	38.05
	Other	"	n.a.	n.a.	1.75	2.22	1.75	2.13	2.30	2.57	2.90
	Amount landfilled	"	368.80	387.00	389.00	398.00	406.00	413.00	423.00	442.00	450.00
- by type of waste											
	Paper, paperboard and paper products	"	105.10	110.30	110.87	113.43	115.71	117.71	120.56	125.97	128.25

Textiles	"	24.70	25.93	26.06	26.67	27.20	27.67	28.34	29.61	30.15
Plastics	"	44.60	46.83	47.07	48.16	49.13	49.97	51.18	53.48	54.45
Glass	"	4.40	4.64	4.67	4.78	4.87	4.96	5.08	5.30	5.40
Metals	"	8.50	8.90	8.95	9.15	9.34	9.50	9.73	10.17	10.35
Organic material	"	153.40	160.99	161.82	165.57	168.90	171.81	175.97	183.87	187.20
Other	"	28.10	29.41	29.56	30.25	30.86	31.39	32.15	33.59	34.20
<i>(Last updated 9/1/2004)</i>								n.a. = data not available		

Waste management

In recent years, Cyprus has invested considerably in more efficient waste collection systems. The biggest problem was the lack of recovery and recycling capacity. Most of the waste was disposed to landfills.

In 2001, there were no separate waste collection systems and no integrated waste management system. The only waste that was recycled was aluminium cans (1,500 Tonnes/year), paper and cardboard (4,000 Tonnes/year). (European Union 2001). As it is not economic to run domestic recycling schemes, most of the collected recycling material is being exported. An energy recovery process was created as a short-term solution until a full recycling system can be put in place. (Gardiner/Cameron – SDS 2003).

Waste management is financed by collection fees being paid from households, the services and industrial sectors. Often municipalities have to borrow money from banks to finance projects. (CEDARE et al. 2000).

Before 2001 there are six official large landfills, with a capacity of 368,000 tonnes/year, none of which complied fully with the Landfill Directive (e.g. they have not been equipped to prevent the escape of leachate). Landfills are owned, run and maintained by the municipalities – however they generally do not have the resources to manage them properly. There are no municipal waste incineration plants in Cyprus – although they have not been ruled out.

In 2001/2002 the construction of waste treatment plants in Larnaca, Paphos, Ayia, Napa, Paralimni and a number of rural centres started. In 2003, a four-year programme for closure or upgrading of existing landfills was decided. Two new landfills, one in Paphos and one in Larnaca, were created that comply with EU directives. The landfills at Kotsiatis and Vati were supposed to be upgraded and others closed. The plan was also to reduce the overall volume of waste for landfilling through recycling, composting and incineration for producing energy. (Gardiner/Cameron – SDS 2003).

The MANRE and the Ministry of Interior (MI) are responsible for the solid waste management. The MANRE is responsible for issues related to recycling and treatment of hazardous waste and the MI for the general framework directive on waste and landfills. Local authorities are responsible for domestic solid waste management and the municipalities for the collection and disposal of waste. Financial decisions need to be approved by the government. (Gardiner/Cameron – SDS 2003)

In order to support and encourage local authorities and private recycling companies to participate in achieving the waste targets, the government subsidised the Household Recycling Partnership programme with €2.8 million. The subsidies were meant for buying containers, and covering transport and segregation costs. (Gardiner/Cameron – SDS 2003) The MI was also responsible for preparing terms of reference for each district - within the framework of the EU Directives and the Athens Polytechnic study - for private companies willing to propose solutions for recycling, production of energy from waste, and composting. (Gardiner/Cameron – SDS 2003)

The main problem in Cyprus in terms of institutional capacity is the limited staff of the Environmental Service within the Ministry of Agriculture, Natural Resources and Environment (MANRE). With respect to the supervision and control of shipment of waste, the strengthening and technical improvement of the administrative structures (MANRE, Ministry of Communications and Works, Ministry of Finance) will be needed. There are weaknesses in local administration in waste management (as in other areas). Staffing needs to be increased in the field of waste management.

The annual cost to Cyprus to implement the acquis on waste management was around €62 million. (Gardiner/Cameron – SDS 2003). Investments in the order of 100 million EURO are envisaged in the waste management sector.

The Household Recycling Partnership programme and the Packing and Packaging Waste Act, which came into force in January 2003, are important steps towards tackling the problem of recycling. However, similar progress is needed regarding hazardous waste, supervision and control of shipments of such waste, as well as batteries and accumulators containing dangerous substances. The Packing and Packaging Waste Act has set targets of 50%-65% recovery and 25%- 45% recycling by 2005. The legislation gives companies a choice between individual compliance and joining a recovery system. Local authorities will be able to set up their own systems should they choose to do so. The regulations will set out the criteria for Government approval if industry decides to set up a collective compliance system. The Directive on the list of waste and hazardous waste has been transposed in the law on Environmental Impact assessment of April 2001. In addition, in 2002, legislation was approved covering directives for the management of solid and hazardous waste. The legislation provides for a number of measures on the management of hazardous and non-hazardous public waste, household, packaging material and industrial waste. It will also include management of old tyres, electrical appliances and used mineral oils, making manufacturers responsible for waste management. (Gardiner/Cameron – SDS 2003). Objectives of the waste management programme were new regulations, improvement of collection systems, separate waste streams and modernisation and construction of waste treatment facilities (Republic of Cyprus - MANRE 2004).

4.2 Experience of previous investment programmes

The EU has funded a project on upgrading the solid waste management system (landfill). This included carrying out studies and designs for the construction of new landfills and rehabilitation of old ones.

Through LIFE three other projects were funded: 1. Project to provide “Guidelines to the Cyprus Competent Authorities for Policy Formulation for Sustainable Management of pig-farming wastes in Compliance with EU Practice”; 2. Project dealing with the “Development of best management systems for high priority waste streams in Cyprus” and 3. project on “Household Recycling Partnership”. (See European Commission b (DELCYP b))

The project ‘Guidelines to the Cyprus competent authorities for policy formulation for sustainable management of pig farming wastes in compliance with EU practice’ has a

LIFE contribution of €36,706 (70% of eligible costs) The project aims to support the Cypriot competent authorities in designing and implementing a pig waste management and disposal policy in accordance with EU directives. The main actions of the project are to:

- Assess the current situation of pig farm operations and waste management.
- Review and report relevant EU directives and other regulations.
- Analyse the present practices in Cyprus.
- Review of best available technologies as carried out elsewhere under similar climatic conditions.
- Design and operate pilot schemes with most promising waste management techniques.
- Evaluate economic issues and disseminate the results and experiences to the authorities and farmers.

The project ‘Development of best management system for high priority waste streams in Cyprus’ has a LIFE contribution of €420,000 (70% of eligible costs). The project aims to elaborate effective, sustainable and viable management systems for three priority waste streams:

1. End of life vehicles;
2. Construction and demolition waste; and
3. Electrical and electronic equipment waste.

In 1999, Household Recycling Partnership, with a total budget of €261,360.00 and a Life contribution of €235,644.39, focused on the collection of paper, glass, aluminium, and plastic for recycling. Collection points were set up and made public. This pilot project for waste recycling was also intended to be a model project for future PPPs. (European Commission b).

The Environment Service support recycling to the level of C£ 684.000 (1,193,349€) (for 12 recycling companies at C£ 57.000 (99,445€)) and treatment and disposal of waste to £3,3 mn (5,757,385€) (CY Stats). In the transposition of the WEE and ROHS Directives in 2004, Cyprus requires producers not local authorities to fund all collection, sorting, transportation and treatment. (Perchards, 2005).

4.3 Needs for the future

The Government has stated that the lack of an adequate framework for the management of solid waste, as well as problems in the basic environmental infrastructure constitute one of the most urgent environmental problems. The disposal of domestic waste often still takes place in non-approved areas with minimum controls, while the existing approved waste landfills have problems and require upgrading. In addition, an integrated system for the management of solid and hazardous waste is only just developing. The Ministry of Interior has prepared a strategic plan for the management of domestic solid waste, which is gradually being implemented, while the problems of managing the remaining solid waste are tackled in the framework of the implementation of a comprehensive strategy for waste.

The Government has therefore decided, as a first step, to implement a Household Waste Management Plan, which provides for the operation of 4 sanitary landfills (one per district) and a number of transfer stations. Two sanitary landfills have so far been developed. At the same time, the strategy for the gradual restriction in the volume of waste that is disposed in landfills will also begin to be implemented through the adoption and implementation of a recycling policy and through the recovery and treatment of the organic matter in combination with energy recovery measures, as provided by Directive 99/31.

The national policy for solid and hazardous waste aims to comply with the EU Acquis Communautaire (with the main Directives being 99/31 and 91/689 and Decision 94/904) and at implementing a programme for the recovery of energy and primary resources, by recycling part of the produced waste and by restricting the volume of waste disposed in landfills.

The general strategic framework of environmental policy in the field of solid waste management includes:

- Termination of operation of uncontrolled landfills in conjunction with a programme for their replacement.
- Creation of modern and comprehensive installations for waste disposal with sorting, composting and incineration plants and sanitary landfills.
- Implementation of programmes for the reduction in volume of waste that is deposited in sanitary landfills, with sorting programmes operating either at source or at the place of disposal.
- Construction of transfer stations for the environmentally safe and economically sound transport of waste.
- Development of a comprehensive communications, information and public education strategy that will contribute decisively to the confrontation of the solid waste management problem.

The primary objectives are:

- Abolition of uncontrolled areas for the disposal of solid waste and creation of modern sanitary landfills with the objective of maximising the recycling of materials/recovery of energy so as to reduce the quantities of waste being put to landfills.
- Increase in the proportion of population that is served by the solid waste management systems to 100% by 2006.
- Increase in the proportion of waste recycling per category:
 - Paper 25% by 2010
 - Glass 25% by 2010
 - Plastic 25% by 2010
 - Metals 25% by 2010
 - Other products (lubricants, lubricating oils, accumulators and batteries)
- Reduction in the proportion of biodegradable urban waste that will be deposited to sanitary landfills to 75% of the total quantity that was produced in 1995.

Is funding for further landfill sites required?

The following projects identified within the indicated development objectives are planned to have been implemented during the period 2004-2006.

- Creation of a sanitary landfill, a sorting, composting and incineration plant in the Nicosia district, Kotsiatis area, and of the necessary transfer stations (30 million Euro).
- Creation of a sanitary landfill, a sorting and a composting plant in the Larnaka and Ammochostos districts, and of two transfer stations, in the villages of Xylofagou and Skarinou (30 million Euro). This is the final stages of implementation.
- Creation of a sanitary landfill, a sorting, composting and incineration plant in the Limassol district, Vati area, and of the necessary transfer stations (30 million Euro).
- Creation of a sanitary landfill in the Paphos district, Marathounta area, and of the necessary transfer stations (18 million Euro). This has been implemented.

The Ministry of Interior has been responsible for commissioning the studies and the design of plants and sanitary landfills to consultants, and for the supervision of the construction which shall be undertaken by contractors. The projects are then handed over to Boards established in every district and in which local authorities represented. The Boards will have the right to draw contracts with the private sector for the operation and maintenance of the installations. Furthermore, the Boards have the right to impose a special tax to the inhabitants of the area in order to cover part of the construction cost and part of the operation and maintenance cost.

Examples of two of these are described in further detail.

Creation of a sanitary landfill, a sorting and composting plant for the districts of Larnaka and Ammochostos and two transfer stations in the villages of Xylofagou and Skarinou. The whole project incorporates the creation of a sanitary landfill, a plant which includes a sorting unit and a composting unit with energy recovery. The construction of two transfer stations to serve the two districts is also included. The project serves the inhabitants of the Larnaka and Ammochostos districts. The annual waste production of the two districts is estimated at approximately 100.000 tons. Previously, 22 uncontrolled sites for the disposal of waste operate in the Larnaka district and 4 in the government controlled area of the Ammochostos district. The total cost of the project is estimated at 30 million Euro.

Construction of a sanitary landfill a sorting and composting plant in the Limassol district. The project will serve the inhabitants of the Limassol district. The annual production of refuse is estimated at 114.000 tons. Previously, 26 areas of uncontrolled disposal of waste operate in Limassol, and are a source of great concern, due to the direct repercussions on the environment. The cost is estimated at around 30 million Euro.

What other funding is required?

The issue of waste to energy has yet to be settled. There is clearly the potential for some growth in this area, meeting both waste management and energy objectives. At this stage the issue is still a political one. Thus future funding might be required. Such a plant would cost around €50 million. However, this figure would change depending on location, capacity, etc, if developed.

4.4 Priority assessment

Waste management is an area that requires further funding. Collection systems are in place and there is already ongoing construction of some of the necessary disposal systems. Currently the only project funded by the Cohesion fund is the Larnaca waste project (that in Paphos is now constructed). However, there are similar priority needs for Nicosia (including a waste transfer station) and Limasol. However, priority setting is complicated by unanswered issues such as whether to adopt selective waste sorting and recycling and whether to use incineration.

The total costs for landfill improvements are €108 million. Further cost estimates are unclear.

	EU Cohesion Fund	Boards¹	Central Gov.	Private Funds	Total
1. Sanitary Landfill Nicosia	---	6	12	12	30
2. Sanitary Landfill Larnaka/ Ammochostos (underway)	24	6	---	---	30
3. Sanitary Landfill Limasol	---	6	12	12	30
4. Sanitary Landfill Paphos (completed)	---	3.6	7.4	7	18

Apart from the need for further construction of sanitary landfills, there is also a need for better waste sorting facilities to deliver recycling objectives and, possible, alternative disposal via waste to energy.

As a result, the following priorities are ranked accordingly.

MSW	Waste collection	3
	Waste sorting	2
	Recovery	2
	Disposal	1
	Remediation of disposal sites	1

5 RENEWABLE ENERGY

5.1 Current situation

Type of investment	Indicators		Environmental issue
Wind	No. of wind turbines	-	Can be high, depends on wind speeds
	capacity of wind turbines (MW) and % over total energy production	-	
	Output of wind turbines (MWh) and % over total energy production	-	
	Areas and energy potential (E.g. wind speeds above 5m/s)	Some areas, but not much potential	
Biomass	MWh/ GJ/ ToE produced and %	2.5 ktoe/y biomass heat off-grid	Fuels for transport, generation of heat and electricity, High growth
	suitable assessment of potential based on land area and suitable crops.	From animal waste	
Solar thermal	GJ capacity installed (MW) and %	29 ktoe/y, 315.1 MWth, 93% buildings, 53% of hotels	Can be high
	m ² installed	450,200 m ² (2004) thermal solar collectors	
PV	Capacity installed(MW) and %	0.190 MWp (0.150 MWp grid, 0.040 MWp off-grid)	Solar roofs etc.
	m ² installed	655,000m ² solar collectors	
Hydro	Capacity (MW) and %	-	? additional capacity
	Energy production (MWh) and %	-	
	sites;	-	
	distinction among sizes – to see progression to small/large hydro;	Only potential for small hydro	

	percent of available capacity exploited	-	
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Renewable Energy is the only domestic energy resource in Cyprus. In 2000, 90% of primary energy came from oil products, 6% from coal and only 4% from solar energy. There is also a small contribution from biomass and wind energy. Thus, the investment in renewable energies could make Cyprus less dependent on energy imports, secure energy supply and at the same time address environmental issues and create new jobs.

Most of the renewable energy (4% of total energy) comes from solar energy and is used for water heating systems. 92% of buildings and 53% of hotels use solar water heating systems. A very small part of the renewable energy comes from biomass (wood from the forest and agricultural wastes, olive kernels, almond husks, etc). However, there is still a high potential to increase RE capacity. (Cyprus Institute of Energy and EREC 2004).

The Government encourages the development of renewable energy sources (primarily solar and wind) and promotes energy efficiency measures in all sectors. The latter has included the erection of a wind turbine by the electricity authority of Cyprus. (Gardiner/Cameron – SDS 2003)

The Ministry of Commerce, Industry and Tourism (MCIT) is responsible for Renewable Energy. In 2001 MCIT produced an Action Plan for Renewable Energy Resources (2002-2010) in Cyprus. The aim is to double RES contribution from 4.5% in 1995 to 9% by 2010, and to increase the RES contribution to Electricity production from the present almost zero level to 6% by 2010. (Cyprus Institute of Energy and EREC 2004)

To achieve these goals new laws were introduced to regulate production and sale of electricity from RES and the provision of technical support, investment and other incentives were adopted. A “New Grant Scheme For Energy Conservation and the Promotion of the Utilization of Renewable Energy Sources” for the promotion of RES and Energy Conservation was adopted, which provides incentives for all RES Applications and Energy Conservation for the period 2004-2006. (Cyprus Institute of Energy and EREC 2004). The Government has recently adopted a new grant scheme effective from 2003 to 2007. (European Commission 2004b)

A five year programme for the promotion of **energy saving** will be implemented as **from 2006**. The programme will be mainly financed from the **special fund** for energy conservation and the promotion of renewable resources. It includes a number of measures:

- The undertaking of an **intensive campaign on energy saving**;
- The provision of a subsidy on the excise duty of **hybrid cars**;
- Promotion of the use of biofuels through the **imposition of a zero excise duty on biofuels**;
- Expansion of the use of the school bus;
- Energy saving through **relevant investment** expenditure in **public buildings**;
- By the construction of new buildings of the broader public sector, the relevant provisions on energy saving should be complied with;

Cyprus also aims to diversify its energy supply sources. A terminal for Liquefied Natural Gas (LNG) is under construction, which would allow the **importation of natural gas**. This project is planned to begin in 2007 and be completed by **2009**.

Energy needs

The recent economic activity in the energy sector in Cyprus and its project growth to 2013 has been analysed by LSE. The results are presented below.

Year	GVA in Energy (millions 2000 Euro)	Growth rates (%pa)
95	105.4	n/a
96	109.8	4.18
97	114.1	3.89
98	124.3	8.9
99	136.1	9.52
00	152.6	12.13
01	163	6.83
02	175.3	7.53
03	186.6	6.45
04	207	10/92
05	223.7	8.06
06	242.2	8.29
07	259.5	7.13
08	277.1	6.78
09	294.7	6.35
10	312.1	5.9
11	324.8	4.09
12	336.9	3.73
13	348.1	3.33

It can be seen that there has been significant growth in the energy sector in the last decade. Growth is predicted to continue, although there will be some reduction in the annual percentage increase. Renewables, therefore, have an important potential role in this growing sector.

State of infrastructures

Renewables Type	Existing installed capacity (MWth, MWel)	Power/generation/annual production (MWh, MJ, t.o.e., etc)
Wind	56.6 MWel (construction approved until July 2005) 16 MWel (construction under consideration)	Little potential as low wind speeds Potential for electricity generation:

		On-shore 0.18 TWh/y* Off-shore 0.13 TWh/y*
Hydro (>15 MW)	-	Potential for electricity generation: 0.001 TWh/y*
Hydro (<15 MW)	-	No potential
Solid biomass	-	Potential for electricity generation: 0.18 TWh/y* For heat generation: biomass heat non-grid 2.5 ktoe/y existing* Potential for heat generation: grid 6ktoe/y, non-grid 12ktoe/y* some potential for biogas
Liquid biofuels	-	1.2 ktoe/y* some potential for biogas
Geothermal	-	No potential
Solar thermal	93% buildings, 53% of hotels	Potential for heat generation: 29 ktoe/y existing, potential* 84 ktoe/y (incl existing)*
Solar electric (PV)	minimal	Potential for electricity generation: 0.002 TWh/y*
Other (specify)		Potential for electricity generation: tide & waves 0.24 TWh/y* biowaste 0.06 TWh/y* biogas electricity 0.14 TWh/y*

* European Commission 2004b

Even though there are incentives for RES, the main energy infrastructure is still fossil fuel. Solar power and energy from biomass have the highest potential in Cyprus.

Solar thermal systems and Photovoltaic grid connected and stand alone systems are already in use in Cyprus. 655,000m² solar collectors have been installed by 2002. Per capita this is 0.86 m². (Republic of Cyprus – MCIT). PV cells are already used for powering telecommunication receivers and transmitters at remote areas and the Cyprus Telecommunications Authority has installed PV cells on telephone booths. (Republic of Cyprus 2002).

Cyprus enjoys a very sunny climate, during the whole year; the average number of hours of sunshine is 75% at daytime. The daily sunshine in December is 9.8h and in June 14.5h. In the summer months in the plain and eastern lowlands, the average sunshine per day is 11.5 hours whilst in December and January there are still 5.5 hours sunshine per day. In the mountain areas, the winter months have an average sunshine of 4 hours per day and in June and July 11 hours. The average daily radiation is 4 kWh/m². (MANRE Website, Republic of Cyprus – MCIT).

PV could be successful in Cyprus due to the many hours of sunshine, but is still expensive and would probably need more subsidies. The solar potential is up to 1800 KWh/m². There is more potential for use of solar energy in the hotel sector and as a contribution to electricity production. (Republic of Cyprus – MCIT). The real cost of generating solar PV electricity is estimated at 35 - 50 c/kWh. (CypEnv)

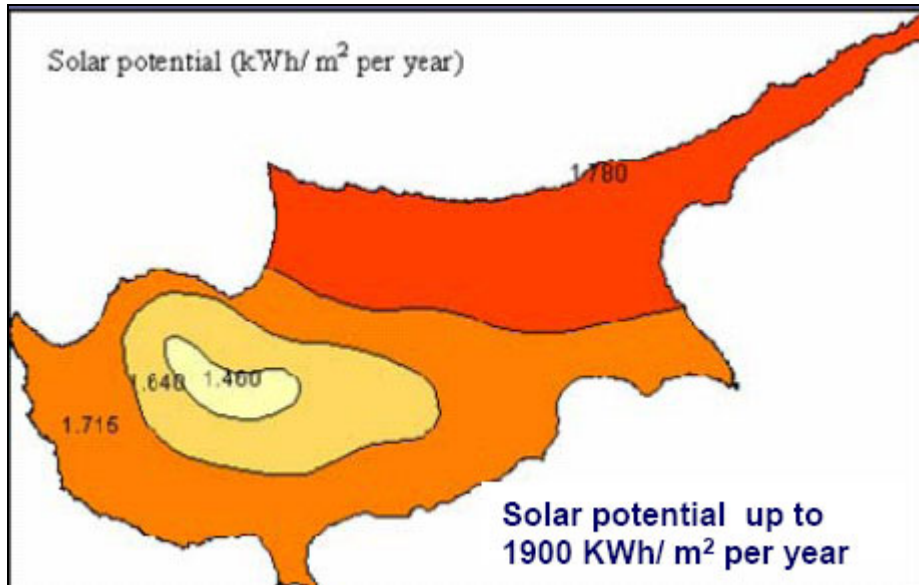
Biomass could come from the exploitation of agricultural residues, energy crops, Municipal Solid Wastes, the exploitation of landfill gas from landfills or medium and large-scale animal farms and Biofuels (i.e. energy crops). The potential for the use of Municipal Solid Waste for energy generation is the following: Nicosia (100,000 tn wastes/y, capacity: 1.1MWe / 1.5MWth /7.5GWh/y); Limassol (150,000 tn wastes/y, capacity: 1.75MWe / 2.5MWth /15.6GWh/y); Larnaka (45,000 tn wastes/y, capacity: 0.45MWe / 0.7MWth /2.7GWh/y); Total: 295.000 tn wastes/y, capacity: 3.3 MWe / 4.7MWth /25.8GWh/y). (CIE 2005) Waste incineration would also contribute positively to the waste management problem, especially in areas with higher density of people.

Cyprus consumes 650,000 metric tonnes of fossil fuels per year, the national target for biofuel is 6,500 metric tonnes. A law has been drafted in 2005 to subsidies 30%, or up to £400,000 in investment costs per project. (Kambas 2005)

Biofuels and –diesel are not much in use yet. Cyprus is, with the UK, the only country taxing Biofuels. In order to promote them, this tax should be lifted or lowered. The tax was like for normal diesel 14.3 Cy cents. Biodiesel used came so far from frying oil especially from Mc Donalds. Due to water scarcity and limited space it is not recommendable to substitute food crops with oil plants. The import of biodiesel is still more efficient. Also, environmentalists fear that the introduction of an invasive plant like safflower, which needs less water, could harm the ecosystem. An option for producing biodiesel in Cyprus would be to use the liquid by-product from olive oil production. Around 100,000 tonnes of liquid by-product are produced every year. For biofuel from ethanol the wineries could be involved. (Kambas 2005, Markides 2005)

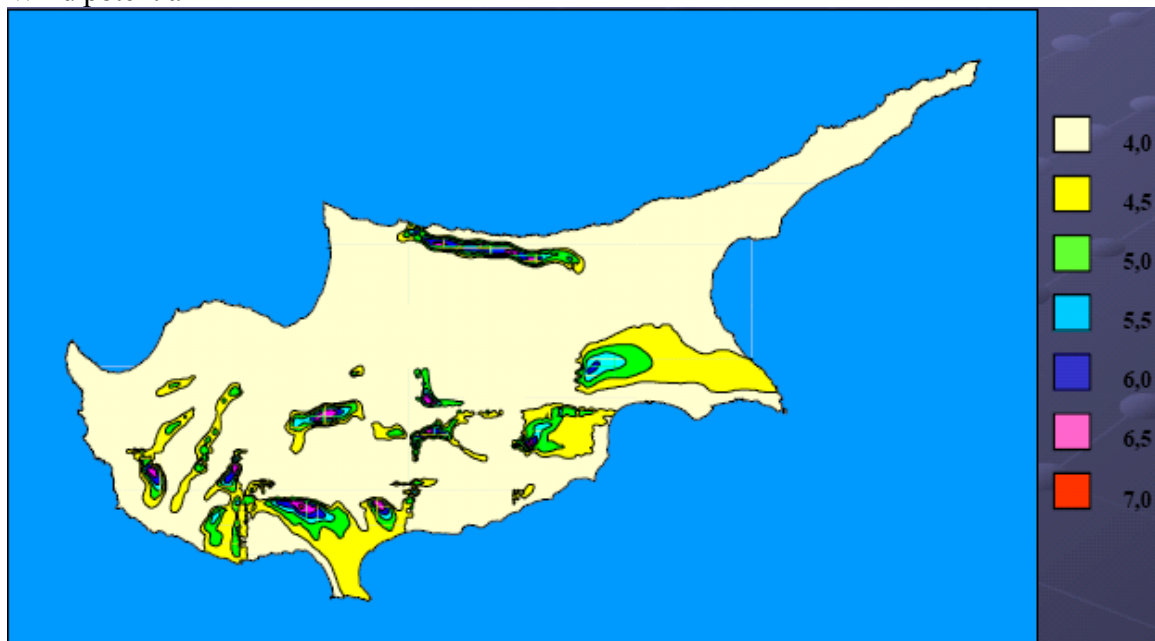
Wind energy is already in use on Cyprus. There are some wind turbines for water pumping and wind turbines for electricity generation are already installed. (Republic of Cyprus – MCIT). However, the potential for wind energy in Cyprus is rather low. The winds on and around Cyprus are of light and moderate strength coming from west/ southwest in winter and north/ northwest in summer (MANRE website). There are some areas with mean wind speed 5-6m/sec and few areas with 6.5-7m/sec. The estimated exploitable potential is 150-250MW. (CIE 2005)

The winds on and around Cyprus are of light and moderate strength coming from west/ southwest in winter and north/ northwest in summer (MANRE website). There are some areas with mean wind speed 5-6m/sec and few areas with 6.5-7m/sec. (CIE 2005) For strength and continuity of wind are unreliable, the installation costs may exceed the benefit and makes wind power less efficient.



Source: Pharconides 2005, CIE

Wind potential



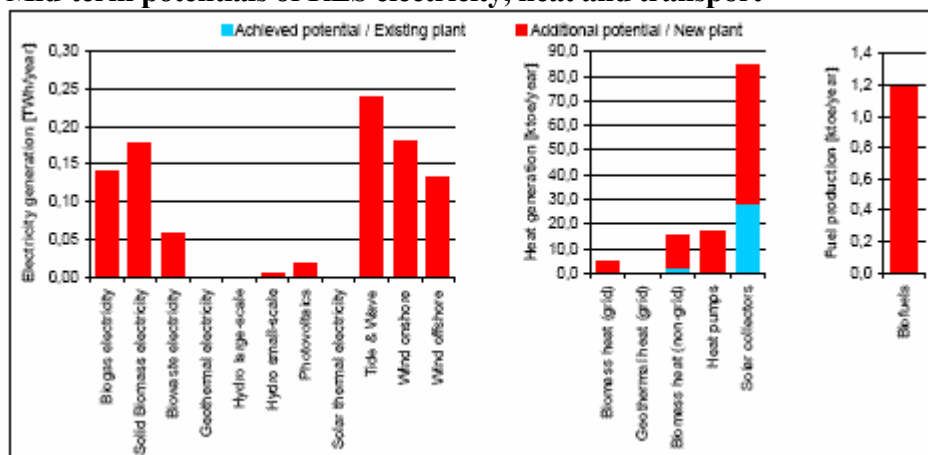
Source: Pharconides 2005, CIE

As there are no perennial rivers in Cyprus, so large-scale hydro power is not possible. There are a number of small hydro power systems in use; small mills up to 30KW rated power. (Republic of Cyprus – MCIT)

Tidal and wave generation have some potential in Cyprus (see table), but tidal changes are rather low. It is questionable if this would be efficient. The possibility to use geothermal energy is quite unlikely.

In conclusion, therefore, there is considerable potential for enhanced use of renewables. For electricity generation this is likely to be most focused on biomass and wind energy and supported with additional solar generation for heating (see figure below).

Mid-term potentials of RES electricity, heat and transport



Source: European Commission 2004b

Renewable energy pricing and support issues

The current electricity consumption charges using the tariffs in force are as follows using the corresponding Eurostat definitions (for further details see attached table of electricity prices):

- DC : Price all taxes included: 6.25 Cyprus cent
- Ib : Price all taxes included: 12.22 Cyprus cent
- Ig : Price all taxes included: 4.98 Cyprus cent. (1 Cyprus cent = approx. 1.7 Eurocents) (CERA 2005)

Proposed national average network costs

ITEM	MAX. DEMAND CHARGE CYP/MW/MONTH	ENERGY CHARGE CYP/MWH	AVERAGE KWHR CHARGE CYPCENT/KWHR
High Voltage (66-132kV)	2570.36	-	0.586
Medium Voltage (11kV)	1773.57	4.1	0.821
Low Voltage (400 Volts)	-	8.92	0.892
Transmission System Operator	-	0.23	0.023
Ancillary Services	-	1.22	0.122
Long term cold reserve	-	3.22	0.322

Average Total CYP cent/kWhr	2.766
EURO cent/kWhr	4.72

The Electricity Authority of Cyprus (EAC) has committed itself to purchase all electricity from RES under defined conditions of the connection between the RES producers and the electricity grid. (Cyprus Institute of Energy and EREC 2004). The fixed purchase price for is 6.3 € cents/kWh (3.7 cyp. cent/kWh). In 2004, the “New Grant Scheme For Energy Conservation and the Promotion of the Utilization of Renewable Energy Sources” (2004-6) started and, according to the Law, a managing board of the Fund was created. The grant scheme includes the promotion of all forms of RES that exist in Cyprus and the promotion of energy efficiency. It provides financial incentives in the form of governmental grants (30-40% of investments) for investments in wind energy systems, solar thermal, PV, biomass, landfill and sewage waste using RES. (European Commission 2004b).

The feed-in tariffs are as follows: Wind: first five years: 9.2 € cents/kWh (5.4 cyp. cent), for the next 10 years: 4.8 € cents/kWh to 9.2 € cents/kWh (2.8 to 5.4 cyp. cent/kWh) according to the mean annual wind speed. Biomass, landfill and sewage: 6.3 € cents/kWh (3.7 cyp. cent/kWh) PV up to 5 kW: 20.4 € cents/kWh (12 cyp. cent/kWh) (European Commission 2004b).

The fund is financed by a tax of 0.13 cents/KWh (0.221 euros/KWh) on every category of electricity consumption (in force since 01.08.2003). The EAC pays a special premium depending on the technology used from this fund. (European Commission 2004b)

The Commission Communication on electricity from renewables (COM(2005) 627, 7.12.2005) considers that electricity prices in Cyprus ‘seem to be sufficient’ for development of on-shore wind power, but not for agricultural or forestry biogas. The data on price support for small scale hydropower are insufficient as the Communication does not include some investments. However, this energy source has only limited potential.

Institutional and public support issues

The Energy Department of the Ministry of Commerce, Industry and Tourism is responsible for the administration of all applications regarding RES and Energy Conservation. (Cyprus Institute of Energy and EREC 2004). Support is also given by the Electricity Authority of Cyprus.

The special fund created to promote RE and energy efficiency is managed by the Board, which is under the supervision of the MCIT. The board also decides on the beneficiaries of these grants. The fund is financed by an electricity consumption tax of 0.13 cents/KWh (0.221 euros/KWh), which is collected by the authorised electricity providers and transferred to the grant. (Cyprus Institute of Energy and EREC 2004)

The Cyprus Energy Regulatory Authority (CERA) and the Transmission System Operator (TSO) were established in 2004 according to the EU regulation with the law on Electricity Market Regulatory (N.122(I)/2003). One of CERA’s objectives is to promote RES.

As part of the measure to increase and promote RES, the Applied Energy Centre (AEC) was established in 1986 to serve as a focal point for Renewable effort in the country. In 2000, the Institute of Energy was established with the aim to develop and promote Renewable Energy Sources (wind, solar, biomass, hydroelectric, geothermal, or any other form of renewable energy known, or which will prove to be of interest in future) and energy conservation and energy efficiency. The Institute of Energy shares the facilities with the AEC. (CIE 2005)

5.2 Experience of previous and other ongoing investment programmes

The first grant scheme ran from 1999-2003. The money was granted to existing enterprises in the sectors of manufacturing industry, hotels and agriculture. The maximum amount granted was Cy £30,000 or 30% of the total investment. (CIE 2005)

A new national grant scheme (2004-2006) for the promotion of renewable energy was then adopted. The grant scheme began in February 2004 and the fund was activated in August 2003 and has been supported by an electricity consumption tax of 0.22 €/kWh, donations and governmental grants. The financial incentives that are part of the Action Plan 2002-2010 for the promotion of RES and RUE in all economic sectors are 40 million CY pounds (ca. 68 million euros). (CIE 2005).

The grant scheme for energy conservation and the promotion of the use of renewable energy sources covers investments in energy production from biomass and the following applications for the utilization of biomass resources for energy uses other than transport purposes are eligible for financing: Tele-heating and/or cooling, Co-generation electricity/heating and/or cooling, Heating/Cooling production. The total cost of the investments was up to 2005 1.2 million CYP (2.06 million Euro). (Republic of Cyprus – MCIT 2005).

For biofuels, a law has been drafted in 2005 to subsidies 30%, or up to £400,000 in investment costs per project. (Kambas 2005)

The ERDF under the heading ‘environmentally friendly technologies, clean and economical energy technologies’ has funded under the heading ‘assisting SMEs and the craft sector’ to the total of €1,419,067 from EU sources and €1,948,499 from national sources. It is not clear how far this funding contributes to energy management specifically.

Needs for the future

For 96% of all Cyprus energy comes from imported fossil fuel, using up to 62% of the country’s export revenues, Cyprus should have a high interest in RES, the only domestic energy resource. Cyprus has one the highest rates of CO₂ emissions per capita (9 tonnes). (www.res-cyprus.net). Though, Cyprus has no quantified reduction targets according to the Kyoto-Protocol because it is neither an Annex 1 country of the UNFCCC nor an Annex B country of the Kyoto Protocol, Cyprus committed itself to cut down CO₂ emissions. As climate change will have a huge impact on the island, Cyprus is sensitive for this issue. Cyprus signed the Convention in 1992 and ratified it in 1997. The Kyoto-

Protocol was ratified in 1999. The Focal Point is situated in the Ministry of Agriculture, Natural Resources and Environment (MANRE). According to the NAP of Cyprus, a Strategic Plan for the limitation of the greenhouse gases emissions in Cyprus was prepared by the National Observatory of Athens. The SP includes a number of measures and policies. (NAP report)

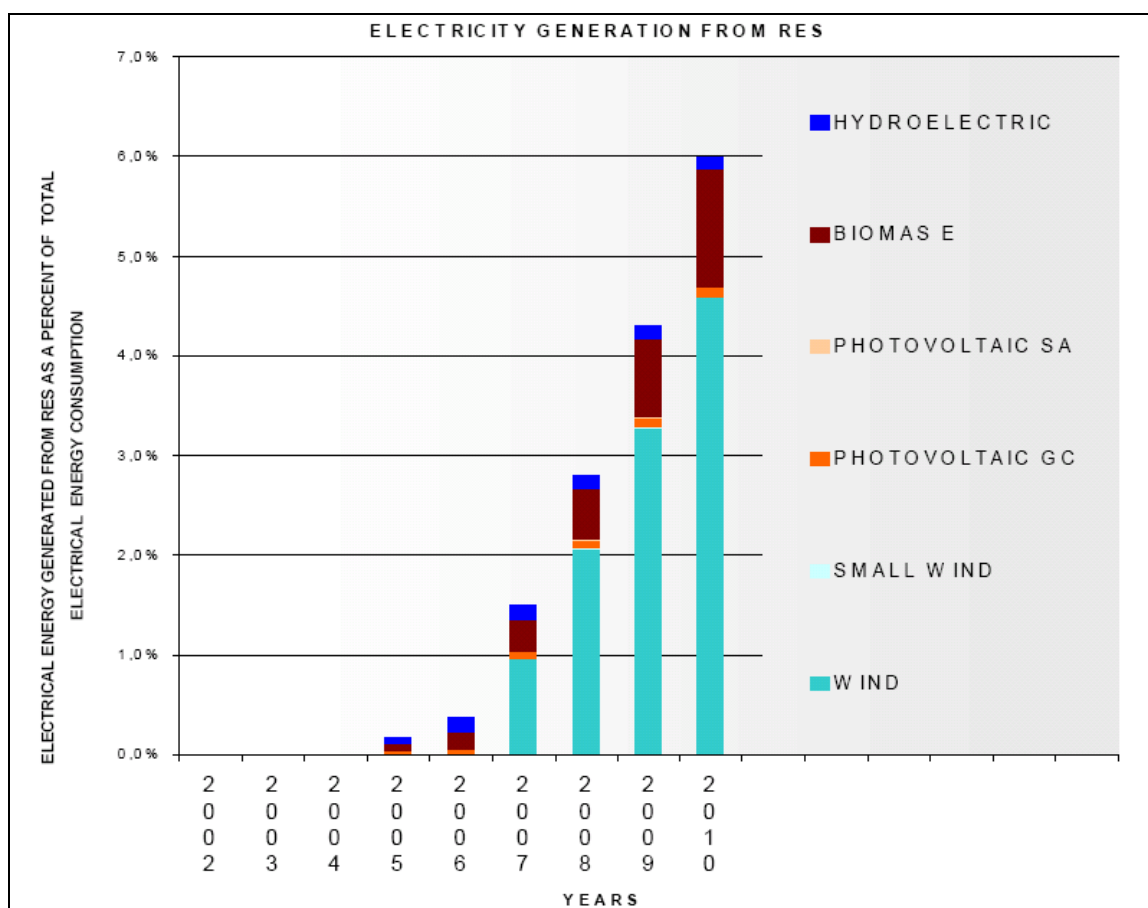
The most important measures are done in the field of renewable energies, natural gas for electricity production and energy efficiency. The strategy focuses as well on the growing transport that should be handled by the promotion of public transport, small engine capacity vehicles, among others. The industrial sector will reduce its emissions by substituting conventional fuel by natural gas and waste incineration eg in the cement production industry. (NAP report)

Cyprus' renewable energy target for primary energy is to double it from 4.5% in 1995 to 9% by 2010, and to increase the RES contribution to Electricity generation from the present almost zero level to 6% by 2010. These aims were set out in the accession treaty and transposed in the Action Plan for Renewable Energy Resources (2002-2010) by the Ministry of Commerce, Industry and Tourism (MCIT) that is responsible for Renewable Energy (Cyprus Institute of Energy and EREC 2004). Cyprus consumes 650,000 metric tonnes of fossil fuels per year, the national target for biofuel is 6,500 metric tonnes. (Kambas 2005)

Cyprus is still some distance from fulfilling the renewable targets, especially in the electricity production. The target for RES electricity is considered as being difficult but feasible if all relevant legislation are being implemented and grant scheme reinforced and upgraded. (www.res-cyprus.net)

In order to comply with the acquis, provisions of Directives 96/92/EC and 2003/54/EC concerning common rules for the internal market in electricity, Cyprus liberalised its electricity market. Thus, the independent, not-for-profit, semi-governmental Electricity Authority of Cyprus (EAC) had to open 35% of the electricity market on generation and supply for competition the date of accession. (MCIT website) The EAC guarantees to buy any electricity from RES. For many foreign and local/national investors have an interest in investing in RES with support of the new grant scheme on Cyprus, the liberalisation might have a positive impact for RES. (www.res-cyprus.net)

As already mentioned the energy sector in Cyprus is heavily responsible for CO₂ emissions for most energy comes from oil. In order to follow a sustainable development strategy Cyprus needs more RES and energy efficiency. The legislations passed are aiming in this direction.



Source: Pharconides 2005, CIE

Energy from RES

	2000	Today (2005)	2010
GDP (in 000 M€ '00)	9.8*	11.7*	14.0*
population	750,000*	780,000*	810,000*
Households		247,700**	
Energy demand/ Gross inland consumption – GIP (Mtoe)	2.43*	2.57*	2.8*
RES as Mtoe and % in GIP	0.05 (1.9%)*	0.07 (2.7%)*	0.09 (3.3%)*
Electricity generated/ capita (kWh/inh)	4465*	4949*	5515*
CO₂ emissions (Mtoe) and % 1990 levels (4.5 Mtoe)	7.2 (59.1%)	7.5 (66.1%)	8.1 (79.3%)
CO₂ emissions/capita	9.59*	9.55*	10.00*

(t of CO₂/inh)			
CO₂ emissions/ GDP	0.7*	0.6*	0.6*
8t of CO₂/M€ '00)			

*European Commission, Energy and Transport Trends to 2030

** Republic of Cyprus, CyStats

Additionally, there is a Law on the Promotion and Utilisation of RES and Energy Conservation. In 2004, the “New Grant Scheme for Energy Conservation and the Promotion of the Utilization of Renewable Energy Sources” (2004-6) started and, according to the Law, a managing board of the Fund was created. The grant scheme includes the promotion of all forms of RES that exist in Cyprus and the promotion of energy efficiency. It provides financial incentives in the form of governmental grants (30-40% of investments) for investments in wind energy systems, solar thermal, PV, biomass, landfill and sewage waste using RES. (European Commission 2004b) The new grant scheme includes the two components: A Energy Conservation and B Renewable Energy Sources.

New grant scheme

I/No	INVESTMENT	% SUBSIDY of eligible costs	Total Purchase Price per KWh (incl. subsidy)
A.1.	Energy conservation in existing enterprises and non profitable organisations	30% Maximum amount of grant £50,000	
A2	Insulation of existing households	30% Maximum amount of grant £1,000 For house holds above 600m 30% Maximum amount of grant £1,500 100% for the first £800	
A3	Co-generation	30--45% Maximum amount £100,000	Day Rate: 3.82 cent Night Rate: 3.35 cent EAC Day Rate 1.71 cent EAC Night Rate 1.5 cent Day=07:00-23:00 Night=23:00-7:00
A4	Hybrid and other vehicles running on alternative fuels	Initial Subsidy £700 for Hydride vehicles running on alternative fuels, and £400 for electric cars. Maximum number of cars for enterprises 7	

Source: Pharconides 2005, CIE

	Installation	% Subsidy	Price of KWh
B1 Wind energy systems for electricity production	B1.1 Large commercial systems for the first 5 years		5.40 cent, 5.40-3.70=1.70 cent

			subsidy
	For the next 10 years		From 2.80 cents up to 5,0 cents according to wind resource
	B1.2 Small systems of up the 30 KWh capacity	40-50%, maximum 10,000 CYP	3.70 cent, no operating support is offered
	B1.3 Small water pumping systems	40-50%, maximum 10,000 CYP	
B2 solar systems	B2.1 central water heating systems	30%-45% of eligible costs, Maximum amount of grant £10,000	
	B2.2 Space heating and cooling	40-55% of eligible costs, Maximum amount of grant £50,000	
	B2.3 Domestic solar systems	20% of eligible costs, Maximum amount of grant £100-200	
	B2.4 swimming pool water heating systems	30%-45% of eligible costs, Maximum amount of grant £10,000	
B3 Biomass utilisation		Grants of 40-55% of eligible costs, The maximum amount of grant is £68,750 district heating £11,000 for households £400,000 enterprises (New, more generous, scheme is being developed for the promotion of energy production from biomass. Generous support is offered for the produced electricity. Up to 7.5 cents per KWh according to the category of investment)	3.7 cents per KWh, No operating support is offered with current scheme
B4 Photovoltaic Systems	B4.1 Small photovoltaic systems of 5 KWp capacity, connected to the grid.	For households and other entities and enterprises not engaged in economic activities the grant is set to 55% of eligible costs. The maximum amount of grant £9,500. For enterprises the grant is 40% of eligible costs. The maximum amount of grant is £7,000 NEW Scheme will allow investors to select between subsidy on initial investment or only running support	12 cents EAC 3.7cents SF 8.3cents Or 22.4 cents for households 19.6 cents for companies
	B4.2 Autonomous / hybrid (not connected to the grid), of up to 5KWp capacity.	For households and other entities, organizations not engaged in economic activities, the grant is set to 55% of eligible costs. The maximum amount of grant £9,500 For enterprises the grant is 40% of eligible costs.	

		The maximum amount of grant is £7,000	
B5 Desalination RES	Desalination using RES	40%--55% of eligible costs. The total amount of grand should not exceed the amount of £100,000	
B6 Hydroelectric systems	Small hydroelectric systems	40%-55% of eligible costs. The maximum amount of grant is £30,000	3,70 cent per KWh No operating support is offered

Source: Pharconides 2005, CIE

The fund is financed by a tax of 0.13 cents/KWh (0.221 euros/KWh) on every category of electricity consumption (in force since 01.08.2003). The EAC pays a special premium depending on the technology used from this fund. (European Commission 2004b)

The feed-in tariffs are as follows: Wind: first five years: 9,2 € cents/kWh (5,4 cyp. cent), for the next 10 years: 4,8 € cents/kWh to 9,2 € cents/kWh (2,8 to 5,4 cyp. cent/kWh) according to the mean annual wind speed. Biomass, landfill and sewage: 6,3 € cents/kWh (3,7 cyp. cent/kWh) PV up to 5 kW: 20,4 € cents/kWh (12 cyp. cent/kWh) (European Commission 2004b)

After criticism about the bureaucratic and complicated application procedure to receive these grants, application forms and procedures were simplified. The following table summarises the application status for the grant scheme.

In order to contribute towards increasing the use of renewable energy sources and/or cogeneration for electricity generation, EAC purchases electricity produced in this manner at the following prices:

- Renewable Energy Sources: 3.7 cent/kWhr
- Cogeneration: Day rate (07:00-23:00): 1.71 cent/kWhr; Night rate (23:00-07:00): 1.50 cent/kWhr

The above kWhr purchase prices are based on a nominal fuel price of CY£50 per metric ton. In each period the kWhr purchase prices shall be increased or reduced by 0,0015 cent per kWhr for each 5 cents by which the cost of fuel per metric tonne, as may be prescribed by EAC in the period, shall be above or below CY£50 per metric ton.

The purchase of electricity from PV is subject to the following terms and conditions:

- The technical requirements, as specified in the quoted terms are satisfied
- A 15-year Purchase Agreement is signed between the producer and EAC. Upon expiry of the 15-year period, the Agreement may be renewed for further periods of five years, at the prevailing rate, if requested by the producer and agreed by the EAC.
- The initial purchase price from the part of EAC will be 3.7cents/kWh. This does not include the subsidy from the Special Fund amounting to 8.3 cents/kWh, thus making a total of 12 cents/kWh for every kWh produced by the Photovoltaic System.

The subsidies and guarantees of electricity purchase have resulted in a significant number of applications. These are outlined in the table below.

Current status of submitted application (11/2005)

Wind Systems	Submitted applications		Approved	Installed	Existing	Total installed capacity, expected end of 2005
Large commercial systems	400 MW, sufficient for approximately 17% of total electricity consumption by 2010		65 MW, sufficient for approximately 3% of total electricity consumption by 2010	None	None	none
Small systems of up to 30 KW capacity	24 KW		24 KW	None	203 KW	227 KW
PV systems	Average size	Submitted application	Approved	Installed	Existing	Total installed capacity, expected end of 2005
Grid connected	≤ 3.2 KWp	550 KWp	500 KW	400 KW	65 KW	565 KW
Stand alone	≤ 1.2 KWp	110 KWp	100KW	70 KW	370 KW	470 KW
Solar and energy saving	Submitted application		Approved	Installed		
Domestic, solar heating systems and thermal insulation	Approximately 2500 application		2500	2500		
Industrial, solar heating systems and energy saving investments	Approximately 300 applications		300	300		

Source: Pharconides 2005, CIE

The Cyprus Energy Conservation Action Plan aims to double the contribution of RES to 9% the energy balance by 2010 (from 4%) and increasing its proportion in energy generation to 6% (from 0%).

Currently electricity generation is undertaken by three major power stations. The total capacity (988 MW) of these power stations is indicated in the table below.

Power station	Units	Capacity (MW)
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Vasilikos	2 X 130 MW oil/steam	260
Vasilikos	1 X 38 MW gas turbine	38
Dhekelia	6 X 60 oil/steam	360
Moni	6 X 30 MW oil steam	180
Moni	4 X 37.5 gas turbines	150
TOTAL		988

Pharconides (2006) of the Cyprus Institute of Energy considers that:

- The estimated exploitable potential for wind generation is 150-250 MW.
- The estimated exploitable potential for hydro generation is less than 1 MW.

The aim is to have the following contributions to electricity generation:

- About 4.5% from wind
- About 1.5% from biomass
- Small contributions from other sources.

Although the current contribution from wind energy is minimal, there is already significant activity in this area, not least stimulated by the grant system that is available. The following table (Pharconides, 2006). It shows the number of applications submitted for wind turbines (to apply for a subsidy) and the number approved.

Type	Submitted application	Approved applications
Large commercial	26 totalling 743 MW	4 totalling 65 MW
Small up to 30 KW	10 totalling 24 MW	0 (note there is already 203 KW existing)

The four approved applications would be sufficient for 3% of electricity generation projected for 2010 and the submitted applications would address 25% of generation (this assumes a 25% utilisation rate due to wind conditions). Note that the latter is above what is considered the total potential for wind generation in the country.

There is also currently significant activity in relation to the introduction of PV. These are described in a similar table.

Type	Average size	Submitted applications	Approved	Installed
Grid connected	2004: 3.4 KWp	161 totalling 550 KWp	2004: 120 totalling 408 KW	100 KW subsidised plus 145 KW not subsidised or installed before 2003
Grid connected	2005: 4.6 KWp	139 totalling 640 KWp	2005: 88 totalling 405 KW	
Stand alone	<1.2 KWp	2004: 86 totalling 103 KWp 2005: 55 totalling 66	2004: 75 totalling 90 KW 2005: 32 totalling 38 MW	32 KW subsidised plus 370 KW installed before 2003

		KWp		
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PV systems both substitute for energy generation by direct supply to individual buildings, but the larger systems also supply to the grid and substitute for fossil fuel generation.

It can be seen from this table that the number of approved applications, if installed, would deliver another significant contribution to the proportion of generation from RES.

From the figures it would suggest that the 6% goal of electricity generation from RES by 2010 should be met. However, Pharconides (2006) states that the objective is ‘difficult but attainable’. This suggests that there is expected to be a significant gap between approved applications and actual working installations.

One reason for the seemingly large figures for wind energy (if one considers applications) is partly that there are multiple applications for the same resource (i.e. site), but these are only a small percentage of the total applications. Thus from the total of 740 MW of the applications, approximately 100-250MW will not be installed because they are basically for the same site. The main reason for the miss-match between the number of applications and the number of MW of exploitable potential is that the applications are basically ‘declarations of interest’. Indeed these have continued to rise since the publication of Pharconides (2006), so that currently they stand around 1GW (Pharconides pers. Com.). The applications are submitted to the Ministry for subsidy on the produced energy, but they are only evaluated when the investors/ applicants produce and submit all the required documents and also, very importantly, the valid/certified wind measurements that have to be for a period of at least 12 months and come from the location where the proposed wind park will be erected. Thus it is expected that the difference between the final capacity of installed wind generators and the current applications will be significant.

Overall, PV systems will contribute only a very small amount to the 6% renewable target, even though there has been much interest and many applications. The maximum possible contribution of PVs is 0.6% (if all the money is invested on PVs). Wind systems will be the prevailing renewable technology and contribute most to the 6% target.

Even with the large number of wind applications, there can still be problems reaching the 6% 2010 target. In order for this to be done, they must be built. To do this requires a building permit and, therefore, the acceptance of local authorities and communities. As none are yet built, this is difficult to judge, although it might become clearer when the first wind farm is built in 2007. Currently 107.5 MW of wind generation have all of the necessary permits and subsidies. All that remains is the start of construction.

However, while the national target for 2010 might be met (and further progress made beyond that date), there is clearly the potential for further exploitation of RES.

The costs of such developments are difficult to determine accurately as each depends upon the particular size and individual subsidy. However, from data above, maximum subsidies are similar for wind and PV systems, although the former generate more electricity. Currently one can give a conservative estimate of around 80 PV systems receiving subsidy

per year. If this continues until 2013 at a maximum rate, the total subsidy would be €4.5 million. The current applications for wind generation already seem to cover the wind potential for the country. If the applications are, however, financed over forthcoming years, the total required subsidy would be around €K150-250.

There are no known technical barriers for RE. One barrier for biomass and biofuel is the water scarcity that makes it unreasonable to plant crops for this purpose rather than crops for eating. There was also resistance from environmentalists to introduce plants that do not need much water because the ecosystem might be affected in a negative way. For Cyprus is against GMO, the fear that modified corn or soya for biomass or biofuel use could be introduced and contaminate the soil is a barrier as well.

Generally people are open to new technologies that improve their living standards and add value. Solar heating systems are already popular and widely accepted because the payback period is short, they are easy to install and maintain and long life. However, the motivation to use renewable energies is not an environmental one but rather an economic interest. For electricity prices are relatively high the trend to invest in solar is has financial aspects, as the. (www.res-cyprus.net).

As in other countries people oppose wind farms in their nearby area (NIMBY syndrome). In Limassol, the EAC wanted to invest in a wind park when the licensing procedure was stopped due to citizens' opposition. A reason could be the lack of knowledge of advantages and disadvantages. (www.res-cyprus.net) Awareness campaigns to promote renewable energy and biofuel would be useful to make the citizens sensitive for this issue, to convince them to fuel their cars with vegetable oil and to accept wind farms. However, given the huge number of applications for wind energy currently in place, it is important to monitor the response of communities to these developments. Thus even though currently applications would, if implemented, form a significant proportion of electricity generation for the country, the social response could limit this. In this instance, therefore, the limitations would not be funding by social acceptance.

Wind power is, if at all, only feasible in mountain areas, the amenity aspect and negative impact on tourism should not be a reason against it. Off-shore wind parks are neither planned nor feasible.

Cyprus and the UK are the only countries taxing Biofuels. In order to promote them, this tax should be lifted or lowered. The tax in Cyprus was for normal diesel 14.3 Cy cents. (Kambas 2005, Markides 2005).

5.3 Priority assessment

The position of RES in Cyprus is changing rapidly. The country already has a very high level of solar thermal application on buildings compared to other countries and, where practicable, this remains attractive to residents. It is, therefore, not a major priority for further investment.

There is little potential for hydro generation in the country and, therefore, it is also of low priority, as is geothermal. Biomass options are limited, due to agricultural restrictions, although some waste to energy may be appropriate (see Chapter 4).

The main areas of potential growth are PV systems and wind energy. Both are, therefore, given a high priority. However, it is questionable whether additional funds are required, given that the current subsidy for construction and electricity purchase schemes have evidently stimulated many applications for development. Clearly the financial equation for development is positive.

As a result the priority ranking is set out as follows.

Renewables	Wind	1
	Hydro (>15 MW)	4
	Hydro (<15 MW)	4
	Solid biomass	2
	Liquid biofuels	3
	Geothermal	4
	Solar thermal	3
	Solar electric (PV)	1

6 NATURAL RISKS

6.1 Current situation

The main natural risks are forest fires, earthquakes and droughts. Being an island, Cyprus would be at risk from flooding from sea level rise due to global warming. Therefore it is an issue that influences Cyprus politics in the Kyoto process.

Droughts

Droughts are a major problem of Cyprus. Low rainfall and salination of aquifers lead to water scarcity especially from June to November. Often three or four, sometimes even six consecutive years of drought are observed. From 1996 to 2000 Cyprus experienced low rainfall and in the following years precipitation was high again. From 1996 to 2000 Cyprus experienced low rainfall and droughts as a consequence. (Monacelli 2005). Droughts are managed within the water management programme. The measures implemented to face the situation were as follows:

- Water supply restrictions
- Demand management measures
- Supply enhancement measures

Another measure to face droughts was to built desalination plants and use of recycled water, especially for irrigation. The measures are generally accepted by public and their sensitivity for water consumption could be strengthened. (Monacelli 2005).

For only 50% of overall consumed water could be water of lower grade quality, the Department of Water Development is subsidising private boreholes (cost €1,500, Government gives €350 as a subsidy) or the recycling of “grey water” for watering the garden and/or for the operation of the WC’s (connection between borehole and WC costs ca €550, of which €350 can be subsidy) in households. This measure saves 2.0 million cubic meters per year of drinking water. This measure saves between 30% and 65% drinking water conservation.

Another development in Cyprus is to separate lightly polluted or Grey Water from baths, showers, hand or wash-basins and washing machines from heavily polluted or Black Water from WC’s and kitchens. Thus, it can be treated accordingly. This development was tested between 1997 and 1998 after five years of research and is now subsidised by the Government (installation for a 1 cubic meter per day production costs €1.400; subsidy of €700 is given). This scheme conserves 30% to 45% of the per capita water consumption of drinking water. (Monacelli 2005).

Chapter 3 on waste water treatment also indicated increasing use of treated waste water for irrigation. Drought will, therefore, remain an issue. However, many of the measures taken in relation to water management are, and will, tackle this problem.

Earthquakes

Cyprus is situated in one of the largest earthquake-stricken zone worldwide. However, the seismic activity is low and less than in Greece or Turkey. Nevertheless, many destructive earthquakes have struck Cyprus and destroyed town and villages. Whereas the last three decades were relatively tranquil with less seismic activity, from 1995-2000, the seismic activity became more intense and four very strong but non-destructive events occurred with magnitudes ranging from 5.0 to 6.5. (Kythreoti & Pilakoutas 2000).

The seismological section is carrying out monitoring of seismic activities. The aim is to reduce earthquake losses. In 2004, the seismic activity slightly increased (344 local events; 81 on land, 263 offshore, but only seven were felt by humans). The number of the events is considered as being normal. (Republic of Cyprus – MANRE 2004).

The majority of the houses today are constructed in a superior standard, which is not that vulnerable to earthquakes. In 1990-1992 already 90% were built in a superior standard (see table below). A seismic code was introduced in the mid 1980s. Also water dams, hospitals and airports were built according to this standard. Nevertheless, there are still a number of houses with standard or substandard constructions. (Kythreoti & Pilakoutas 2000) This could be the reason why the number of people killed in earthquakes was less in 1995 than in 1953 (two intense earthquakes), whereas the people affected and the economic damage cost increased. (www.em-dat.net).

Percentages of domestic dwellings assigned to superior or standard/substandard construction with respect to earthquake impacts by Kythreoti & Pilakoutas (2000).

Year of construction	Superior	Standard or substandard
Before 1950	20	80
1950-1959	30	70
1960-1969	50	50
1970-1979	60	40
1980-1989	75	25
1990-1992	90	10

Thus measures to mitigate the effects of earthquakes have been being implemented for some years. However, risks remain from a major quake.

Fires

The major natural hazard problem facing Cyprus is forest fires and much of this chapter is dedicated to this issue.

The forest area of Cyprus is mostly found in the Troodos and Pentadactylos mountains. The more widely dispersed agricultural land can also be subject to fires during the summer when the vegetation is dry.

The following tables and figures show the changing number and area of fires in the country over the last few years and then presents these figures in a longer historical perspective.

It is clear that the number of fires and area burnt varies significantly from year to year. Given the importance of climate and the accidental nature of many fires, this is to be expected. Overall the area burnt on private land is greater than that on state owned land and it is through that this could result from the actions of those who work there. So, for example, in 2004 fewer fires than in previous years broke out in state forests (15 forest fires, 14 hector burned). In private and government land adjacent to state forests 164 fires broke out and 960 ha were burned. (Republic of Cyprus – MANRE 2004).

Since 1886, there was an increasing rate of forest fires; from 1930 to 1955 the rate was stable, and in the last 40 years the number of fires has decreased. The burned area in most cases was less than 2000 ha, except for four high peaks in 1890, 1915, 1955, and 1974. The last peak reflected the effects of the war. One reason for the decrease in the number and severity of forest fires is the dramatic reduction in total forest area, together with improved fire management.

Number of Forest Fires and Total Burnt Area for the period 2000-2004

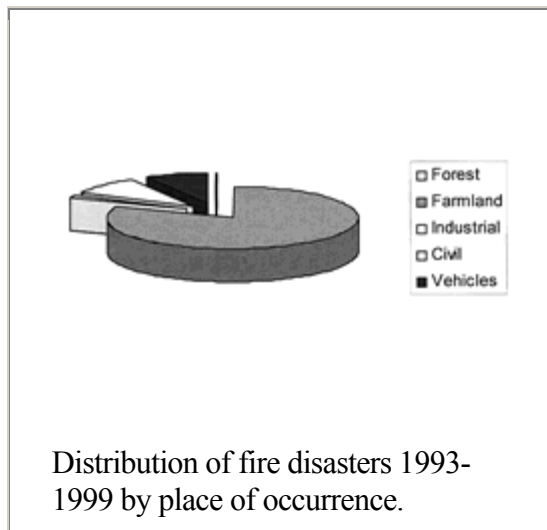
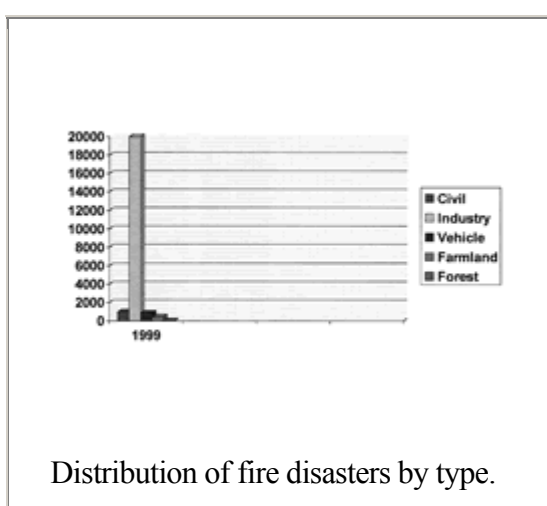
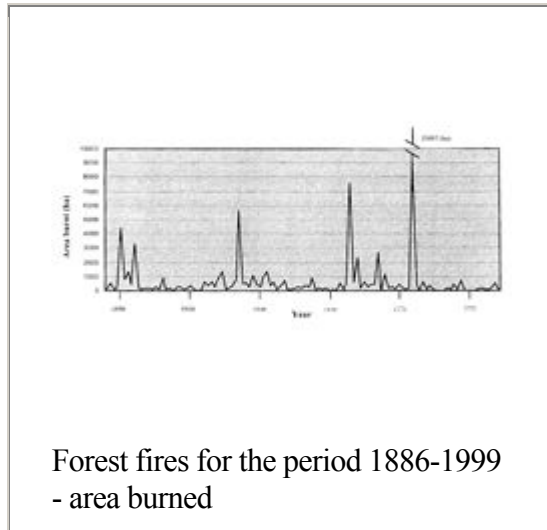
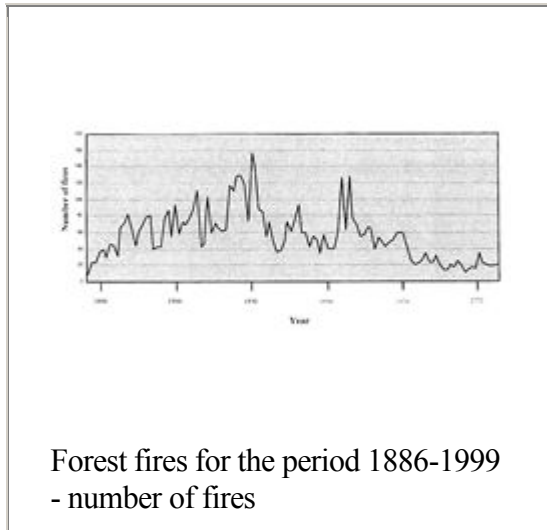
Year	Number of forest fires	Total burnt area (ha)
2000	57	747
2001	58	1099
2002	82	69
2003	72	311
2004	82	405
Total	351	2631

Source: Republic of Cyprus - Ministry of Interior, Press and Information Office: Forest Fire Protection. Fact sheet

Number of Forest Fires within State Forest Land and Total Burnt Area for 2000-2004

Year	Number of fires	State forest land burned (ha)
2000	23	334
2001	23	380
2002	28	20
2003	27	11
2004	15	14
Total	116	759

Source: Republic of Cyprus - Ministry of Interior, Press and Information Office: Forest Fire Protection. Fact sheet



Source: http://www.openspace.eca.ac.uk/costE33/pdf/Pattichis_ForestryCyprus.pdf

The cost of reafforesting a burned area of 1 ha is €1,335, and the overall cost in the last decade was about €10 million. Reafforestation in an island with limited rainfall is not easy and large burned areas may never in fact be reafforested.

The MANRE analysed the causes of forest fires between 2000-2004. The result was that most fires are caused by human activities, such as agricultural activities (20%), people visiting the forests (15%) or deliberately (11%). More specifically the reasons are:

- burning of grass by farmers
- picnickers cooking and grilling with fire
- cigarettes and matches
- Military exercises with ammunition or explosives
- burning of rubbish at non-organised rubbish dumps
- Fires caused by people or machines engaged in any activity associated with forest engineering and forest production.

- hunting during summer time, use of different tools and machinery etc. (Republic of Cyprus - MoI, Press and Information Office)

Institutional issues

The management of natural hazards is carried out by different departments. The Forestry Department of the MANRE manages forest fire issues. The management of droughts eg falls mainly under the responsibility of the Water Development Department. Additionally, the Geological Survey Department (boreholes), the Department of Agriculture (irrigation) and the Environment Services are incorporated in water management. Earthquakes are dealt with in the Geological Survey Department of the MANRE. Concerning investment decisions, the Ministry of Finances and the Planning Bureau are responsible for decisions but also the relevant departments.

Wildland fires in Cyprus are distinguished into two categories¹²:

- fires occurring in State Forest land or in the privately owned lands, situated within a distance of 1 km from the boundary of the State Forest land;
- fires occurring in the privately owned lands, other than those specified in the first category.

For category 1 the responsible Authority is the Department of Forests of the Ministry of Agriculture, Natural Resources, and Environment. The Department is responsible for the detection of forest fires within the State Forest land using a well-organized detection system, through integrated fire management plan.

For category 2 the prevention and suppression of fires are based on an action plan where the suppression of these fires is shared between the Fire Brigade Service of the Ministry of Justice and Public Order and the Department of Forests and other Government Services. The preventive measures and the co-ordination of the suppression are handled by the District Officers of the Ministry of Interior. The detection of the fires in this category is based partly on the detection system of the Department of Forests and partly on other means.

Municipalities and the communities do not participate in the fire management activities, except through general co-operation, to some degree, with the authorities involved.

In exceptional cases, such as the fire in June 2000, it can be necessary to draw upon the armed forces, such as the air force, and to seek assistance from neighbouring countries, such as Greece and Israel.

The Cyprus Forest Law prohibits the lighting of any fire in the forest or within 1 km from the boundaries of a forest. Any person who causes a forest fire shall be liable, in case of

¹²

http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/006/AD653E/ad653e63.htm

conviction, to imprisonment for a term not exceeding five years and/or to a fine not exceeding CY 5,000.

Measures taken to reduce the wildfire hazards in the State Forest land include fuel-breaks along ridges, around picnic and camping sites, along boundaries, the construction of roads, the pruning of roadside vegetation and plantations, and thinning operations. Wildfire risks are addressed through education and information, law enforcement, and patrolling. Problems do remain in private lands, although efforts are made to address these through general education, information programmes, and law enforcement.

More specifically, pre-suppression measures include:

- Firebreaks are constructed in order to break up the continuity of the vegetation.
- To improve fire protection, the Forestry Department maintains a good road network.
- To ensure the necessary amount of water in case of a fire concrete water tanks of about 100m³ capacity are constructed. Hydrants and water valves are installed on pipelines which pass through the forest.
- The Forestry Department maintains a satisfactory number of vehicles with fire-fighting equipment able to transport the personnel to be employed in fire fighting. It also has its own fire engines.
- A number of look-out stations have been established.
- During the fire season regular patrolling is done especially along the forest delimitation line where most of the forest fires start.

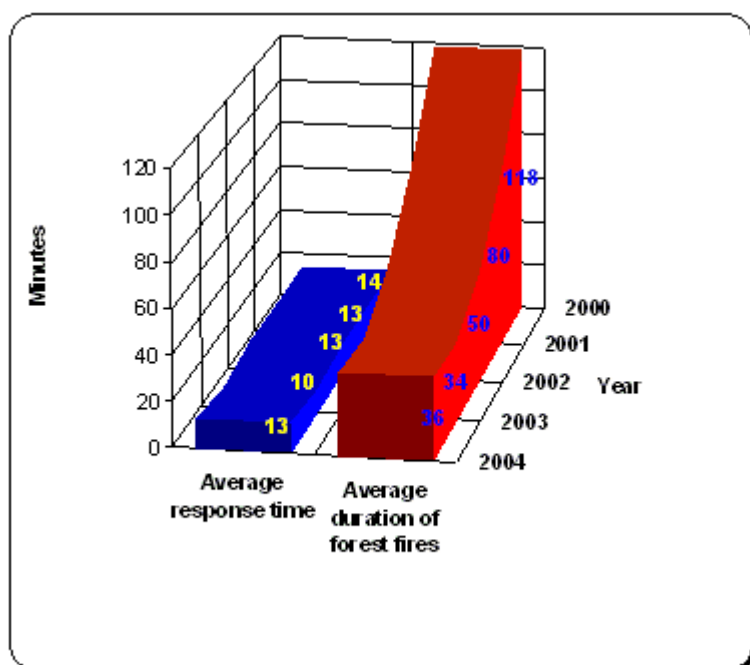
Educational activity includes:

- Talks and interviews of forest officials through the mass media.
- Special programmes through the radio and television services.
- Publication of texts and articles in the press and magazines.
- Lectures and film projection at schools, the Police, army clubs and other organised groups.
- Production and distribution to the public of relative leaflets and stickers.
- The degree of fire hazard is broadcasted on radio and TV several times a day. It is also indicated on special sign posts located at the main forest stations to warn visitors.
- Posters and signposts, which warn the public about the danger of forest fires, are made and placed at conspicuous places of roads and villages.
- Production and distribution to schools of special leaflets.
- The "Save our Forest Week" is celebrated every year. A "Save the Forest Day" is also celebrated in all schools in co-operation with the Ministry of Education.

The Forest Service is under the direction of the Conservator of Forests who is responsible for all forestry work within the island; it consists of four territorial divisions and one working-plans division. The field staff includes seven professional foresters, two forest assistants and 150 permanent rangers and forest guards. Its financial resources derive from annual, ordinary and development budgets authorized by the Government. There is statutory provision for the protection and control of private woodlands by the government at the request of the owners; fourteen private forest properties totalling over 1,000 ha. are

under this protection¹³. During fire season, 320 persons are recruited to form the fire fighting squads. The fire-fighting body is split up into groups of 10-15 men, which are distributed to various forest stations that are considered as key points for attacking quickly and effectively any fire outbreak. Each group is provided with one or more cross-country vehicles equipped with mobile radiotelephone and with at least one fire engine and other necessary equipment for fire fighting. During fire season, forest officials remain standby in all forest stations and divisional headquarters, based on a duty roster, according to a 24-hour plan for each forest division.

The average response time to take action against fires for the period 2000-2004 is 13 minutes and the average duration of the fires that broke out during this period is 64 minutes. The rapid intervention results in minimizing the extent of losses. The total burned area of 81% of the forest fires during the period 2000-2004 did not exceed the one hectare. The data are set out in the following figure¹⁴.



The Forestry Department prepared a National Forest Programme covering the 10-year period ending in 2011¹⁵. The adopted strategy, known as the Rural Betterment Strategy, seeks to protect and improve the natural environment of Cyprus, for the benefit of all citizens and visitors from abroad. The strategy is based on multiple use of the forest

¹³

<http://sادل.uleth.ca/nz/collect/faodocs/import/www.fao.org/docrep/x5364e/x5364e03.htm>

¹⁴ <http://www.moi.gov.cy/moi/pio/pio.nsf/All/C4DA276D1C1530A7C2256DC900390F11?OpenDocument>

¹⁵ <http://www.unece.org/trade/timber/docs/jc-sessions/jc-25/Country%20statements/CYPRUS-2004.doc>

resources. It is directed at improving the condition of the forests, conservation of soils and watersheds, protection of the flora, fauna, biodiversity and heritage sites, the promotion of ecotourism, and sustainable production of wood and non-wood products. The Strategy includes projects to reduce the risk of forest fires, reforestation of burnt and bare areas, conservation and protection of Natural Environment and timber production (forest management). The Fire Protection Plan for rural areas started in 2001. The measures taken for the prevention and control of forest fires are the following:

- increasing the number of employees in the Fire Fighting Task Force and in the Fire Look-out stations and observation points from 180 to 360 and the introduction of 12 hour shifts.
- 20.58 km of new forest roads were built, 1.20 km man forest roads, 7.98 km vehicle forest tracks and 11.4 km extraction roads.
- 20 km of new fire breaks were constructed, 11 hydrants and one water tank and one observation point installed.
- During the summer months mobile patrols were carried out for prevention, detection, and early intervention.
- Public awareness campaign, lectures and mass media publicity for the prevention of forest fires, celebration of the “Save our Forest Week”

Being an island most natural hazards are domestic issues. However, co-operation with neighbours is occasionally important, as noted above for fire suppression in exception cases.

6.2 Experience of previous investment programmes

Investment relating to droughts is addressed in earlier chapters.

Earthquake preparedness is addressed through general emergency response preparedness.

The Forest Fire Protection Plan was planned to be completed within 5 years and the total costs were expected to be 2.5 million Cy£ (€4,360,947). (Republic of Cyprus - PIO 2000).

Earlier investments have clearly delivered significant benefits. For example, the capacity of the fire management system is now significantly enhanced, so that there is extensive action to prevent fires (both on the ground and via education) and the response time for tackling fires that do arise is good.

6.3 Needs for the future

The management needs for drought are addressed in earlier chapters.

The application of building design requirements to cope with earthquake impacts has been in place for some time.

For forest fires there has been significant progress in recent years. However, more is needed. However, much of this is focused on education (both for residents and tourists) and some additional staffing for forest managers and some additional equipment. A key

objective of the Department of Forests is, however, the continuous upgrading of the prevention, detection and suppression of fires. This will require some new technology. However, specific needs for the future are (Papageorgiou, pers com):

- The establishment of a network of remote automatic weather stations to predict potential fire behaviour, assist in fire risk assessment and analyse seasonal fire danger trends.
- The installation of automatic forest fire detection systems in order to enhance the existing conventional detection system.
- The purchase of new, more powerful fire fighting equipment.

6.4 Priority assessment

The priority assessment does not identify what risks are most important to Cyprus. These are clearly droughts, fires and earthquakes. It addresses the priorities for major investment programmes in these areas. From the analysis it is clear that further investment is required in drought management. However, given that major water storage (dams) and supply (desalination) plans are already in place, drought mitigation is focusing on making better use of the water that is available (such as from waste water treatment plants and use of grey water domestically). These actions are intimately linked to the water management issues identified in Chapters 2 and 3. We, therefore, assign them a high priority, although not as a separate investment activity. Therefore, there is no separate figure which is appropriate.

For fire management, there is clearly a very effective system in place. However, some needs for an even more efficient system have been identified and, therefore, a medium-level priority is given to this area.

Thus the priority assessment table is as follows.

Natural hazards	Drought	2
	Fire	2
	Earthquake	4

7 PRIORITY ASSESSMENT

The needs in Cyprus are summarised in the following tables. This section then continues to analyse the elements of these needs and priorities within them.

Table: Needs Summary: Qualitative Analysis

Summary qualitative needs assessment – providing context and background to the priority assessment.

Cyprus

	WATER	WASTE WATER	WASTE	RES	NATURAL HAZARDS
On-going needs being addressed by current initiatives	None new production plants required due to recent major investment	STPs are not required for major agglomerations, but are for smaller (<2,000 pe) rural ones. Some, at least, being met by ongoing investments	Manual/mechanical sorting facilities need considerable extension – some is already planned	Wind (partially)	Improvements in fire prevention and management – no major infrastructure
	Existing plants are of good standard	Existing STPs of higher (tertiary) standard	Recycling facilities are being initiated	Additional solar thermal	Drought measures being tackled through dams, waste water re-use, etc.
	New network largely in place	Further extension of the sewage collection system is needed. Some met by ongoing investments		Solar electric (PV) (partially)	Flooding of little importance
	Renovation of existing network is not applicable	Sludge treatment is of high standard with re-use of sludge and of water	Existing landfill sites are being upgraded, closed and new ones developed.		

Cyprus

	WATER	WASTE WATER	WASTE	RES	NATURAL HAZARDS
Needs requiring further planning and/or investment in 2007 - 2013	N/a	Extension of sewerage collection in rural areas likely to require further investment	Additional waste sorting and recycling facilities	Biomass?	Further development of fire management
		Further facilities for sludge disposal	Additional landfill	Wind extension	Extension of water storage might be required depending on drought developments
		Further assessments of groundwater re-charge	New incineration plants	Additional efforts on liquid biofuels	
			Further promotion on waste reduction	Additional solar electric (PV)	

Key:

Table 2: Needs Summary: Key Indicators

Summary of needs (indicating the additional infrastructure / capacity required) using key indicators to be selected by the national evaluator based on the types of investment needed and where available information allows some quantification of needs – using indicators taken from the needs assessment.

Cyprus

	WATER	WASTE WATER	WASTE	RES	NATURAL HAZARDS
Needs requiring further planning and/or investment in 2007 - 2013	None	<i>New collection systems for smaller rural sources</i>	<i>Improved sanitary landfill</i>	<i>Extension of photovoltaic and other solar systems</i>	<i>Further enhancement of fire protection systems, particularly staffing</i>
		<i>Finalisation of collection systems in municipalities (if not already addressed)</i>	Improved waste sorting and recycling facilities	<i>Extension of wind generation</i>	<i>Further water storage systems</i>
		Sludge disposal	<i>Incinerator?</i>		

Key:

Table 3: Needs Summary: Indicative Investment Needed

Summary of investment needed over the 7 Year Programme Period, providing examples and illustrations if a complete picture is not possible. Highlight key gaps so account can be taken of missing data.

Cyprus

Needs requiring further investment in 2007 - 2013	WATER	WASTE WATER	WASTE	RES	NATURAL HAZARDS
Indicative level of investment (Meuro):	None	120	110	5	?
Indicative examples of the types of investment needed:		Finalisation of collection systems in municipalities	Waste collection, sorting, recycling and disposal systems	Solar and wind energy infrastructure	Additional staff and equipment for forest fire management
Key data gaps:		Unclear if all municipal collection systems are fully funded (as piecemeal) – important as acquis compliant.	Unclear what the impact of greater integration with northern Cyprus might mean.		

Key:

The chapters above have identified the priorities according to each issue. These are reproduced in the table below.

Table. Ranking Types of Investment within Fields (Most important is ranked as 1)

Field	Type of Investment	Ranking
Water Supply	Reservoirs	0
	Drinking water production plant	0
	Transport (inc leakage) - long	0
	Transport (inc leakage) - local	0
	Metering	1
Waste Water	New STPs	2
	Renovation/upgrade STPs	n/a
	New Sewerage collection	1
	Renovation/upgrade sewerage	n/a
	Sewerage pumping stations	1
	CSO upgrading	3
	Sludge treatment	2
MSW	Sludge disposal	2
	Waste collection	3
	Waste sorting	2
	Recovery	2
	Disposal	1
Renewables	Remediation of disposal sites	1
	Wind	1
	Hydro (>15 MW)	4
	Hydro (<15 MW)	4
	Solid biomass	2
	Liquid biofuels	3
	Geothermal	4
	Solar thermal	3
Solar electric (PV)	1	
Natural hazards	Drought	2
	Fire	2
	Earthquake	4

However, it is important to note that other environmental issues are also of importance in Cyprus. Two are worth noting:

1. Hazardous waste management – Cyprus has a very poor record of hazardous waste management and lacks the facilities to cope with the problem. It is, therefore, an investment priority. However, the extent of the needs has not formed part of this study.
2. Northern Cyprus – this is an issue which already affects infrastructure as seen in waste water management in Nicosia. How far further co-operation based on need will take place is uncertain, but needs have largely been based on what is

happening in government-controlled areas, rather than the island as a whole. This will, therefore, be a developing future issue that affects investment.

It must, therefore, be noted that additional funding priorities probably exist beyond those analysed in this study.

In addition, other environmental issues are also of importance in Cyprus, and additional funding priorities probably exist beyond those analysed in this study. Among these, it should be mentioned:

3. Hazardous waste management – Cyprus does not have any system for hazardous waste management. This is currently under active consideration, but there is a need for investment in this area.
4. Biodiversity – Cyprus has a number of important Mediterranean habitats both on land and in the marine environment. The latter will be further protected with progress on waste water treatment as described above and the former through some measures on managing fires. However, further investment will be required to protect sites and species (including migratory) of Community and national importance.
5. Energy saving: although outside the scope of this study, energy saving devices should be taken into consideration when evaluating the needs for renewable energy technologies.
6. Capacity building: issues of institutional capacity have been discussed in relation to the specific areas of this study. However, wider capacity issues also need to be taken into account. These include wider horizontal policy developments, such as on SEA, as well as capacity development generally on new areas such as the use of public private partnerships which are still at a very early stage in the country.

Each type of investment has been assessed for its contribution to the following criteria:

1. securing compliance with the acquis – Cyprus has largely met the requirements of the acquis in relation to drinking water and is on course in relation to waste water treatment (investment needs in this sector go beyond the acquis). The primary area that requires investment to meet acquis requirements is in waste management.
2. avoiding economic and social damages – Previous and current investment in water supply and waste water treatment have been important in this area (both for local communities and enhancement of the tourist economic sector). However, social damages will occur if waste management is not adequately addressed and there are economic gains to be made with increased use of renewable energy sources.
3. encouraging new technology and market development with the potential to replace imports or generate exports – this is most obviously seen in the area of renewable energy sources which have considerable potential for enhancement in the country. However, it is also important to note the role of water conservation measures in encouraging innovative solutions to supply problems.

4. generating employment opportunities in line with national and regional employment goals – many of the developments have limited significant employment opportunities in themselves. However, the improved environment and security that developments have, and will have, are critical in supporting sectors with large work forces, such as tourism.
5. providing employment and training opportunities for low skilled workers or ‘hard to reach’ groups (e.g. ethnic minorities, women, older workers) – see comment on 4 above.
6. promoting cross-border co-operation – this has proved particularly problematic in this case. Being an island, Cyprus has limited cross-border issues to address. However, the obvious area is co-operation with the north of the island. Until recently co-operation has been extremely limited for political reasons. However, recent improve relations have increased such co-operation, as has been noted in relation to waste water treatment. However, systematic assessment of future cross-border co-operation developments is fraught with difficulties and can easily be overtaken by political events. Clearly such co-operation has potential in all areas. Thus if the relations between the two parts of the island do improve in the near future, some re-assessment of investment needs might be required. This is therefore the critical issue with respect to impacts on **regional development**.
7. delivering national and regional environmental strategies and plans which are well integrated with wider development strategies and plans – the primary focus of investment was been on areas delivering such integration (e.g. linking water supply with tourism development and sustainable agriculture). The latter is a good case in point where implementation of the UWWTD, for example, is not simply seen as a means to reduce pollution discharges, but as a means to obtain new water supplies for a critical economic sector. Future improvements in waste management and, more particularly, the energy sector, will provide similar positive interactions.
8. promoting more cost-effective programme design and delivery

Within the issues addressed, however, there are obvious priorities identified in the analyses. The following table provides a multi-criteria score for the issues across all sectors. These scores and the above narratives demonstrate clear priorities:

- Waste water collection and treatment – completion of collection systems in municipal areas and extension of collection and treatment to rural areas. The former is the principal issue relating to acquis compliance in this area.
- MSW – development of further sanitary landfills, improved collection and sorting of waste, development of recycling facilities, possible incineration. All of these issues are also driven by acquis compliance.
- Renewables – principle focus on photovoltaic and wind energy development, with some aquis compliance benefits.
- Natural hazards – some investment further in fire management.

Of these issues, those relating to municipal solid waste management are of the greatest priority. The results are further summarised in the following tables.

Planning

As stated earlier the 2004-6 Single Programming Documents provide little concrete analysis of environmental problems to be addressed in Cyprus (details are provided above and will not be repeated here). There is, therefore, clearly a need for a more detailed analysis in future planning documents. This should include needs identified in this work and other environmental needs listed above. How far environmental priorities compared to other development issues should be address is, however, outside the scope of this work.

Feasibility of Managing and Delivering ERDF/CF Programmes to Meet Needs

This section considers the following three issues in terms of assessing the requirements for investment funding from the ERDF/CF funds:

- Alternative funding sources: the scope to meet investment needs through the market or through national programmes in each area.
- Use of flanking measures: the scope to reduce investment needs through the use of flanking or complementary measures, such as user charges.
- Administrative capacity: the scope to manage and deliver the indicative investment needs identified taking account of the current administrative capacity.

Alternative funding sources

Market support measures.

For most of the issues covered the infrastructure is in public hands (the use of charges is addressed in the next section). There is the potential for market mechanisms in the energy sector. The expansion in RES will place considerable generation in the private sector. However, the actions of the sector are currently dominated by the subsidies available and guarantees of purchase of subsequent generation.

Extent of previous/current/planned funding.

For Cyprus this is a major contributor. The extent of previous/planned funding has been included in the analysis of priorities. Key points are:

- Drinking water supply has now largely be guaranteed by the construction of dams and desalinisation plants.
- Waste management

Use of flanking measures

There are user charges in three areas addressed in this report – water supply, waste water treatment and waste disposal.

Water supply – water charges vary across the country and are important in stimulating conservation by users. They also contribute to operational costs. However, this area is not a priority in the terms of this report.

Waste water – water charges have been important in contributing to the enhancement of infrastructure. However, such charges largely to running costs. This is important given the size of such costs identified. These charges have been taken into account, although the major funding requirement relates to construction.

Waste management – charges fund collection and this system is in place. Further major developments relate to disposal options and such investments need funding beyond what is obtainable through charging.

The scope for additional charging is limited. There is already consumer concern over the level of charging and its variability across the country. Thus the issue raises political questions. The waste water charges probably do not need increasing (except as running costs increase) and the higher running costs for small rural communities need to be taken into account to ensure that they are not unfairly treated (rural development being an important governmental priority). The potential for differential waste charging, for example to stimulate recycling, has not been explored, but could form the basis for a future study.

Administrative capacity

A number of training programmes were undertaken for staff of the National Authorising Officer (Accountant-General), the National Aid Co-ordinator (Planning Bureau) and the Implementing Agencies, covering the Practical Guide of Procedures, preparation of Terms of Reference, etc. The capacity of authorities in Cyprus was significantly enhanced. However, some problems at the time were (source Single Programming Document Objective 2, 2004-6):

- Authorities had no previous experience with EC External Aid Contract Procedures since any assistance received before 2000 was limited and managed centrally from Brussels.
- There was no Financial Officer in charge of procurement at the EC Delegation in Brussels, so that this meant a more time consuming assessment process via Brussels.

It is reported that these issues have been overcome and that tendering ‘is progressing without long delays and no problems are envisaged’.

Managing Authority

The Planning Bureau has been designated as the Managing Authority of the Cohesion Fund, in accordance with the Decision of the Council of Ministers of the Republic of Cyprus No.55.114 dated 12.2.2002. The Permanent Secretary of the Planning Bureau has overall responsibility for the operation of the Managing Authority and will represent it towards the European Commission. The Planning Bureau constitutes also the Single Managing Authority for all the other interventions (SPD of Objective 2, SPD of Objective 3, and SPD for the Fisheries Sector, as well as Community Initiatives INTERREG III and EQUAL) that will be co-financed by the Structural Funds of the EU in Cyprus.

The Planning Bureau, as Managing Authority, has a long list of explicit tasks and responsibilities relating to programme design, the gathering and monitoring of information, reporting, ex-post evaluation, etc. The Planning Bureau has, therefore, established a Structural Funds Unit within it, with four sub-units:

- Sub-unit for programming and evaluation.
- Sub-unit for monitoring and implementation at a project level
- Control sub-unit.
- Sub-unit for organisation, technical support and Management Information System.

Paying Authority

The Treasury of the Republic of Cyprus has been designated as the Single Paying Authority (as defined in Article 8 of Council Regulation 1260/99) for all the Programmes of the Structural Funds and for the Cohesion Fund by the Decision of the Council of Ministers with No.55.114, dated 12.2.2002. The tasks of the Paying Authority have been approved by the Council of Ministers, in its Decision dated 30.4.2003. This is responsible for submitting applications to the Commission, ensuring beneficiaries receive funds, assisting with monitoring and auditing with the Managing Authority, etc. It contains a Financial Management Unit and a Paying Authority Audit Unit, so that payment processes and auditing are separate.

Independent Auditing Authority

The Independent Auditing Authority for the present Programme, which is designated to undertake the carrying out of the third level of audit, is the new Internal Audit Service established by the new Internal Audit Act. The tasks of the Internal Audit Service have been approved by the Council of Ministers in its decision dated 30.4.2003.

There will be no Intermediate Bodies as the limited number of projects calls for a streamline structure.

Solid Waste

The Ministry of Interior is responsible for commissioning the studies and the design of plants and sanitary landfills to consultants, and for the supervision of the construction which shall be undertaken by contractors. The projects will be handed over to Boards that will be established in every district and in which local authorities will be represented. The Boards will have the right to draw contracts with the private sector for the operation and maintenance of the installations. Furthermore, the Boards will have the right to impose a special tax to the inhabitants of the area in order to cover part of the construction cost and part of the operation and maintenance cost. The composition of the Boards has been designed and it will be ratified by Law early in 2004. Control of the implementation lies with the Ministry of Interior.

Sewerage Schemes

On the basis of the Sewage Boards Law, the competent authority for the collection, treatment and disposal of sewage is the Sewage Board of the respective area; Sewage

Boards are established on the basis of the above mentioned Law. The sewage systems in the urban areas, up to the level of secondary treatment, are funded through rates that are collected from users by the Sewage Boards. The Government finances by 100% the installations for tertiary treatment and the transport and distribution of the recycled water for irrigation. In rural areas the Government subsidises the construction cost by a percentage that varies between 75% - 100%, depending on the cost of the project, so that the burden of sewage rates on the inhabitants of the communities is not excessive (according to the criteria used the average rate per connection should not exceed 140 Euro). The Water Development Department acts as a technical consultant, invites tenders for the construction of the projects and supervises their construction. Upon completion of the projects, these are handed over to the corresponding Sewage Board which undertakes the operation and maintenance as well as the imposition of rates to users. The contracts for the construction of the systems are signed by the Department of Water Development and the contractors, whilst the contracts for the operation and maintenance of the systems are signed by the Sewage Boards and the contractors. Since these projects are to a large extent financed by the Government, the final beneficiary of the projects is the Department of Water Development which has the responsibility to invite tenders and monitor the construction of the projects.

This table summarises the analysis using a combination of available qualitative and quantitative information for a given field.

Estimate of the Financial Requirement for all fields, 2007-2013

Stage in the Field Assessment	Water supply	Waste Water	Waste	RES	Risk
A: Indicative Total Investment Needs (Meuro)	None	204 M Euro	110 M Euro	5 M Euro (further government subsidy)	Minor
		Expert estimation of financial need per type of investment: Capital (excluding already financed): (50 urban, 70 rural) 120 Recurrent: 84 from new construction	New landfill sites: 60 Waste sorting: ? EFW: 50	Current wind applications to be financed. Estimate of 80 successful PV system applications per year	Only minor capacity issues to be addressed – no significant financing
B: Investments likely to be covered by market schemes (eg purchasing of renewables)	0	0	0	All schemes include purchasing of RES energy, unless consumed by the producer. Investments already exclude market schemes	0
C: Amount recovered from existing user charges not included in investment need			0		
D: Further amount that could be recovered from higher rates for existing or new charges to fund investment	0	84 M Euro	Unlikely	N/a	0
E: Financing Requirement Before Absorption Review (A-B-C-D) (Meuro)	0	120 M Euro	110 M Euro	5M Euro	0
F: Absorptive Capacity (% of Financing Requirement (E))	n/a	100	100 %	100 %	n/a
G: Financing Requirement After Absorption Review (Meuro)	0	120 M Euro	110 M Euro	5 M Euro	0

Assessing priorities across fields

This Part assesses the priorities across the five fields depending on the criteria, taken into account the total estimated need (see table above) and the contribution of the different types of investment per field for each criterion.

Relationship to Community Strategic Guidelines¹⁶

The Commission has issued guidelines to guide Cohesion policy for the period 2007-2013. It is important, therefore, that the priorities identified in this analysis are discussed in relation to these guidelines. It is important to note, however, that the guidelines address all aspects of Cohesion policy, while the analysis is limited to a sub-set of environmental issues. However, the critical objectives of the guidelines were synthesised into a series of issues to be addressed in a multi-criteria analysis. The following table provides a MCA for the different areas under analysis. Each is scored according to the following issues:

- securing compliance with the acquis (e.g. because of replacement of non-compliant treatment plant)
- avoiding economic and social damages (e.g. because of reduced natural risks of flooding, fire or because of improved environmental quality, or because of increased security of supply)
- encouraging new technology and market development (e.g. priming the development of local PV or passive solar market) with the potential to replace imports or generate exports
- generating employment opportunities in line with national and regional employment goals (e.g. for employment in lagging regions, or in particular cities or in rural areas - because of improvements in environmental quality in particular areas or because of the location of utilities and construction firms)
- providing employment and training opportunities for low skilled workers or 'hard to reach' groups (e.g. ethnic minorities, women, older workers)
- promoting cross-border co-operation (e.g. management of cross-border flooding)
- delivering national and regional environmental strategies and plans which are well integrated with wider development strategies and plans (e.g. where environmental priorities are well linked to economic or social objectives)
- promoting more cost-effective programme design and delivery (e.g. encouraging the use of public-private partnerships, or more effective procurement, or through use of well developed technologies which take account of subsequent maintenance arrangements)

¹⁶ COM(2005)299, 05.07.2005

The priorities identified in the report have different contributions for each area. For example:

- Waste water: there is a major emphasis on acquis compliance, as well as contributing to wider environmental strategies and reducing economic and social damage (e.g. on tourism).
- Waste management has a stronger emphasis on acquis compliance, as well as contributing to wider environmental strategies and reducing economic and social damage. There are also limited opportunities for employment enhancement.
- Renewables has less emphasis on acquis compliance, but a strong emphasis on economic and social enhancement. New energy sources are also potential new nuclei for future employment opportunities.

In Cyprus each area also has the potential for regional development (strictly cross-border co-operation with the North), although this is a far from simple political issue, as noted earlier.

Multi-Criteria Assessment for Cyprus

This table score the potential investment benefits of **new** investments above and beyond those that are already planned..

		Assess the contribution of each type of investment to each criteria							
Field	Type of investment	1	2	3	4	5	6	7	8
Water Supply	Reservoirs	0	3	0	0	0	0	0	0
	Drinking water production plant	0	0	0	0	0	0	0	0
	Transport (inc leakage) - long	0	3	0	0	0	0	0	0
	Transport (inc leakage) - local	0	0	0	0	0	0	0	0
	Metering	0	0	0	0	0	0	0	0
Waste Water Treatment	New STPs	3	7	0	3	0	0	3	3
	Renovation / upgrade STPs	0	0	0	0	0	0	0	0
	New Sewerage	3	7	0	3	0	0	10	0
	Renovation / upgrade sewerage	0	0	0	0	0	0	0	0
	Sewage pumping stations	0	3	0	0	0	0	3	0
	CSO upgrading	0	0	0	0	0	0	0	0
	Sludge treatment	0	7	0	0	0	0	7	0
MSW	Sludge disposal	0	7	0	0	0	0	7	0
	Waste collection	7	7	3	7	7	0	7	7
	Waste sorting	7	3	7	7	7	0	3	7
	Recovery	7	3	3	3	3	0	3	3
	Disposal - new disposal facilities	10	7	7	3	3	0	7	7
RES	Disposal - remediation of existing	7	10	3	3	3	0	3	3
	Wind	3	7	7	3	3	0	7	7
	Hydro (>15 MW)	0	0	0	0	0	0	0	0
	Hydro (<15 MW)	0	0	0	0	0	0	0	0
	Solid biomass	3	3	3	3	3	3	3	3
	Liquid biofuels	3	3	3	3	3	3	7	3
	Geothermal	0	0	0	0	0	0	0	0
Solar thermal	3	7	7	0	3	0	7	3	

		Assess the contribution of each type of investment to each criteria							
Field	Type of investment	1	2	3	4	5	6	7	8
	Solar electric (PV)	3	7	10	0	3	0	7	3
Natural Hazards	Drought	3	7	3	3	3	0	7	3
	Fire	0	7	3	7	3	0	7	7
	Flood	0	7	3	7	3	0	3	3
	Heat wave	0	7	3	3	3	0	3	7
	Storm	0	7	3	3	3	0	3	7

Key: Very Strong Contribution: Score 10

Strong Contribution: Score 7

Limited Contribution: Score 3

Negligible Contribution: Score 0

Scenarios and end points

From the financial analysis the total financial need is summarised at follows.

	Drinking water	Waste water	MSW	RES	Natural hazards	Total
Total €M	0	120	110	5	0	235
%	0	51	47	2	0	

However, if the amount available is analysed according to scenarios using the MCA, the following percentage results occur. .

1. Weighting according to the MCA scores

	Drinking water	Waste water	MSW	RES	Natural hazards
%	1	15	40	24	18

2. Weighting where compliance with the acquis is given a high score (60 points in table, and others 3)

	Drinking water	Waste water	MSW	RES	Natural hazards
%	0.6	15	38	34	11

3 Weighting where higher scores are given to parameters 2, 3, 4, 5.

	Drinking water	Waste water	MSW	RES	Natural hazards
%	2	12	34	32	19

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