WATER MANAGEMENT STRATEGIES FOR CYPRUS

Dr. Ioannis P. Glekas
AEOLIKI Ltd

Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

12-13 May 2005, Limassol, CYPRUS

Presentation Outline

Scope of Work

Region description

Methodology for Strategy Generation and Evaluation

Results

Conclusions

Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Scope of Work

WaterStrategyMan Project

"Developing Strategies for Regulating and managing Water resources and Demand in Water deficient Regions"

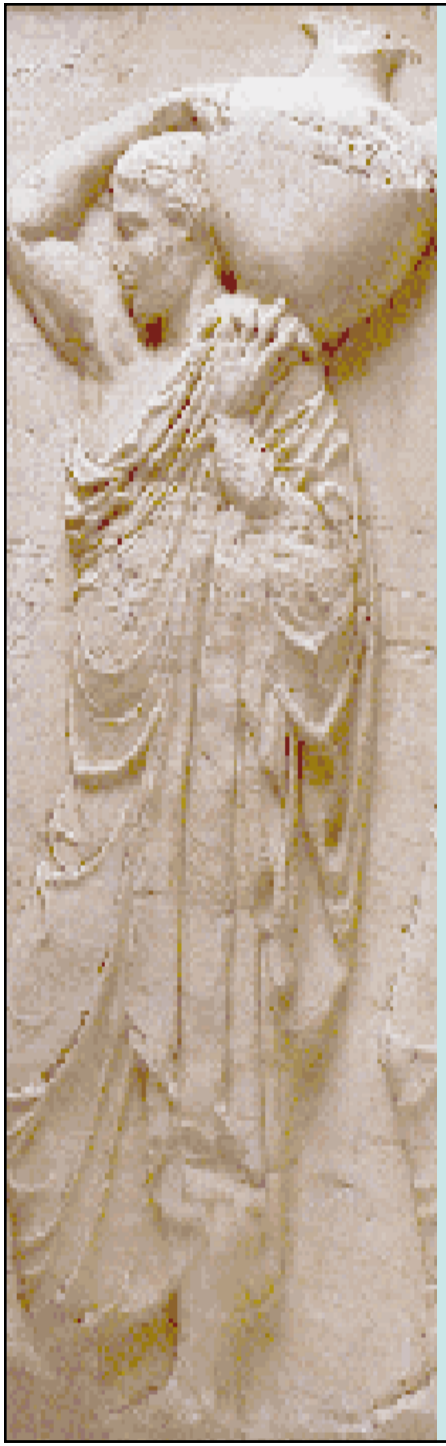
A project supported by the European Commission under the 5th Framework Programme

OBJECTIVES

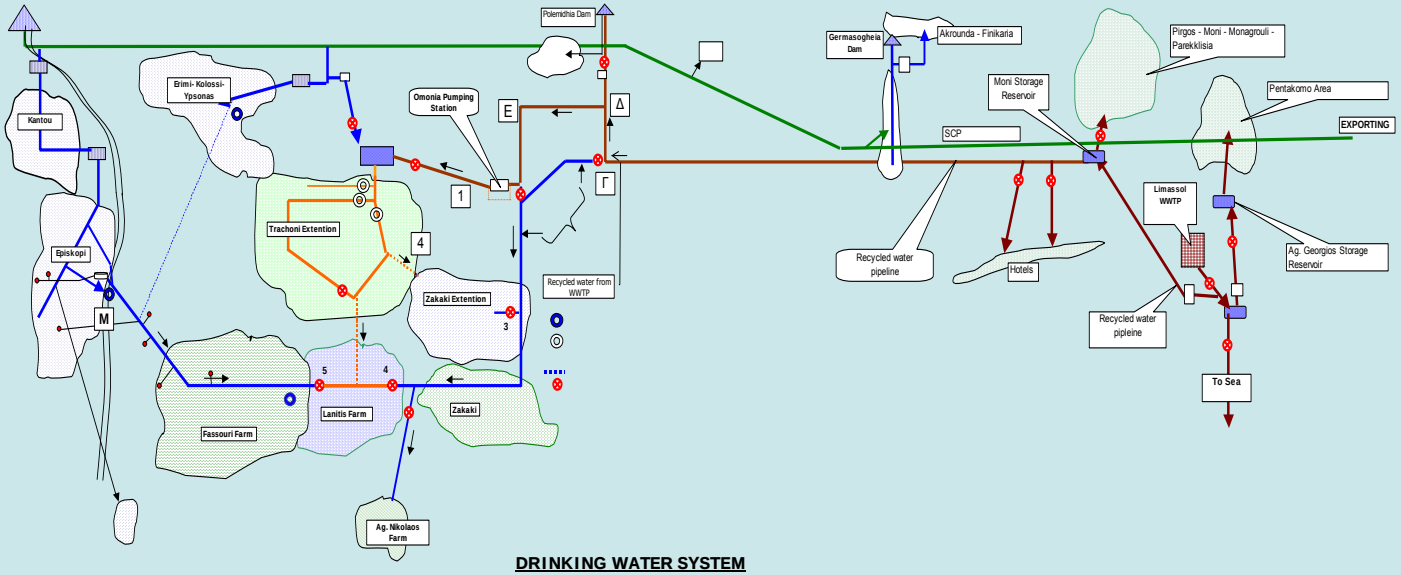
Formulation of improved resource and demand management strategies, being appropriate for arid and semi-arid regions in the Mediterranean in the context of implementing the European Water Framework Directive 2000/60/EC

Pass from a Dominant Paradigm of water management (massive engineering projects – hard interventions) towards a New Shifting Paradigm considering the environmental costs a society has to pay for ecosystem degradation and water resources contamination

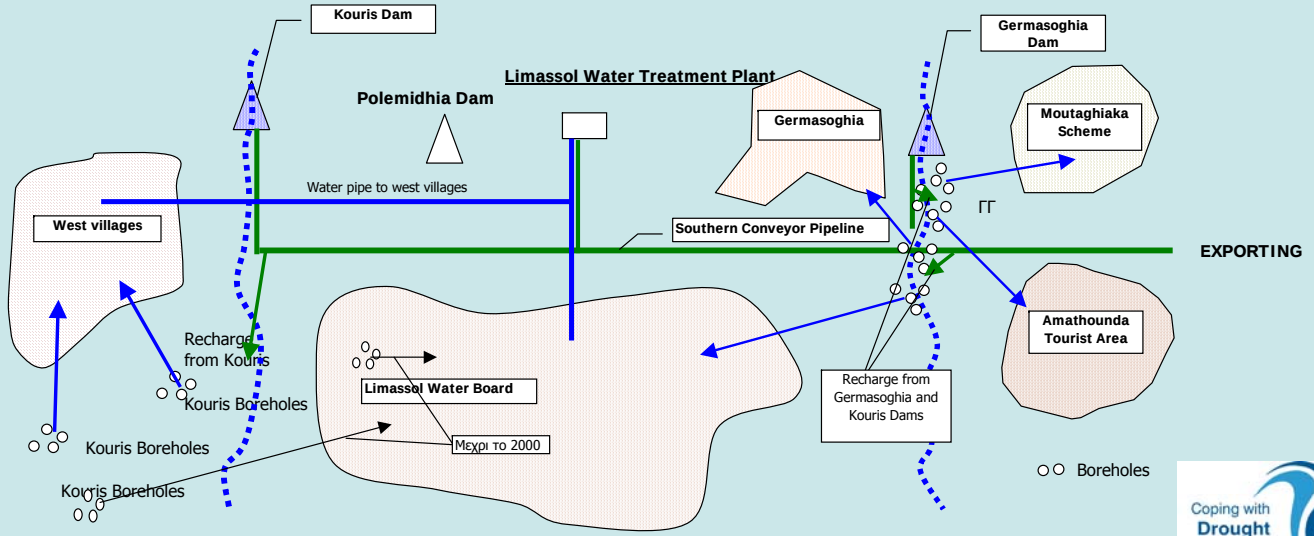
Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING



Limassol Water System



DRINKING WATER SYSTEM



Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

12-13 May 2005, Limassol, CYPRUS

The Methodology of Strategy Generation and Evaluation

Level 1 – Setting the Scope for the Strategy

- Identification of Goals (meet set proportion of water demand)
- Identification of available water policy Options
- Evaluation of available options (scenarios)

Level 2 – Strategy Formulation and Evaluation

- Formulation of strategies from available options
- Evaluation of Strategies using the Decision Support System .

Level 3 – Strategy Analysis

- Evaluation of Strategy performance (by experts and stakeholders)
- Definition of necessary supporting measures

Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Scope for the strategy

Competing demand - dynamic competitive tension between agriculture, urban growth including tourism, and the environment

Strong seasonality of demand

STRATEGY OBJECTIVES

•Meet the growing demand for water exerted by the permanent and seasonal population without affecting detrimentally the traditional agricultural demand which appears to have stabilized.

•Ensure stability of supply and maintain the groundwater exploitation to sustainable levels achieving thus environmental protection of the local aquifers

•Low cost solutions to manage peak demand

Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Target definition

- Primary Goal Definition
  - Meet at least 80% of domestic and irrigation needs in the peak summer period
  - Meet 100% of domestic and irrigation needs during the rest of the year
- Justification
  - Coverage of the domestic demand must be guaranteed – urban growth
  - Maintain agricultural activities

Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

General Assumptions

- Medium to long-term planning
  - Formulation and evaluation of strategies for the period **2002 – 2033**
- Planning under the worst case scenario :
  - dry availability conditions
  - high demand scenario

Population Growth		Irrigation	Consumption rate	
Domestic	Seasonal		Domestic	Seasonal
0,5%	**1% up to 2010 0,5% from 2010**	**10%**	**2%**	**1,5%**

Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Evaluation of available options

Option	**Effectiveness** (Sustainability Index for Demand Coverage)	**Economic Efficiency** (B/C Ratio)	**Environmental Cost** (PV – million €)
Water reuse	***	*	* * *
Water Treatment Plant	*	*	* * * * *
Waste Water Treatment Plant	***	*	* * * * *
Loss Reduction	* * * * *	* *	*
Conservation measures	* * *	* * * * *	*
Irrigation Pricing	* * * * *	*	*
Domestic Pricing	* * *	* * * * *	*

Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

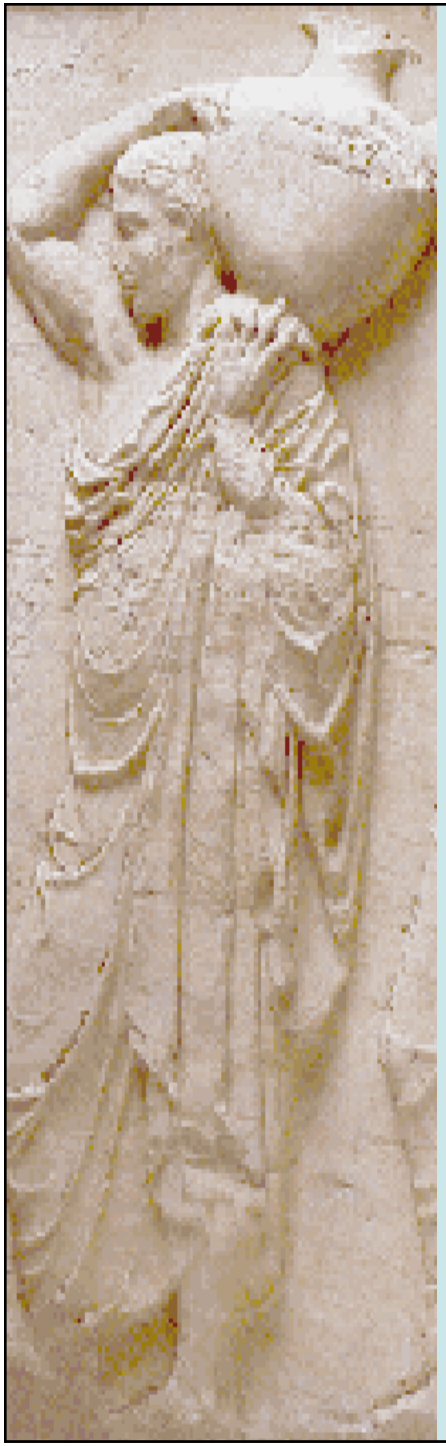
Strategy formulation and evaluation

- Formulation of strategies from available options (scenarios)
  - chose measures thorough examination of the strategy goals and of forecasts for the future
  - determine the timing for the measures application
  - produce a sequence of acceptable/available measures ⟹ STRATEGY
- Evaluation of Strategies using the Decision Support System

Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Strategy formulation and evaluation

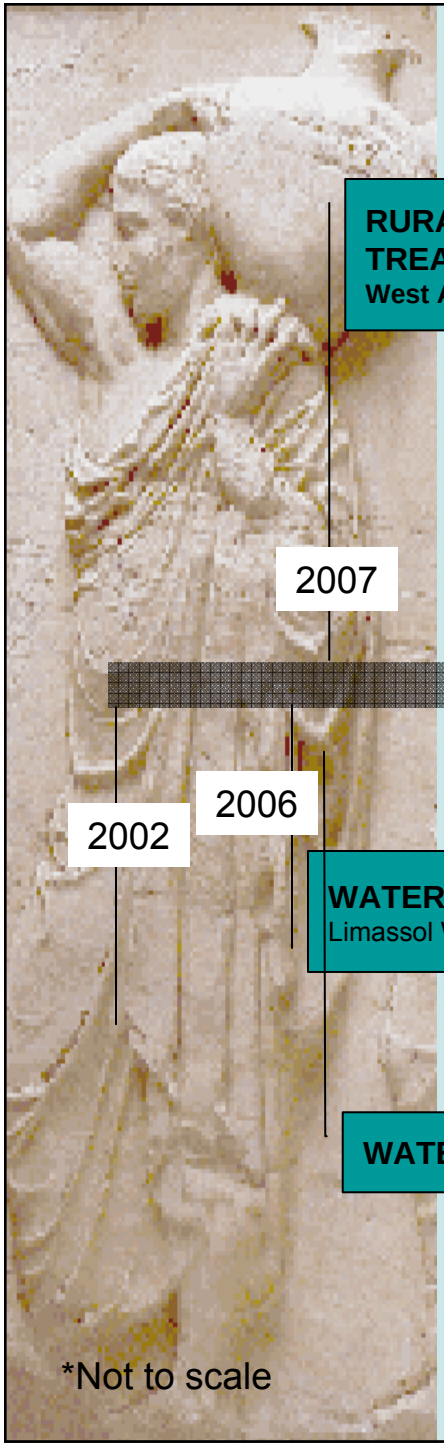
- Emerging Paradigm Strategy (Strategy A)
  - The dominant paradigm incorporating the newest techniques and methods applied and proposed
- Shifting Paradigm Strategy (Strategy B)
  - The new paradigm that will include options not currently used or accepted



Emerging Paradigm Strategy (Strategy A) Summary of options

- Rural Waste Water Treatment Plant (2006)
  - For the western part of the study area
  - Total capacity of 4000m^3/day in 2006
  - Recycled water will be used for irrigation
- Water Reuse (2007)
  - Recycled water from Limassol WWTP will be used for irrigation
  - During periods of minimum demand (winter months) recycled water will be stored in Polemidhia dam and/or will recharge the Kouris Delta aquifer.
- Water Treatment Plant (2006 and 2027)
  - From 40.000 m^3/day to 80.000 m3/day in 2006 (**phase 1**) – minimisation of groundwater abstraction for drinking water
  - From 80.000 m^3/day to 120.000m3/day in 2022 (**phase 2**) - minimisation of groundwater abstraction for drinking water

Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING



Strategy A – Timing

RURAL WASTE WATER TREATMENT PLANT
West Areas : 4.000 m^3/day

2007

2002

2006

WATER TREATMENT PLANT
Limassol WTP (80,000 m^3/day)

WATER REUSE

2027

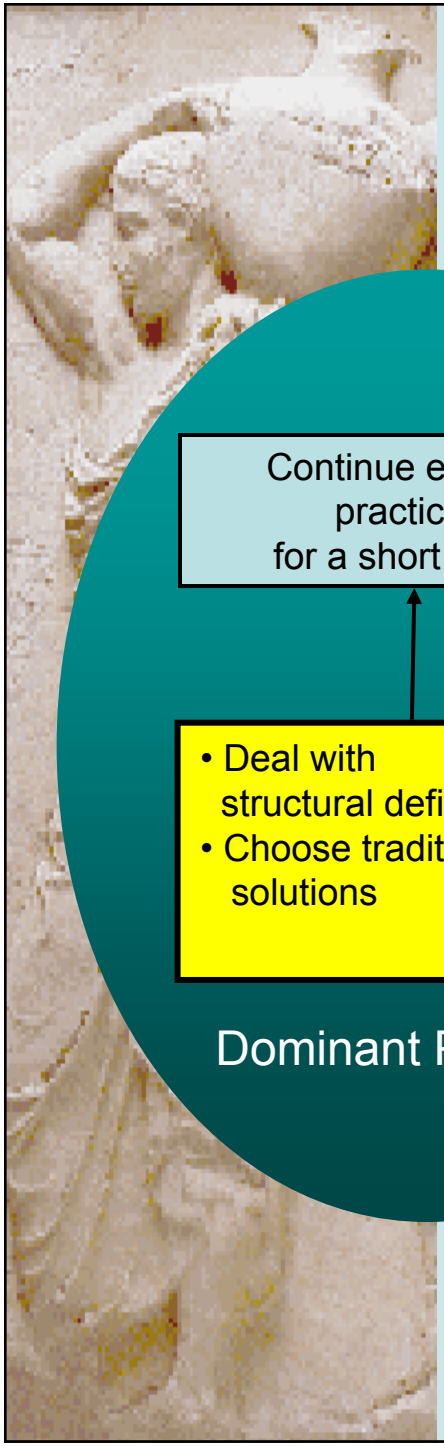
WATER TREATMENT PLANT
Limassol WTP (120000m^3/d)

2033

*Not to scale

Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Shifting Paradigm Strategy (Strategy B)



Continue existing practices for a short period

Shift towards non-structural solutions

- Deal with structural deficits
- Choose traditional solutions

Dominant Paradigm

Use structural interventions of a smaller size for
- **Meeting permanent deficiencies**
- **Contingency planning**

- WFD Goal
- Environmental sustainability
- Equity

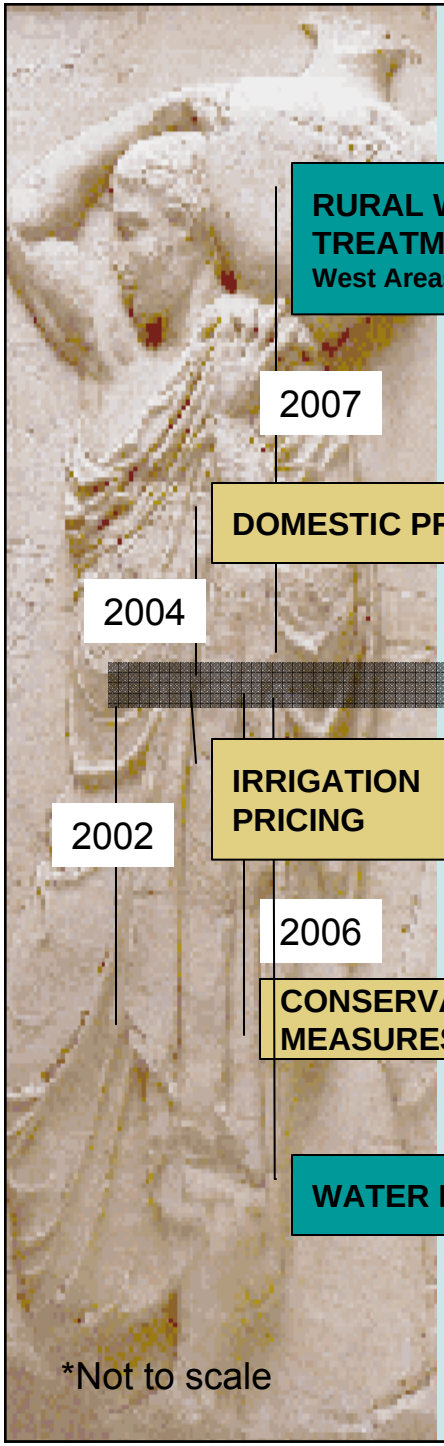
Shifting Paradigm

Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Shifting Paradigm Strategy (Strategy B)
Summary of options

- Rural Waste Water Treatment Plant (2007)
  - as in dominant paradigm
- Water Reuse (2007)
  - as in dominant paradigm
- Conservation measures for domestic use (2006)
  - total reduction of 10%
- Domestic pricing (2004 and 2017)
  - 60% increase of domestic prices
- Reduction of Distribution Network Losses (2010)
  - From 25% to 15% in major municipalities
- Water Treatment Plant (2010)
  - As in dominant paradigm but with different timing (2010 instead of 2005)
- Irrigation Pricing (2004)
  - Increase of irrigation prices from Cy £0,07 /m^3 to Cy £0,11 /m^3 (within a period of 3 years)

Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING



Strategy B – Timing

RURAL WASTE WATER TREATMENT PLANT
West Areas : 4000 m^3/day

2007

DOMESTIC PRICING

2004

DOMESTIC PRICING

2017

2002

IRRIGATION PRICING

WATER TREATMENT PLANT
Limassol WTP (80,000 m^3/day)

2010

2033

2006

CONSERVATION MEASURES

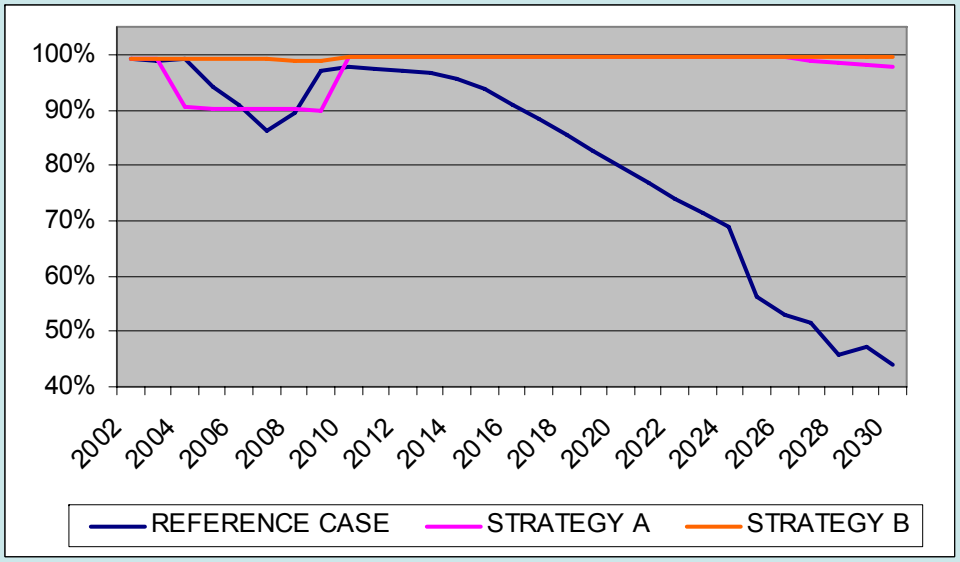
WATER REUSE

LOSS REDUCTIONS
Germasogheia – Limassol City – Limassol Tourist Area

*Not to scale

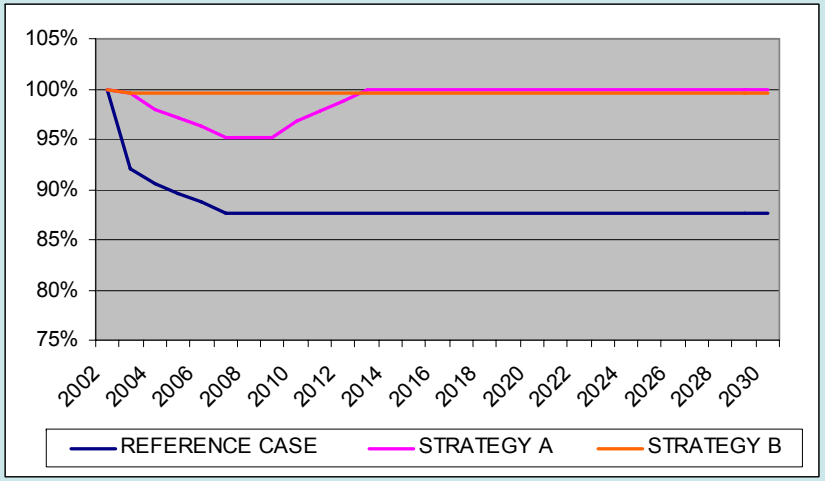
Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Demand Coverage



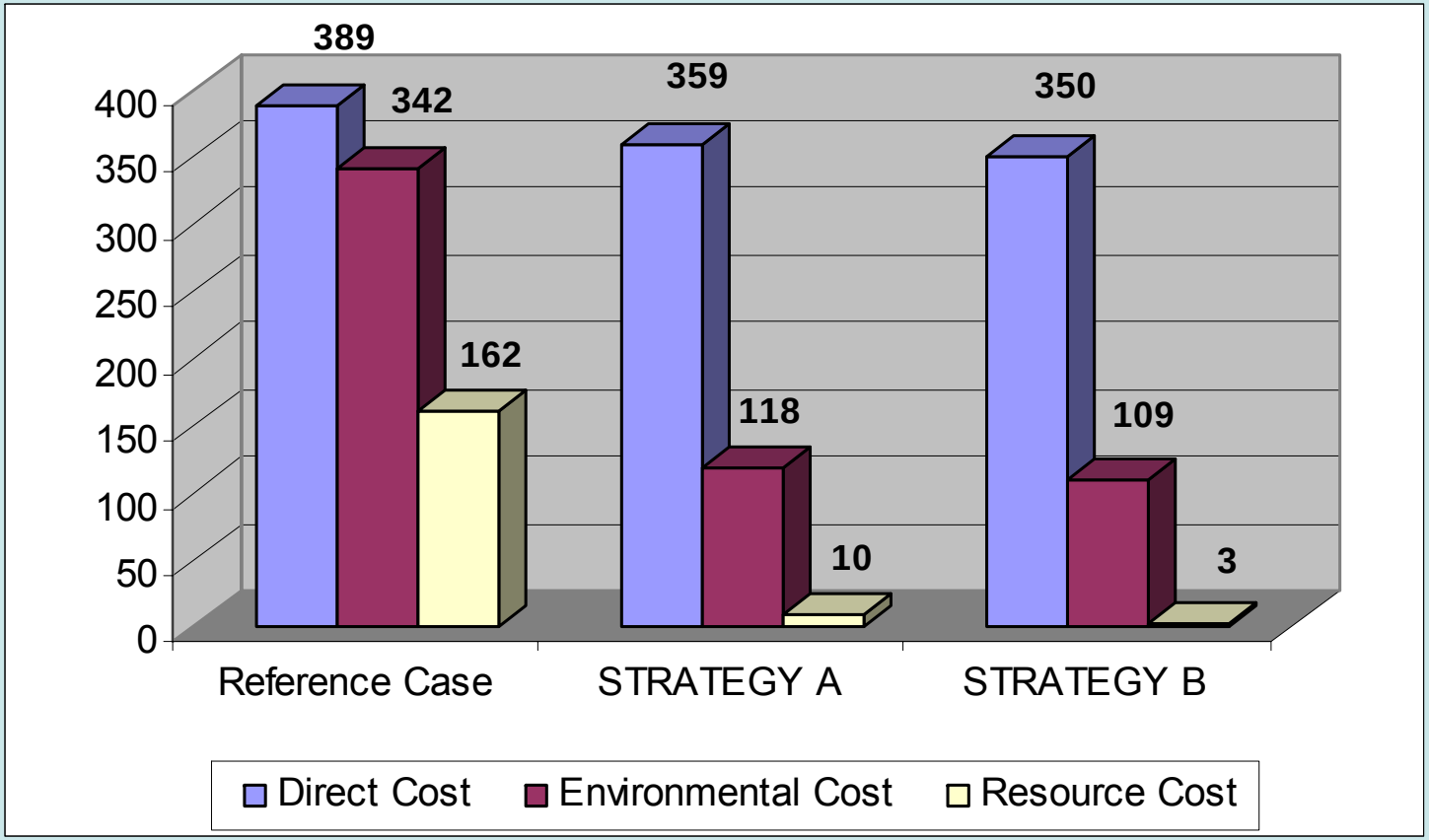
Domestic

Irrigation



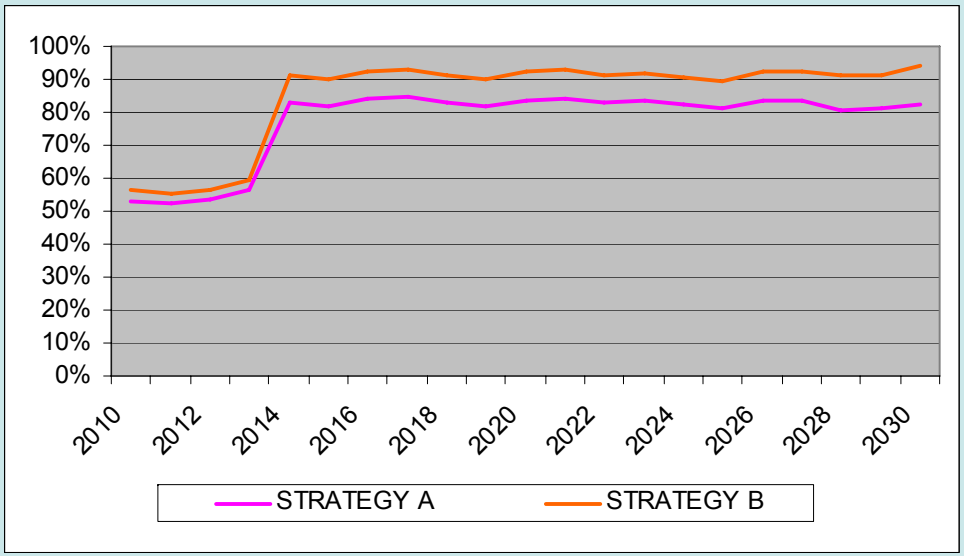
Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Present Values (mil. Euros)

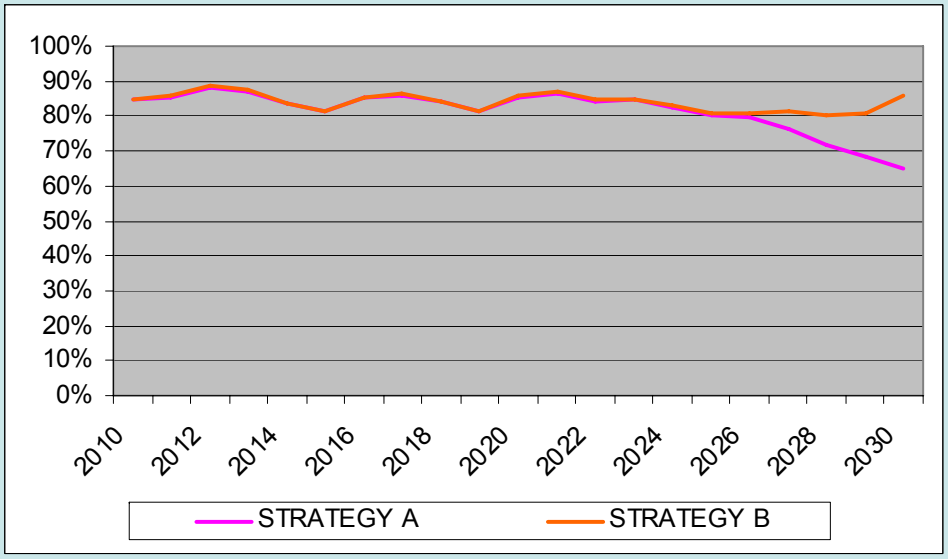


Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Cost recovery rate



Domestic



Irrigation

Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Cost Recovery Scheme

A pricing scheme for domestic use was developed

- *after 2015 CRC>80% reaching 100% by year 2030*

A pricing scheme for irrigation use was developed

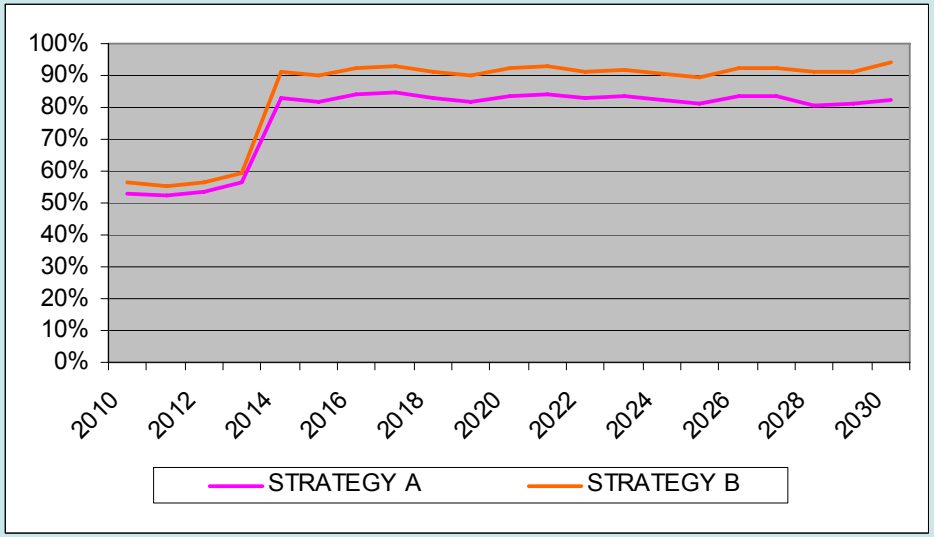
- *to reach 100% with average volumentric prices readjusted every 5 years*

Given the demand elasticity for the domestic and the irrigation use the introduction of pricing is expected to affect the demand

- *an iterative process was used to redefine the extent of the application of options, their costs, and the prices required for the targeted cost recovery*

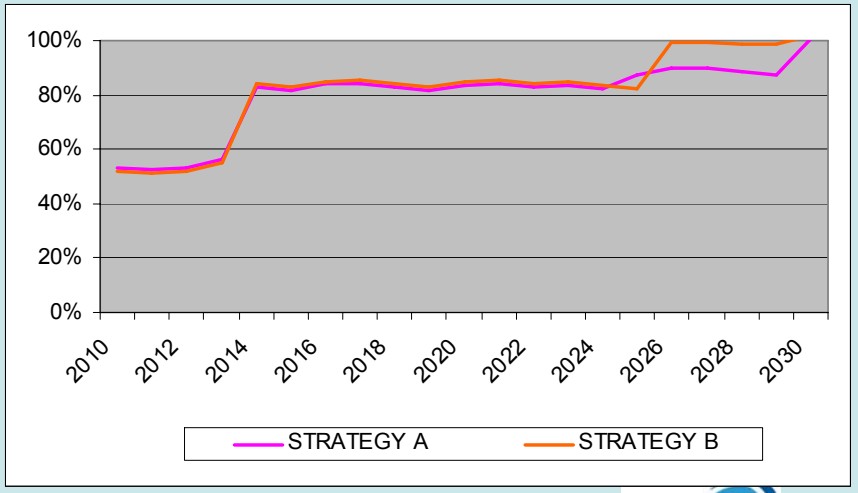
Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Cost Recovery Rate – Domestic use



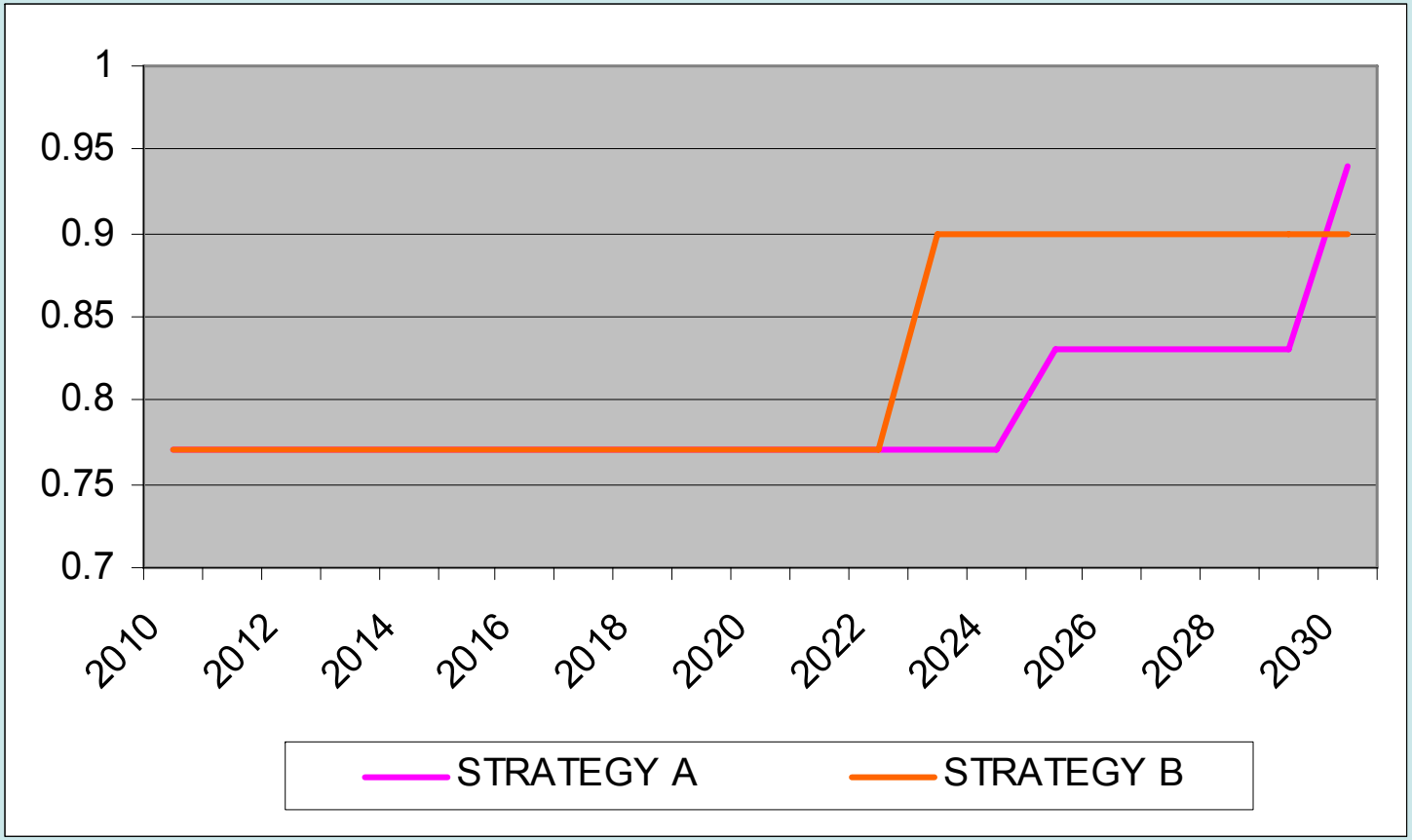
without cost recovery strategy

with cost recovery strategy



Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

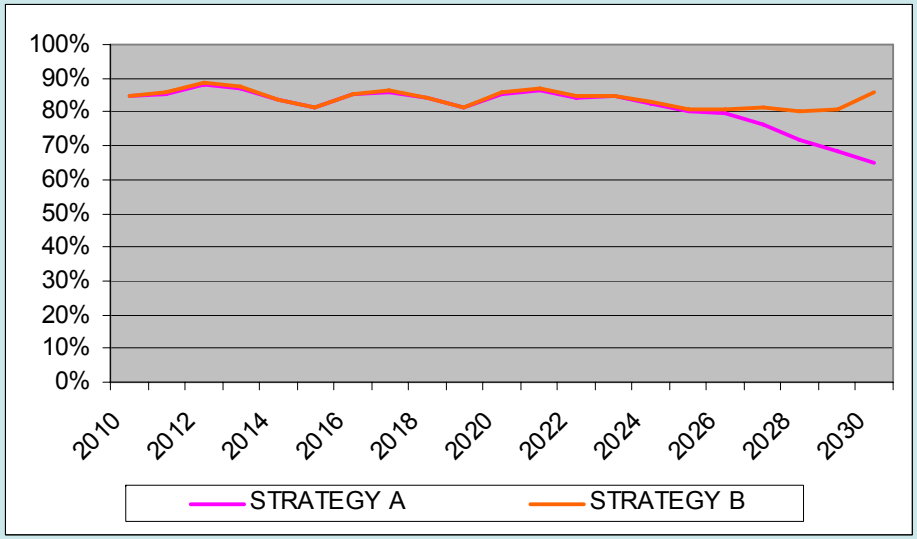
Average Volumetric Price – Domestic Use (Euros/m^3)



Under cost recovery strategy

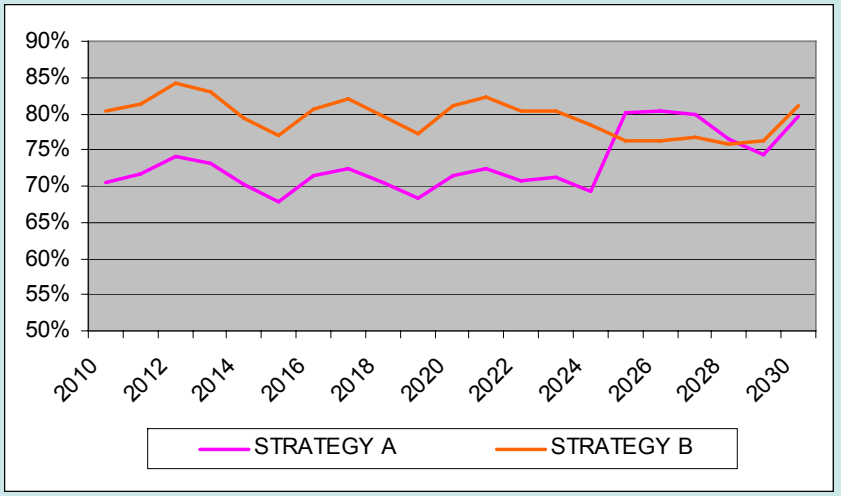
Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Cost Recovery Rate - Irrigation



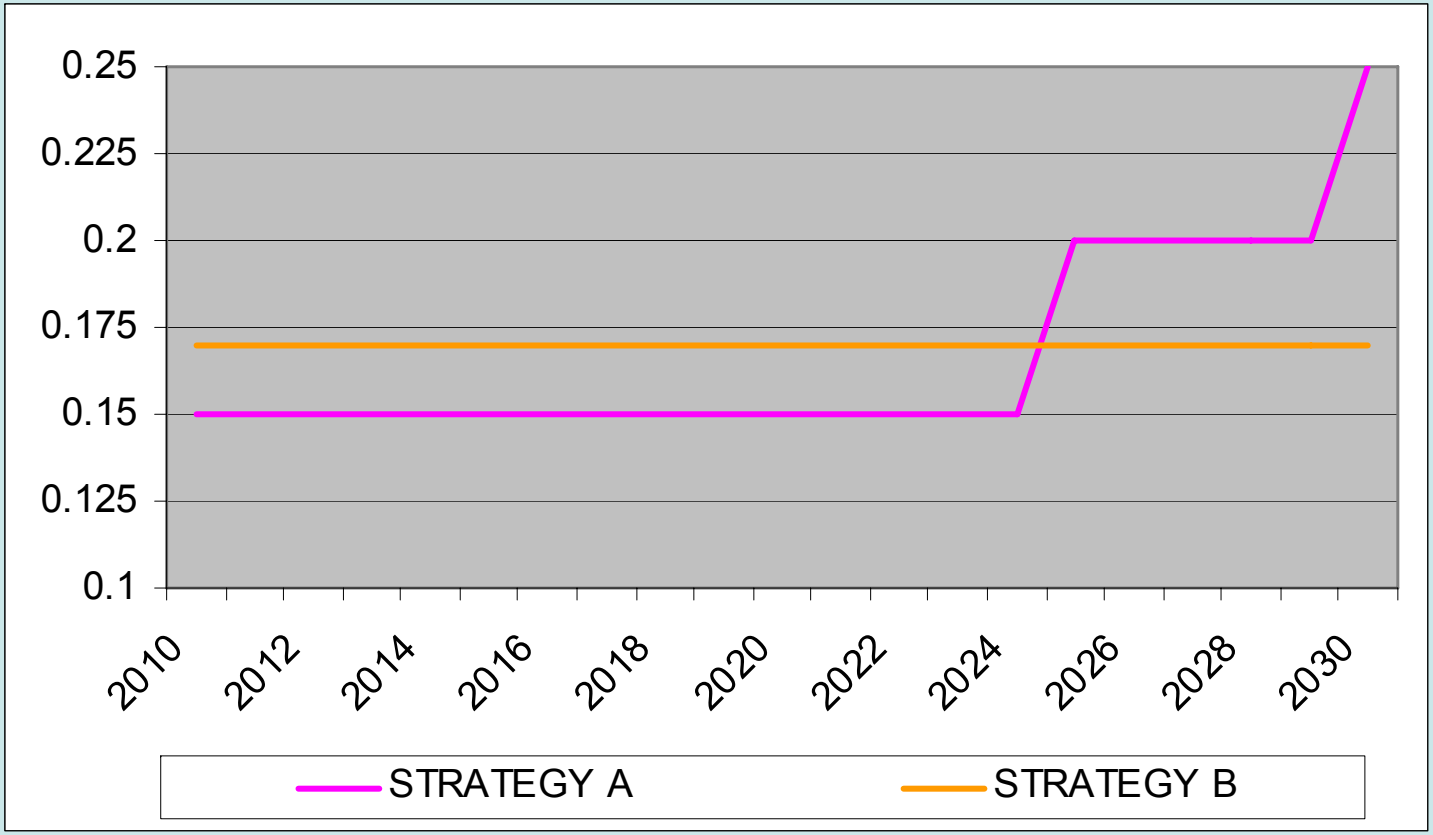
without cost recovery strategy

with cost recovery strategy



Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Average Volumetric Price – Irrigation (Euros/m^3)



Under cost recovery strategy

Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Summary

- Domestic and irrigation coverage reaches 100% by year 2030
- CRR for domestic use reaches 100% by year 2030 under Strategy B
- CRR for irrigation can not exceed 85% under both strategies
- The average volumetric price for domestic use under the cost recovery strategy was determined at 0,95 and 0,9 euros/m^3 for Strategies A and B respectively
- The average volumetric price for irrigation under the cost recovery strategy was determined at 0,25 and 0,17 euros/m^3 for Strategies A and B respectively

Coping with Drought & Water Deficiency
FROM RESEARCH TO POLICY MAKING

Conclusions

Strategy A: includes <u>already applied and planned structural water management options (hard measures)</u>

Strategy B: includes <u>alternative options (combination of soft and hard measures)</u>

Both strategies achieve to meet local water needs for domestic and irrigation use (demand coverage)

The analysis of the two economic policies adopted shows that total direct costs can be fully recovered for the domestic use, and up to 85% for the irrigation use

In terms of economic performance, strategy B appears to be more effective and more attractive after cost recovery strategy is applied, resulting in smaller average volumetric prices for domestic and irrigation use