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Coping with Drought – The Experiences of Cyprus

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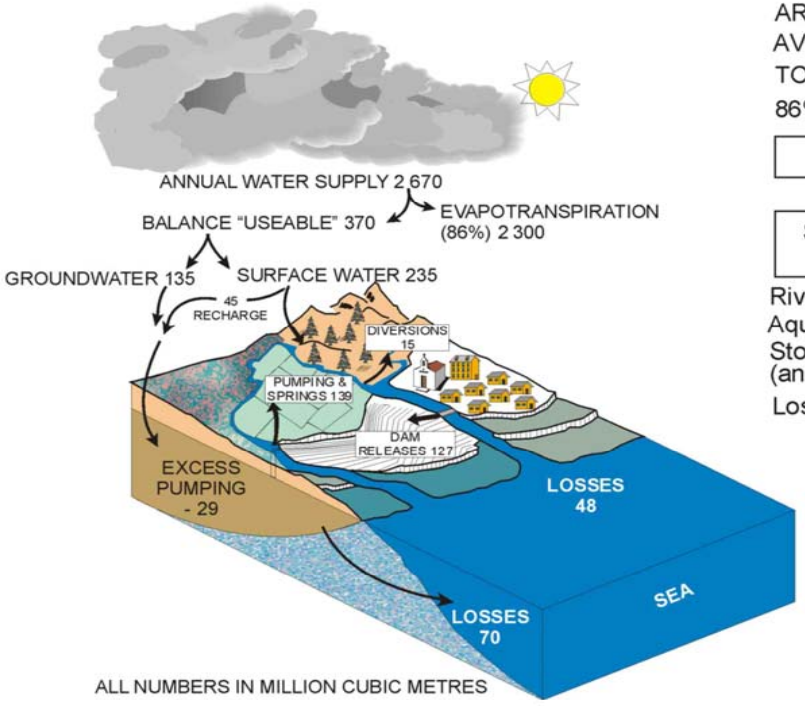
Outline of Presentation

- Water balance.
- Water use.
- Long term water scarcity management.
- Measures in periods of drought.
- Conclusions.

Water Balance

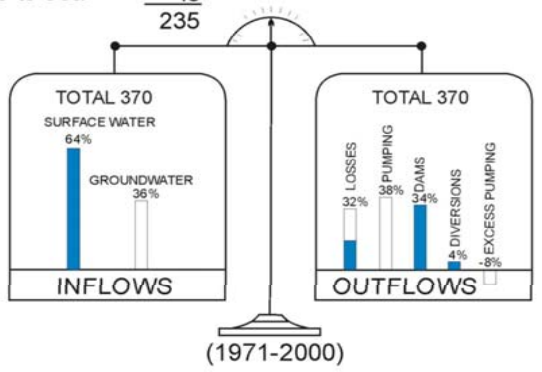
WATER BALANCE FOR CYPRUS (AREA UNDER GOVERNMENT CONTROL)



AREA = 5 800 Km^2
AVERAGE ANNUAL RAINFALL = 460 mm (1971-2000)
TOTAL ANNUAL WATER SUPPLY = 2 670 Mm^3
86% EVAPOTRANSPIRATION = 2 300 Mm^3

BALANCE "USEABLE" = 370 Mm^3

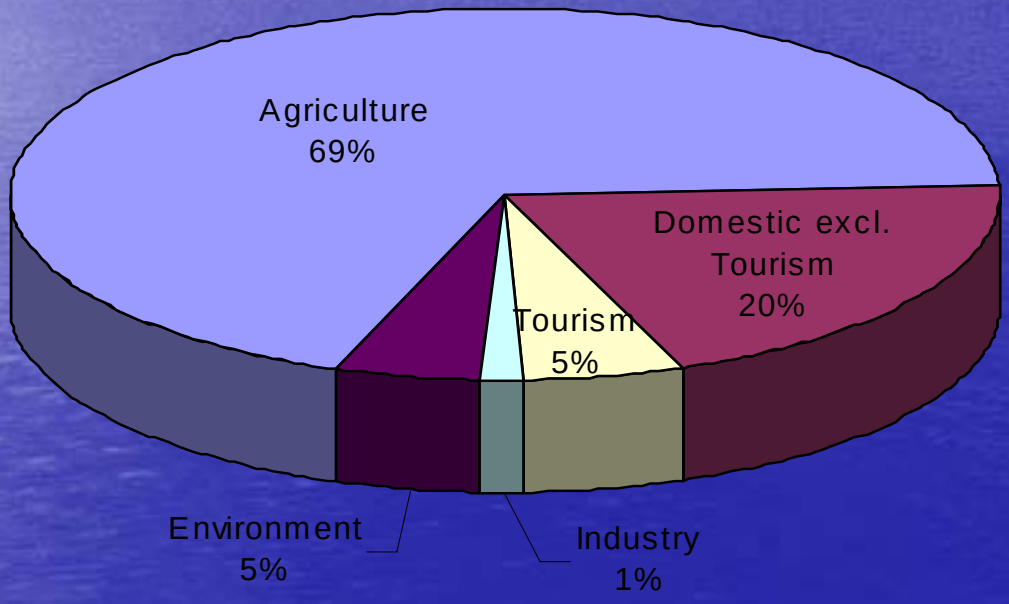
SURFACE WATER 235		GROUNDWATER 135	
Rivers diversions	= 15	Pumping Springs	= 139
Aquifer recharge	= 45	Losses to sea	= 70
Stored in dams (and used)	= 127	Excess pumping	= - 29
Losses to sea	= 48		180*
	235		



(1971-2000)

Water Use

Distribution of Water Demand from various Sectors - Year 2000

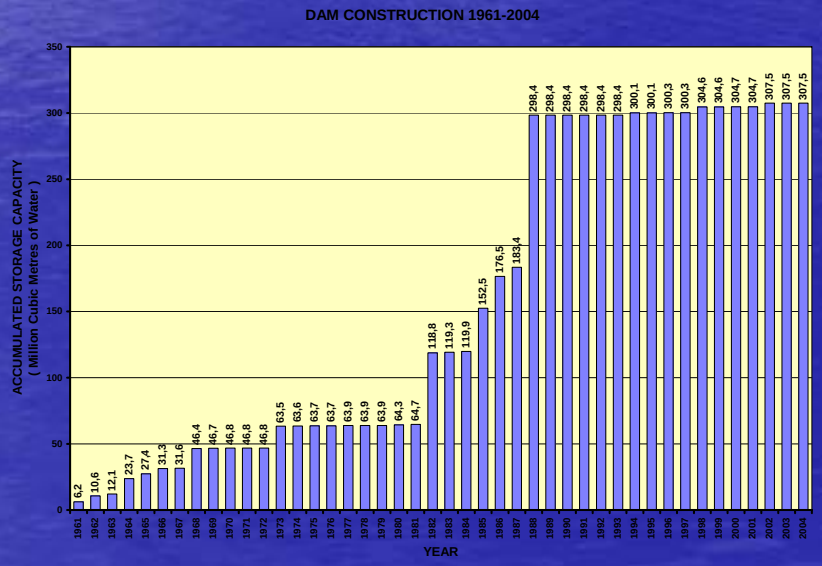


Long Term Water Scarcity Management

- **Water master plan in the 1970's, which envisaged:**

  On the Supply Side

  – **the construction of dams - dam capacity increased from 6 MCM in 1960 to 307,5 MCM today,**



Long Term Water Scarcity Management (2)

- drilling of boreholes, for domestic and irrigation purposes,
- construction of water treatment plants and
- construction of recharge works.

Long Term Water Scarcity Management (3)

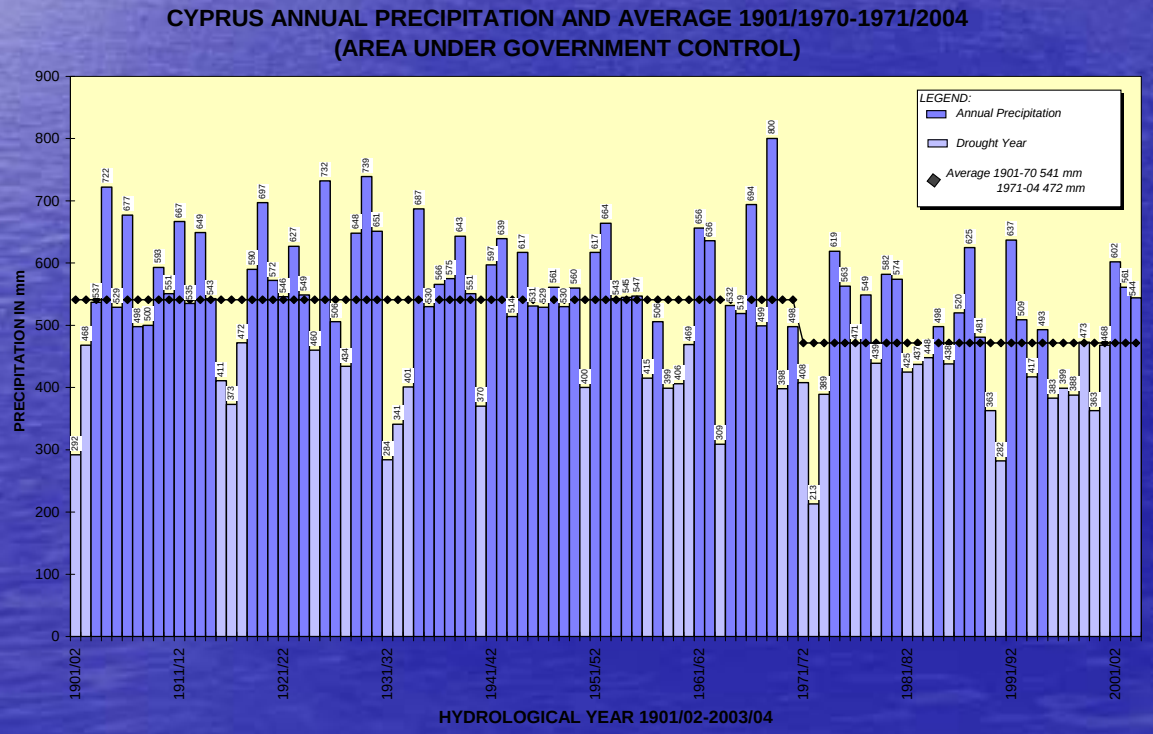
On the Demand Side

Water demand management measures such as:

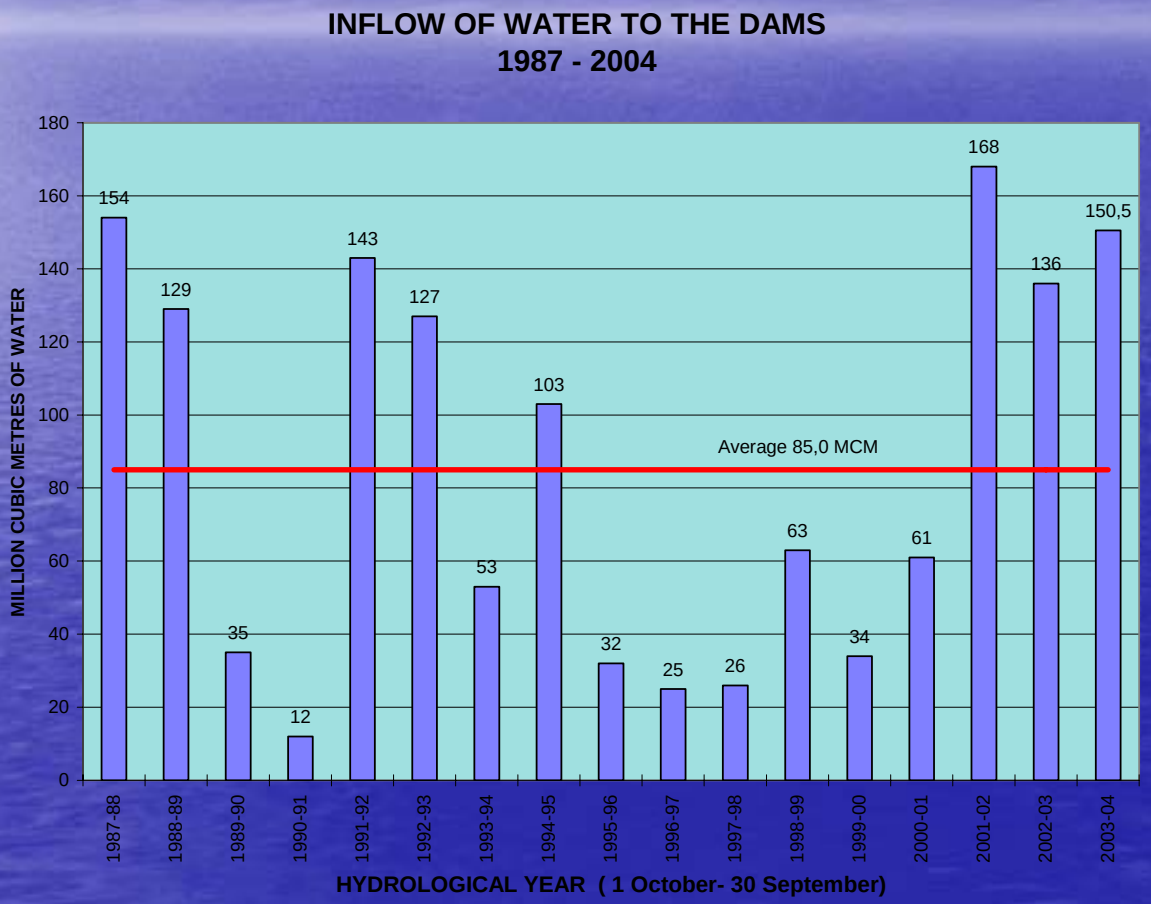
- installation of improved on farm irrigation systems,
- construction of modern efficient conveyance and distribution systems,
- water charge imposed for domestic and irrigation water,
- leakage detection systems and real time tele-monitoring and tele-control are now used.

Long Term Water Scarcity Management (4)

- Available water was still not enough to satisfy the water demand for domestic and irrigation needs.



Long Term Water Scarcity Management (5)



Long Term Water Scarcity Management (6)

- The groundwater resources have been the most obvious and easily accessible sources of water for many years.
- Groundwater resources heavily over pumped especially during periods of drought.
- Seawater intrusion of many coastal aquifers.
- Deterioration of both quality and quantity of groundwater.

Long Term Water Scarcity Management (7)

- The revised policy objective is to:
  - increase the water security by making the supply of water for domestic needs independent from the climatic behavior,
  - increase the reliability of supply of water and
  - reduce water demand.

Long Term Water Scarcity Management (8)

- Cyprus turned to non-conventional water resources:
  - seawater desalination to augment potable water supply and
  - recycling of treated municipal effluents for irrigation and ground water recharge.

Long Term Water Scarcity Management (9)

- Revision of the existing legal and institutional framework.
- All stakeholders to work together for effective water management.
- Efforts are now focusing on establishing a new Directorate for Integrated Water Management.
- Management of the island's water resources within the framework of the national water policy in a holistic way.

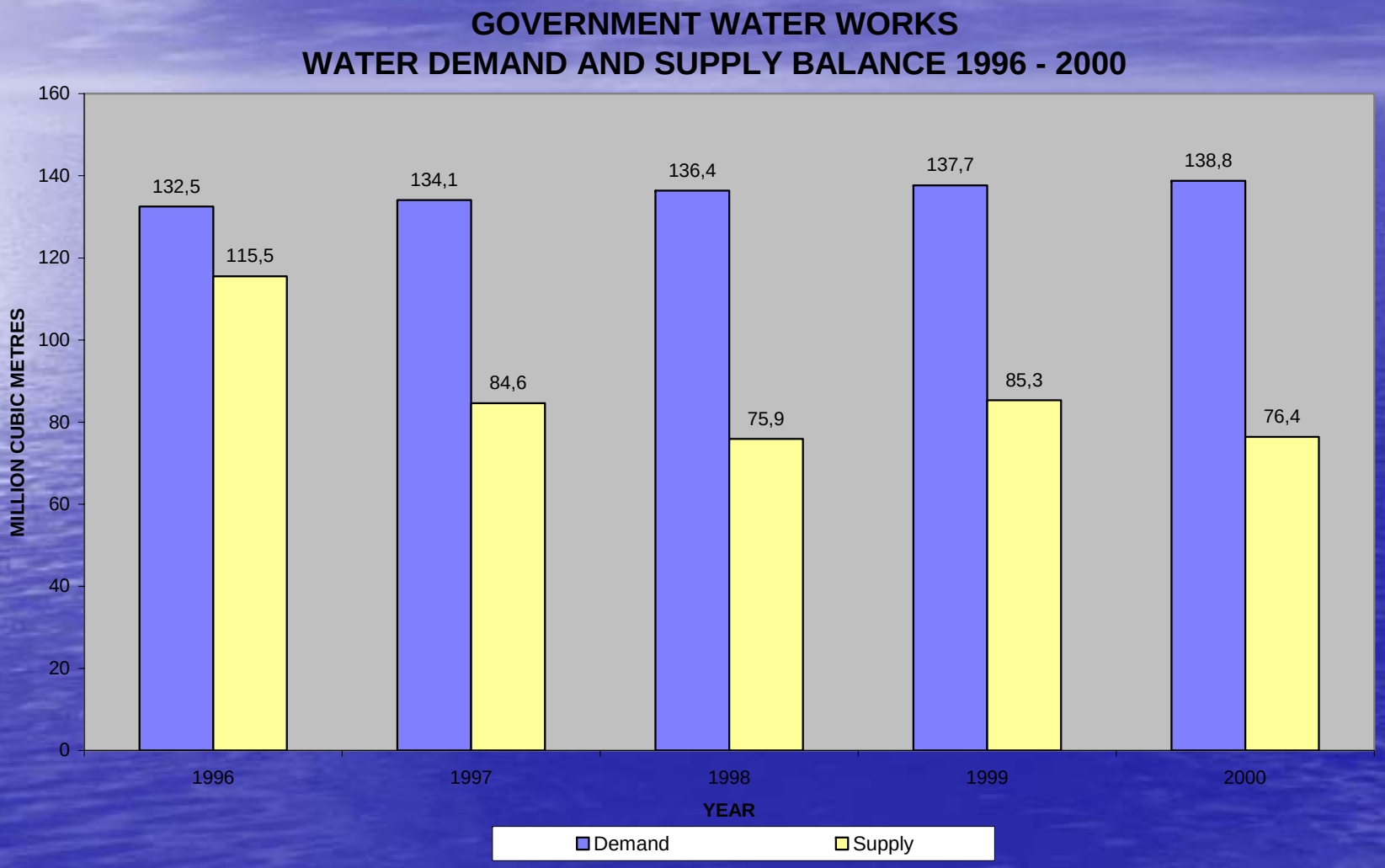
Long Term Water Scarcity Management (10)

- Demand management measures such as:
  - restructuring of agricultural cultivations and the promotion of cultivations which require less water,
  - promotion of water saving measures,
  - creation of awareness among the public for the proper use of water,

Long Term Water Scarcity Management (11)

- establishment of subsidies for saving good quality domestic water,
- metering of water services and use of rising block-tariffs for domestic water supply,
- application of a quota system for the allocation of government irrigation water in combination with penalty charges for over consumption, etc.

Measures in Periods of Drought



Measures in Periods of Drought (2)

- Various measures were implemented to face the situation:
  - Water supply restrictions
  - Demand management measures
  - Supply enhancement measures
- Drought Committee was set up to monitor and coordinate without bureaucratic procedures the implementation of the measures.

Measures in Periods of Drought (3)
Water Supply Restrictions

- Water supplied to households for as little as two or three days per week.
- Irrigation water to seasonal crops almost completely restricted.
- Water allocated to permanent crops reduced to the absolute minimum needed for survival.

Measures in Periods of Drought (4)
Water Supply Restrictions (2)

- Greenhouses receiving water only for one plantation period instead of two periods as the usual practice.
- Animal husbandry and industry suffered a reduction in the supply of about 28%.
- In general, the water supply restrictions amounted to over 20% for domestic uses and 30-70% for irrigation purposes.

Measures in Periods of Drought (5) Water Supply Restrictions (3)

- Severe objections or reservations raised by:
  - The agricultural organisations who demanded that the farmers be compensated by the Government for the lost income.
  - The hotel owners who demanded that the tourist industry be given either a zero or a very small reduction in the supply of water.
  - The environmental organisations who argued that reducing the quantity and timing of supply of water may not be an effective measure.

Measures in Periods of Drought (6) Demand Management Measures Domestic Sector

- Establishment of subsidies for saving good quality domestic water.
- Distribution of sealed plastic water bags, free of charge, for use in the toilet flush tanks as displacers, thus reducing the volume of flush.
- Reduction of the “unaccounted for water” in the distribution systems of the Water Boards, Municipalities and Villages.

Measures in Periods of Drought (7) Demand Management Measures (2) Domestic Sector (2)

- Amendment and strict implementation of the Law 1/91 which prohibits the use of a hosepipe for the washing of cars and pavements (increase of fine from approximately 26 to 52 euros).
- Education and Awareness Campaign of the need to conserve water.

Measures in Periods of Drought (8) Demand Management Measures (3) Irrigation Sector

- Subsidy for the installation of a system to collect rain water from the roofs of the greenhouses; subsidies were also envisaged for the use of improved irrigation systems.
- Application of a quota system for the allocation of government irrigation water in combination with penalty charges for over consumption.
- No supply of water to new irrigation areas.
- Educating farmers for better use of water and for adopting new low water demand crops.

Measures in Periods of Drought (9) Supply Enhancement Measures

- Expansion of the existing desalination plant (at Dhekelia) from 25.000 m3/day to 40.000 m3/day.
- Acceleration of the process for a new desalination plant (west of Larnaca) with a capacity of 52.000 m3/day.
- Use of recycled water for irrigation.
- Emergency measures to increase temporarily the supply of water for drinking purposes to both urban and rural areas.

Measures in Periods of Drought (10)
Efficiency of Measures

- Measures announced were, in general, accepted by the public.
- Consumption in every economic sector decreased.
- The emergency plan for combating the prevailing drought was quite successful.
- The “water consciousness” of the public was high and vivid making the introduction of the measures rather easy.

Conclusions

- In Cyprus, water is a commodity faced with depletion. Droughts are a very usual phenomenon and often two or three consecutive dry years are observed.
- In view of the possible future increases in drought frequency not only in the Mediterranean region but across Europe as well, as a consequence of climate change, Cyprus vulnerability to drought may increase.
- Water availability is affected by changes in climate. Cyprus has experienced approximately 20% reduction in precipitation, which resulted in a 40% reduction in surface runoff.

Conclusions (2)

- The use of storage reservoirs helps overcome the uneven distribution of natural water resources over time and reduces vulnerability to short term droughts.
- In certain semi-arid areas, wastewater reuse and seawater desalination may constitute vital alternative sources of supply. Wastewater reuse is best applied during drought conditions.
- The recent drought has increased public awareness of the fragility of the water resources and has demonstrated clearly the economic, social and environmental consequences of a drought.

Conclusions (3)

- A suitable response to a drought largely depends on adequate management of the water resource system.
- The adopted measures have significantly increased capabilities to withstand the impact of drought episodes.
- Demand management measures such as the use of economic instruments, leakage control, public education programmes, water reuse etc. offer the potential for ensuring that limited water resources are used in a sustainable way.

Conclusions (4)

- Our vision on water is to provide sustainably to the people of Cyprus
  - sufficient,
  - safe,
  - clean,
  - healthy and
  - reliable water

  for domestic and irrigation needs and for the environment.

THANK YOU
FOR YOUR ATTENTION