DESIGNING WATER PRICING IN THE CONTEXT OF WFD IMPLEMENTATION: A CASE STUDY IN THE RIVER BASIN OF ANTHEMOUNTAS, GREECE

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EXTENDED ABSTRACT

The implementation of Article 9 of the Water Framework Directive (WFD) requires Member States to ensure by 2010 that water pricing policies provide adequate incentives to users for efficient water usage and that water uses have an adequate contribution to the costs of water services. Furthermore, the objective of active stakeholder and public participation on water management operations necessitates the establishment of a transparent framework on the water service sector, ensuring access to background information, including financial data, which would enable democratic control over water service costs and charges and facilitate the implementation and possibly the public acceptance of pricing reforms.
This paper outlines a methodological approach for the formulation of pricing policies that would contribute to the objectives of the WFD through the implementation of a "consolidated cost- accounting system" which considers all costs associated with water resource management and the way that these are financed. Furthermore, it presents a case study on the formulation of pricing schemes that can address the objectives of transparency, equitable allocation of costs, cost recovery and incentive pricing, also taking also into account social criteria, such as affordability of water charges and equity among consumers. The approach, which was applied in the River Basin of Anthemountas in Northern Greece, includes two steps: current cost accounting and pricing policies are evaluated against the pre-defined criteria in order to identify the deficiencies of the current system; different pricing schemes are subsequently developed and ranked on the basis of their performance against the set-out objectives.
Results from the assessment, which was undertaken within the framework of the LIFE Water Agenda Project, "Development and implementation of IWRM policy to a river basin, through the application of a social wide local agreement, based on the principles of Agenda 21 and the provisions of the Water Framework Directive 2000/60/EC", were presented during the public consultation process currently under implementation in the region. The initiated dialogue indicated that there is acknowledgement of the need for reforms in the water pricing system; emphasis was given in clarifying the concepts of the "polluter-pays" principle and of environmental and resource cost recovery as disincentives for preventing degradation of water bodies.

Keywords: Water pricing, Water Framework Directive, Cost Recovery, Polluter-Pays Principle, Transparency, Public consultation.

1 INTRODUCTION

Several researchers argue that the outward manifestations of water problems, such as water shortage, intersectoral competition over scarce resources, pollution and environmental degradation are not solely linked to physical or technical water

management; they actually arise from institutional framework deficiency and/or from the failure of underlying economic policies [1]. Water is under-priced and water use is not regulated, while the incentives offered often do not have the anticipated effect. At the European level, the implementation of pricing policies, foreseen by Article 9 of the WFD, tries to address such economic deficiencies by building upon three concepts, each imposing specific requirements on the pricing system: (a) the cost recovery objective, which is related to the amount that is generally paid for water services and refers to the financial sustainability of the water sector, (b) the polluter-pays principle, which refers to the actual contribution of the different water uses to the total cost, according to their respective contribution, and (c) incentive pricing, which implies that pricing should impact on the behaviour of water users and promote efficiency in water use [2]. Furthermore, water supply and sanitation services should ensure full transparency of all relevant data, including financial information, such as abstraction charges, short and long-term budgets, investments, subsidies and tariff definition, particularly as one of the WFD objectives is to promote the implementation of processes that ensure transparency, accountability and democratic control over water management operations [3].

Consequently, a water pricing system that implements the WFD concepts and principles should: (a) aim at least at recovering the financial costs of water services, so as to ensure revenue sufficiency and stability and therefore financial sustainability; (b) allocate costs to water use(r)s in an equitable manner (i.e. according to the costs that they actually incur); (c) offer incentives for efficient water use and convey the right signals to water users; (d) take into account socio-economic effects by ensuring equity of access and protecting low-income users; (e) be based on procedures that allow transparency in cost estimation and allocation, facilitate the identification and justification of subsidies and cross-subsidies and ensure a sound financial management, open to public scrutiny.

This paper outlines a process for the formulation of pricing schemes that can achieve the aforementioned objectives, based also on the implementation of a “consolidated accounting system” which considers all costs associated with water resource management and the way that these are financed (through general or national budget, ear-marked environmental taxation, and pricing). The approach was used for the development of alternative water pricing schemes for the River Basin of Anthemountas in Northern Greece.

2 DESIGN OF PRICING POLICIES

Sound water pricing should aim at full cost recovery, including environmental and resource costs, while taking social concerns into account. Water fees should be earmarked and perverse cross-sector subsidies removed [3]. Figure 1 presents the interrelations among different elements of the pricing system and specific pricing policy objectives. Transparent cost-accounting and recovery means that users can always have access to information related to how much water they have received, how their payments are used and how water tariffs and rates are determined. Furthermore, it means understanding which water services are actually paid for, to which extent, by whom and how, and thus identifying whether external (usually State) subsidies are provided to the water sector, or whether cross-subsidies are paid between categories of users [4]. Cost recovery is primarily related to the financial sustainability of the water service [5]. To a large extent, the achievement of full financial cost recovery consists of setting the various prices and charges in the tariff at a high enough level to ensure revenue sufficiency.

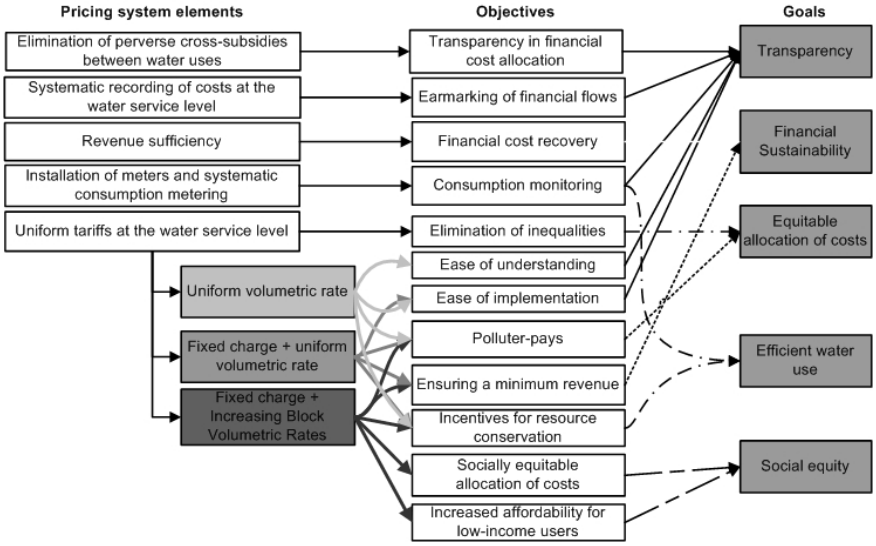


Figure 1: Contribution of pricing system elements to WFD goals and objectives

Furthermore, each element of the tariff structure can impact differently on the set objectives and goals. For example, flat rate pricing can ensure revenue stability and is easy to implement, but has no effect on water consumption metering and control and does not contribute to equitable cost allocation. On the other hand, the commonly applied Increasing Block Tariff, combined with a fixed charge, can offer incentives to users; however the emerging problematique questions the ability of the method to convey the right signals to water users and its contribution to the achievement of social objectives, especially with regard to multi-family households [e.g.5].

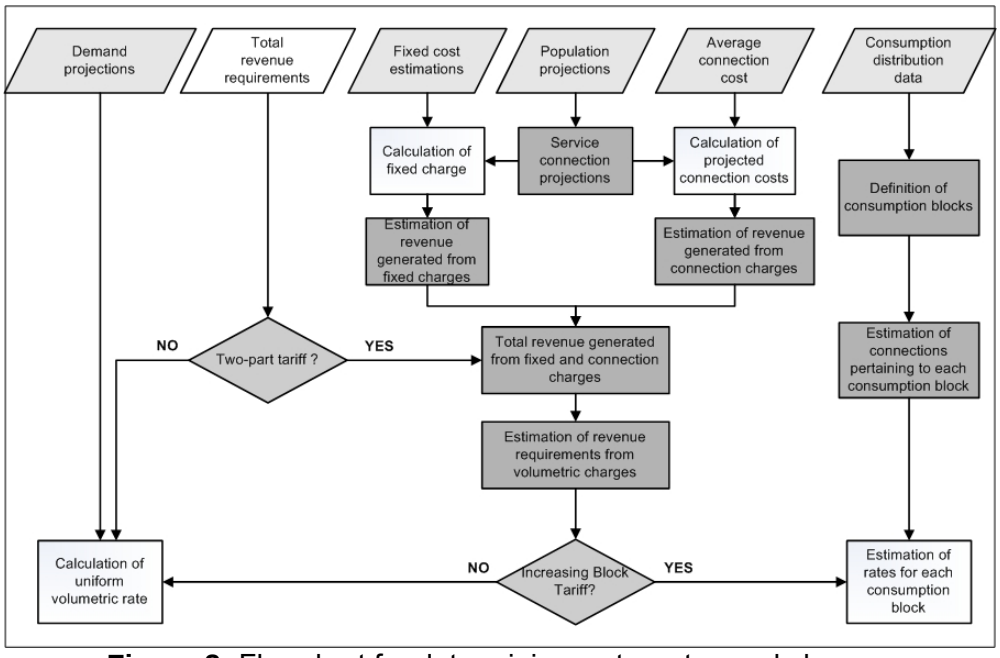


Figure 2: Flowchart for determining water rates and charges

Figure 2 presents the process for determining tariff elements, according to the selected pricing method. Tariffs are designed in order to meet specific revenue requirements, defined by the need for adequate (financial) cost recovery. Revenue requirements as well as the overall tariff structure are open to evaluation, on the basis of social criteria in order to ensure that the developed pricing scheme does not incur disproportionate costs to specific, low-income user groups. Tariff elements are designed in order to recover

specific cost components, following the guidelines of OECD [6], and a simplified approach of the commodity-demand method developed by AWWA [8]. Connection charges are estimated according to the costs incurred at the water utility for connecting a customer to the system. Fixed charges are used to recover costs related to standard expenditures for maintenance and permanent personnel. All other costs, directly or indirectly linked to the volumes of water used, are allocated through volumetric charges.
The approaches described above for the evaluation and formulation of pricing policies was applied in the River Basin of Anthemountas. A brief description and evaluation of the current framework on water service provision, cost allocation and pricing is presented hereafter, followed by the development and evaluation of alternative pricing schemes.

3 THE ANTHEMOUNTAS RIVER BASIN

The Anthemountas River Basin, with an area of 318 km^2 is located in the Region of Central Macedonia of Northern Greece, and falls within the administrative boundaries of the Municipalities of Thermi, Vassilika and Anthemountas. Due to its vicinity to the urban centre of Thessaloniki, the region faces increasing urbanisation, which mostly affects the Thermi area. The total annual water demand in the region is estimated at 22.2 million m^3, 12% of which accounts for domestic water use. Irrigated agriculture, which corresponds to 79% of the total water needs, is the most important water use in terms of quantity. Industrial water consumption represents 7% of the total, whereas animal husbandry water requirements are minor. The most significant water management issue is groundwater overexploitation, as most water needs are supplied through boreholes (public or private), whereas the average annual infiltration is 5.14 million m^3/yr. During the past few years, numerous private illegal boreholes have been drilled, and groundwater abstractions are neither controlled nor systematically metered. Furthermore, the rapid urbanisation exacerbates the need for expanding/developing water supply and sewerage infrastructure, which cannot be adequately addressed due to technical limitations and financial constraints. Water supply and sanitation for the domestic sector falls solely under the responsibility of municipal authorities. Irrigation needs are mostly met through private boreholes, while a relatively low percentage of irrigation water is supplied by Municipal Irrigation Networks, administered by the three municipalities. Similarly, private boreholes are the primary industrial water supply source, and industrial wastewater treatment is also undertaken individually. In addition to the three Municipal authorities, two more operators are indirectly involved in domestic wastewater management: (a) the Water Utility of Thessaloniki (EYATH S.A.) and (b) a municipal enterprise, managing the operation of the Thermi Wastewater Treatment Plant.

3.1 Evaluation of the current water pricing framework

Water pricing is effected at the municipal level and aims at the recovery of operation and maintenance costs only. A distinction is made between water supply and sanitation tariffs applicable to households, and fees for irrigation water supplied by Municipal Irrigation Networks. Domestic water supply tariffs include a fixed charge and an increasing block rate volumetric charge (IBT). Sewerage and wastewater treatment charges generally encompass a fixed charge and an additional charge, estimated as percentage of the corresponding water supply volumetric charge. Irrigation water pricing is practiced in several ways; methods range from area pricing to fees proportional to hours of pumping from public boreholes or volumetric pricing. Even within the same municipality, tariff structures vary substantially, not always according to the quality of services provided. Especially in the case of irrigation pricing, water abstractions are seldom metered and rarely charged; the case of the Municipality of Anthemountas is characteristic of that practice: in 2005 yearly water abstractions were metered at 95,700 m^3. However, according to the total revenue and the volumetric rate applied at that time only 13,043 m^3

were actually charged. Furthermore, financial flows among water service operators lack transparency and are not recorded at the water service level. Table 1 presents the evaluation of the currently applied pricing policies, according to the outlined criteria.

Table 1: Deficiencies of current pricing policies

Goal	Deficiencies
Transparency in:	
Charge estimation	• Pricing adjustments are not backed up by financial data
Cost allocation	• Cost elements are not accurately recorded at the service level
Subsidies and financial flows	• Financial flows among water service operators are not recorded
	• Subsidies are not recorded at the service level
Equitable allocation of costs	• "Equal" user groups are not charged "equally"
	• There is large difference between volumes metered and charged in irrigation
Cost recovery	• Annual cost recovery varies significantly
	• Financial cost recovery in municipal irrigation water supply is very low
Incentive pricing	• Abstractions from public boreholes are not metered
	• Municipal water use is not metered
	• Domestic water supply is used for garden irrigation
Social equity	• The volumetric rate for the first "social" block varies across the same municipality (and across the Basin)

Table 2 presents the financial cost recovery rate of water services and the overall recovery for the period 2001-2004, using an inflation rate of 3%. The estimation of current cost recovery levels was based on financial cost data for the period 2001-2004, derived from the corresponding receipt and expenditure statements of the three municipalities. Financial costs included operating expenses (energy cost, maintenance and personnel costs etc.). Data on small-scale investments were available only for the period 2001-2004. Consequently, capital costs were estimated using the historical value method, as the overall result would not be influenced by the estimation method. Furthermore, several assumptions were necessary to arrive to a more equitable allocation of costs among households and irrigation, as the analysis of the financial records showed that there is a pronounced lack of systematic and uniform monitoring of expenditures and receipts. For example, a large amount of energy or personnel costs is attributed to domestic supply provision in the billing process, while in fact it also includes energy costs for other water services provided by the Municipality.

Table 2: Cost recovery rate per Municipality and service (2001-2004)

Municipality/Water Service	Thermi	Vassilika	Anthemountas
Domestic water supply	93%	76%	89%
Irrigation water supply	83%	23%	43%
WW collection & treatment	96%	8%	77%

3.2 Development and evaluation of alternative pricing schemes

The development of alternative pricing schemes for each municipal water service was based on the evaluation of widely applied pricing methods (e.g. 6, 7). All schemes aimed at adequate recovery of financial costs and were designed on the basis of an assessment of water service costs for 2005. Additional criteria taken into consideration were data availability and reliability, ease of implementation, and public acceptability.

3.2.1 Household water pricing

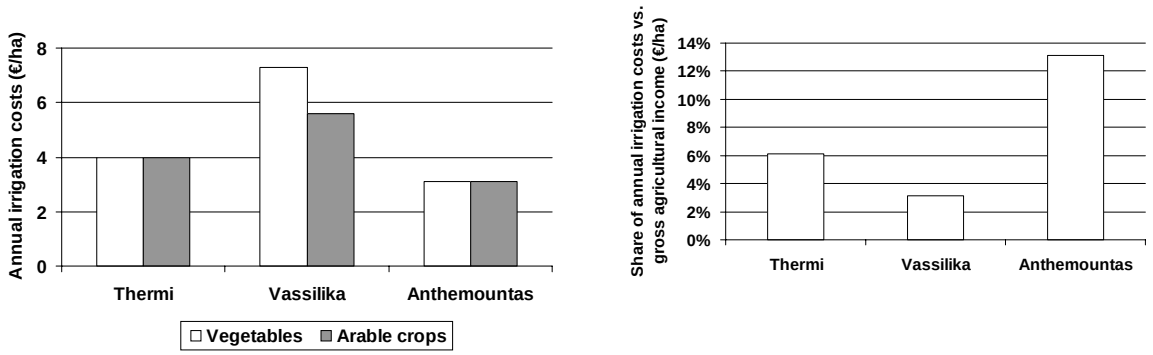
For domestic water supply provision, two schemes were developed, both including a fixed charge, designed to recover "ongoing" customer costs (e.g. regular maintenance, billing and collection costs). The volumetric charge was designed to recover operational, pumping and other variable costs. Two alternative methods were analysed: (a) a uniform volumetric rate and (b) a three-block IBT structure, with uniform consumption blocks across the River Basin. The first consumption block corresponds to the minimum average yearly consumption of a typical 4-member household of the Basin (~100l/cap/d). Block rates were estimated according to the AWWA methodology [8] with the 2nd and the 3rd block rates being equal to 120% and 200% of 1st block rate respectively. Pricing for sewerage collection and wastewater treatment was similarly based on a fixed and a volumetric, uniform rate, charge. Rates for all schemes are presented in Table 3. The evaluation of the analysed schemes was based on two criteria: (a) the affordability of water charges and (b) the anticipated demand reduction as a result of price increase. Affordability was estimated on the basis of the annual cost borne by a 4-member household assuming a typical consumption of 150 l/cap/d [9], and the median, before-tax, family income. In all cases, the estimated affordability criterion did not exceed the threshold of 5% [10]. Elasticity values were obtained from the pertinent literature [e.g 11], as no similar assessments have ever been undertaken in the river basin. The largest decrease is estimated for the Municipality of Vassilika (approx. 7% or 40,000 m³), followed by the one of Anthemountas (6% or 17,000 m³). For the Municipality of Thermi a small increase is calculated, as the estimated prices in some Municipal Departments are lower than the currently applied ones.

Table 3: Estimated household water tariffs

Tariff Element	Thermi	Vassilika	Anthemountas
Domestic water supply			
Fixed charge	21	36	24
Volumetric charge (€/m³/yr)			
Two-part tariff (Uniform rate)	0.33	0.54	0.67
Increasing Block Tariff			
1st Block: 0-150m³/yr	0.28	0.49	0.61
2nd Block: 151-300m³/yr	0.33	0.59	0.74
3rd Block: >300m³/yr	0.55	0.98	1.23
Sewerage charges			
Fixed charge	40	-	5
Volumetric charge (€/m³/yr)	0.24	-	0.32

3.2.2 Irrigation pricing

The development of alternative irrigation water pricing schemes was based on the need to address consumption metering and control. The examined scheme involved the introduction of volumetric, uniform rate, pricing; however and since metered abstraction data were considered unreliable, estimated prices were indicative, derived from theoretical water demand assessment. For improving the current cost recovery levels to rates above 80% in Thermi and above 50% in Vassilika and Anthemountas, prices would be approximately equal to 0.06 €/ m³ in Thermi, and would range between 0.08 €/m³ and 0.15 €/m³ in Vassilika and 0.03 €/m³ and 0.06 €/m³ in Anthemountas. The evaluation of alternative schemes was based on two criteria: (a) the comparison between the total annual cost borne by the users and the gross income from agricultural activities and (b) the anticipated demand reduction, as a result of price increase. Results on the first criterion are portrayed in Figure 3.



(a) (b)

Figure 3: Annual irrigation costs and share of annual irrigation costs vs. gross agricultural income for the developed irrigation pricing schemes

In Vassilika, the dominant and economically efficient cultivation of vegetables would not be affected by the considerable price increase, as the share of irrigation water cost over the overall income from agricultural activities is low. On the other hand, annual irrigation costs are high in the Anthemountas Municipality area, and would offer incentives for abandoning or changing the current cotton and maize cultivations.Demand reduction was estimated by assuming a conservative value for elasticity of -0.04 [12]. Values were not estimated for Anthemountas Municipality due to the large deviation of the current vs. the estimated price. For the other two municipalities, the anticipated impact ranges between 11% (Vassilika) to a reduction of only 2.7% (Thermi).

3.2.3 Overall evaluation

Figure 4 presents the evaluation of the pricing schemes developed for the River Basin, according to the predefined goals and criteria of Section 1.

Goals & Objectives		Domestic water supply		Sewerage & WW Treatment	Irrigation
		Simple two-part tariff	IBT	Simple two-part tariff	Volumetric pricing
WFD	Transparency: Removal of perverse cross-subsidies	√√	√	√√	√
	Transparency: Ear-marking of financial flows	√	√	√	√
	Transparency: Ease of understanding	√√	-	√√	√
	Transparency: Simplicity in implementation	√√	√	√√	√
	Efficient water use: Consumption metering and control	√	√	√	√
	Efficient water use: Incentives towards efficient water use	Satisfactory			High
	Equitable allocation of costs: Equals pay equal	√	√	√	√
	Equitable allocation of costs: Allocation of costs according to the polluter pays principle	√	√	√	√
	Financial Sustainability: Full financial cost recovery	√	√	√	√
	Financial Sustainability: Ensure a minimum amount of revenue	√	√	√	-
	Social equity: Ensure access to basic water services	-	√		
	Social equity: Ensure affordability of water charges	Satisfactory	High	√	3-10% of Gross agricultural income

Figure 4: Evaluation of the analysed pricing schemes

Transparency can be achieved through the introduction of a consolidated accounting system at the municipal or the river basin level, the ease of understanding and implementation and by consumption metering. Incentives towards efficient water use,

which can only be achieved through consumption metering combined with volumetric pricing, are evaluated through the anticipated demand reduction and can be considered satisfactory. In all schemes examined, costs were allocated equitably, following the polluter pays principle and without making distinctions among the consumers of each municipality. Financial sustainability is considered adequate, as in all cases full financial cost recovery was the basis for tariff design. Affordability of domestic water charges is similar in all pricing schemes; obtained values are higher for the IBT scheme, where the first block consumption is priced lower than the average unit cost. Affordability of irrigation charges ranges from high to considerably low values.

4 CONCLUDING REMARKS

The process outlined in this paper aimed at identifying deficiencies of the current pricing system in a typical river basin in Greece, in view of the implementation of Article 9 of the WFD, and also at proposing a framework for the development of pricing policies that would contribute to the achievement of the goals and objectives set out in the Directive. Results from this assessment were presented in a local public consultation process, in order to inform stakeholders and the general public of the concepts, principles and goals described in the WFD, and propose corrective actions towards the development of a more transparent, equitable and sustainable pricing of water services. During this process, issues related to the recovery of environmental and resource costs were discussed as well, also taking into account the fact that at that time the WFD transposition process had not been yet completed, and the institutional framework which would allow for the recovery of such costs, possibly through the application of abstraction or pollution charges at the basin level, has not been yet implemented. The dialogue indicated that there is acknowledgement of the need for reforms in the water pricing system; however the public acceptability is still limited.

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