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MODULE TEN

VALUING WATER RESOURCES

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MODULE 10 VALUING WATER RESOURCES	
RATIONALE	Economic tools are gaining an increasingly significant role in managing limited water resources. They include water pricing, pollution charges, various subsidies and other fiscal tools. The use of such instruments could stimulate motives to conserve water use and its efficient use. For instance, governments may want to implement some of these instruments to encourage the adoption of water-saving devices, water reuse technology and water-saving irrigation techniques. They are also essential for the effective and equitable allocation of water resources, taking into account basic human needs and the various social and economic criteria. Furthermore, water pricing can help in cost recovery by generating revenues to the service providers. However, the formulation of an effective pricing policy must be based on the evaluation of influencing factors such as the characteristics of water demand, the depletion of resources, options for cost recovery, social well-being and affordability, religious obligations, legal and administrative requirements, and consumer acceptance, as well as administrative feasibility. This session introduces the concepts and methodology in costing and the pricing structures and types, and will present the cost of water services in the Arab region and the prevailing pricing structures in the main consuming sectors in these countries, and discuss the relationship between the two and the issues/constraints involved in setting pricing system.
OBJECTIVES	1. To generate an in-depth debate on the pricing issues in the water consuming sectors in the Arab region 2. To introduce participants to basic tools and methodologies in costing and pricing water resources 3. To understand the process in formulating a water pricing policy
MAIN REFERENCES & BACKGROUND MATERIAL	- ESCWA (2003) *Updating the assessment of water resources in ESCWA member countries.* United Nations - ESCWA (2001) *Current water policies and practices in selected ESCWA member countries.* United Nations - GWP. 2000. *Integrated water resources management*, TAC Background Papers No. 4. - GWP. 1998. *Water as a social and economic good: how to put the principle into practice*, TAC Background Paper No. 2.
SUGGESTED INTERNET LINKS	- CIHEAM: http://www.ciheam.org/ressources/en/rapport2000.chapter7.pdf - World Bank: http://www.worldbank.org. - Green Cross International: http://ag.arizona.edu/OALS/ALN/aln44/charrier.htm#facing.
DELIVERY OPTIONS	
DIRECTLY RELATED MODULES	4, 5, 7 and 11

SESSION TOPIC SYNTHESIS	
QUESTIONS FOR DISCUSSION	1. Why do we have to pay for water? As a water professional/manager how do you argue this to a politician? 2. What are the factors, other than the cost of providing the service that should be taken into consideration in the final pricing scheme? 3. Is the current charging schemes in your country/ region conducive to improving water-use efficiency and promoting conservation or cost recovery? 4. How do you compare the cost for water production with water charges in your country/ region? Are they comparable? 5. Taking into consideration the available water resources and the political, technical, social, and economic settings in your country/Sub-region, in your opinion what is the best charging structure for the domestic and agricultural sectors to achieve water use efficiency, equity, conservation, and sustainability? 6. Bearing in mind the principles of IWRM, who should make the decision of the final prices charged and why? 7. What is the impact on the poor and different social groups? 8. What is an affordable structure? 9. What is the role of women and the impact on women and children? 10. What are the social, economic and political implications of the different options of water pricing outlined in Annex 1? 11. How easy are they to administer? Do they ensure cost recovery? How feasible are they in your country?

Background

Economic tools are gaining an increasingly significant and critical role in guiding strategies of water resources management and in promoting a more sustainable pattern of water use, particularly in regions of limited water resources. They include water pricing, pollution charges, various subsidies and other fiscal tools. The use of such instruments could stimulate motives to conserve water use. For instance, governments may want to implement some of these instruments to encourage the adoption of water-saving devices, water reuse technology and water-saving irrigation techniques. They are also essential for the effective and equitable allocation of water resources, taking into account basic human needs and the various social and economic criteria. However, these tools work well only when they are part of an effective overall water resources management system.

Economic tools for implementing water resources management. Water and wastewater pricing, groundwater license fees and permits, subsidies and cost-sharing arrangement, and pollution charges and fines, are examples of market-based incentives and mechanisms for implementing water resources policies that send clear, strong signals to water users. They are flexible and can be designed to both encourage and discourage behavior, making them particularly effective for demand management.

They can also be more cost-effective and less burdensome than the more traditional command and control systems (such as quantity restrictions, pumping quotas, norms, licenses, public information, persuasion and demonstration projects, etc.) because they generally require less administration, management and monitoring. Again, it is important to recognize that economic tools can be used to implement policies designed to achieve equity as well as efficiency goals.

Water Value, Cost and Pricing. A distinction has to be made between the two important principles of water valuation and water pricing.

a. *"Water valuation"* means setting priorities of water use according to its economic value (using the opportunity cost concept).
b. *"Water pricing,"* means actually setting a price or water tariff in practice as a tool for demand management and/or as a mean for cost recovery (i.e., applying an economic instrument to affect behavior and maintain resource and service sustainability).

Theoretically, prices could be determined according to the cost of water provision, or alternatively, according to the opportunity cost of water. In practical terms, it is hard to apply the opportunity cost criterion and transfer it into a standard pricing formula. On the other hand, cost of water provision can be estimated using a number of cost concepts: long-run marginal cost, short-run marginal cost, average costs of supply, or even using O&M cost. The choice of the estimation base will depend on the policy objectives and the weights given to the different priorities and criteria. Marginal cost pricing, according to the future average incremental cost of water supply is hard to apply in many cases. It may be easier and more realistic to set water prices to cover the financial cost of water and gradually move on to cover the economic cost and, eventually, the full cost of water.

Water rates. Several different types of water charges are used in the domestic, industrial and agricultural sectors in various parts of the world. The price structure is typically influenced by the availability of water, consumer income, the sector, and certain socio-economic factors. These include *Flat or uniform rates, Block rates, Seasonal rate and peak rate, Conservation rates, and Capacity rate*. The choice and formulation of an effective pricing policy must be based on the evaluation of influencing factors such as the characteristics of water demand, the depletion of resources, cost recovery, social well-being, religious obligations, legal and administrative requirements and consumer acceptance. It is important to note that the charged price ought to reflect, among other things, the quality, timing, convenience and reliability of water supply while accounting for social and political considerations.

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MODULE 10
WATER COST AND PRICING

A. INTRODUCTION

A distinction has to be made between the two important principles of water valuation and water pricing:

Water valuation means setting priorities of water use according to its economic value (by using the opportunity cost concept), whether by regulatory or economic means. ***Water pricing*** means actually setting a price or water tariff in practice, as a tool for demand management and/or as a mean for cost recovery i.e., applying an economic instrument to affect behavior towards conservation and efficient water usage and environmental protection, to provide incentives for demand management, ensure cost recovery, and to signal to consumers' the true scarcity value of water and the willingness to pay for additional investments in water services. (Check module 5 for details on water valuation and costing methodology).

The association of demand management with the adoption of a pricing mechanism can assist in the efficient distribution of scarce resources and improvement of services to achieve optimal allocation of water resources to different sectors, as well as in the promotion of conservation and privatization. Effective pricing mechanisms can be used as tools in important aspects of water management. Water pricing implies minimizing the use of water while achieving a given level of output or satisfaction. In addition to efficient use, conservation involves some changes in the pattern of use or structure of output itself to reduce water demand.

The idea that water has an economic value and is therefore a marketable commodity means that it is possible to establish a quantity-pricing relationship; in other words, pricing policy can influence the quantity of water to be used. Evidence of the inverse relationship between pricing and water demand, in which increase in price leads to decline in demand (and vice versa) has been documented. However, the formulation of an effective pricing policy must be based on the evaluation of influencing factors such as the characteristics of water demand, the depletion of resources, cost recovery, social well-being, religious obligations, legal and administrative requirements and consumer acceptance.

In general, an effective tariff should be: 1) Affordable: recognizing the vital role of water, the special needs of socially deserving cases, and the importance of safe water and sanitation for public health. Mechanisms to protect the poorest from high charges while avoiding subsidies to the better off are necessary. The urban poor often pay more (per unit) for water via the informal private sector than the better off pay to the official water utility; 2) Acceptable to the public: tariffs should be clear, comprehensible and fair; and 3) Administratively feasible: levying and collection of charges should be within the capacity of the water undertaking (GWP, 2001).

A convenient way to evaluate the impact of pricing policy on water demand is to apply economic principles, including price elasticity and cost recovery approaches, using marginal and opportunity cost concepts. Through such an approach, the efficient utilization of water resources can be considered to have social and economic value. One effective water pricing tool is cost recovery, which can play an important role both in water conservation and in reducing the burden on government budgets. Water charges may be based on the goal of partial or complete cost recovery, depending on the socio-economic situation of the country involved.

In most countries of the region, the assertion that water can constitute an economic good is met with skepticism and resistance by both decision makers and the public owing to socio-economic hardships in some countries, and because water has traditionally been provided free of charge or substantially below the cost of production through different forms of subsidies.

B. WATER PRICING THEORY

Pricing is at the heart of natural resource policy and management. Almost all water resource problems in the region can be traced to discrepancies in valuation and the lack of internalization of opportunity, user, and social costs of water. In general, overexploitation, inefficient use, inadequate conservation and lack of investment in regeneration of water resources arise from the failure of either the market or the government to price water according to its scarcity. It is neither technically nor politically easy to introduce water pricing, especially in societies where water has traditionally been viewed as a God-given right. Yet in the face of severe water scarcity in the region, governments can no longer afford to underprice this scarce resource.

The keys to optimal pricing of natural resources are first to identify and measure correctly the external social costs (or the spillover effects damaging other activities that are ignored in the cost-benefit analysis) and the intertemporal user costs of water use (or the costs of current water use on water use for future generations), and secondly to accurately value and internalize these costs or charge them to the current generation of consumers through correct pricing or taxation.

B.1. Externalities

A major factor that skews water pricing and leads to inefficient pricing and water use is the presence of external costs or spillover effects known as externalities. Externalities are effects or costs of use of water resources on others, whether the others are other farmers in an irrigation conveyance system, municipal water consumers, society, or future generations. An externality may be negative or positive. For example, an externality may be the costs imposed on a community's water supply that has been contaminated by upstream farmers high pesticide use within a watershed. Another example may be the costs imposed on a society to treat waters polluted by unregulated industrial effluent or the loss of a habitat caused by industrial pollution of waters. In both cases social welfare is reduced: in the first example the community's water supply is contaminated, while in the second example the society's tax burden is increased to treat polluted waters, or loss of a habitat. These externalities must be accounted for or internalized, by charging the user for the negative effects generated, or by regulating these negative externalities to minimize the costs borne by other users or society.

Externalities may also be positive, particularly those associated with water resources. For example, a clean river delta may support an ecosystem, which attracts eco-tourism, or supports a community's livelihood. Similarly, a forested area positively impacts the maintenance of a watershed as well as wildlife, yet these impacts are not marketed or priced services of the forest. The absence of private and social valuation of these externalities contributes to the failure of the market to capture these externalities. It therefore becomes vital to correctly identify and value these externalities and the costs of resource exploitation, and internalize them through an adequate pricing scheme.

B.2. Economic Valuation of Water

Valuation of externalities associated with water resources often poses problems, as social, environmental and financial costs must be accounted for. However, often it is difficult to accurately price or value non-market goods such as an ecosystem or habitat, social well-being, environmental services, and the like. Economists and environmentalists have developed techniques for estimating monetary values for resources and environmental services, such as water. However, great debate still exists over how to accurately price resources and environmental services. Several methods of accounting for or pricing environmental resources and services exist: a) a society's willingness to pay for the good or service; b) a physical measure of the resources stocks and depletion; c) accounting for depreciation of the resource in monetary terms; d) the user cost approach which discounts resource stocks according to use of the resource; e) marginal cost representing the incremental cost of

the water supply; f) opportunity cost of water, measuring the net value of a resource in the next best alternative use; g) full cost pricing, reflecting the full costs of supplying water, including variable and fixed costs; and other accounting methods outlined in Annex A. These accounting methods often yield very different results. Thus pricing these externalities, both costs and benefits, within a market system becomes difficult.

The aim of the approaches, however, is to encourage water use at sustainable levels and achieve cost recovery. The user cost approach proposes to account for both depletion of the resource and the cost of extraction/production and delivery. The user cost approach addresses sustainability of the resource in that the cost of resource depletion should reflect the cost of regeneration or development of new water assets so that future generations are equally well off. The true income generated by the sale or use of this water should reflect both the depletion costs as well as the extraction/production and delivery costs. Translating water resource valuation into water prices or user charges is a challenge. In the region, water-pricing policies have yet to reflect resource depletion costs. Water charges in many countries of the region are largely imposed as a means of partial cost recovery and limited revenue generation, often not fully covering extraction/production and delivery costs.

C. WATER COST IN THE ESCWA COUNTRIES[1]

The use of water pricing principles to achieve water conservation requires the application of economic analysis, with emphasis on determining water production costs and water charges. Evidence from the region indicates that the cost of investing in the development of water supplies from both conventional and non-conventional sources has been rising over the past few decades. The cost of producing water and providing services is substantially higher than the price the public pays to use this water. Water charging schemes currently in effect in all sectors in most of the ESCWA member countries are not conducive to improving water-use efficiency or promoting conservation. In the domestic sector, most of the countries apply a progressive price structure. In the irrigation sector, water provided free or at minimal cost contributes to over-consumption, especially of groundwater resources. Water rates both in the domestic and industrial sectors have been generating revenues substantially lower than the cost of operation and maintenance. Water prices are still heavily subsidized through governmental budgeting. The evaluation of water production costs from different sources and the water tariffs applied in practice indicate the degree of water pricing inefficiency. The cost of producing water from different sources and marginal costs in some of the ESCWA member countries are shown in tables 1 and 2 (refer to Annex A for definitions of methods of costing)

[1] The issue of water cost and water-pricing policy was addressed in detail in the ESCWA study entitled "Review of the impact of pricing policy on water demand in the ESCWA region, with a case study on Jordan" (E/ESCWA/ENR/1997/6). This part and the following ones are a summary of the major findings of the above study presented (with minor modifications in document "Updating the assessment of water resources in ESCWA member countries" (E/ESCWA/ENR/1999/13). For references, refer to the original document.

TABLE 1. AVERAGE WATER SUPPLY COSTS FOR SELECTED ESCWA MEMBERS, 1987-1994

ESCWA member country	Year	Sector	Type of cost	Cost/m³		Water source
				Local currency	US dollars	
Egypt	1994	Municipal	Average total	1.00	0.295	Surface water
	1992	Irrigation	Operation & maintenance	0.45	0.133	
			Operation &maintenance	0.01-0.02	0.003-0.006	
Iraq	1987	Municipal	Average total		0.118	Surface water
Jordan	1994	Municipal &irrigation	Average total	0.5	0.0706	Surface water
			Average total	0.0375-0.0598	0.053-0.085	
			Operation & maintenance	0.0099-0.0177	0.014-0.025	Groundwater
			Pumping	0.35-0.65	0.071	
Kuwait	1994	Municipal			1.630	Desalinated water
Palestine	1991-1994	Municipal	Average total		1.280	Groundwater
	1990	Irrigation in Gaza Strip			0.100	
					0.100-0.200	Shallow wells
					0.280-0.340	Deep wells
Saudi Arabia	1987	Municipal	Average total	3.7	1.000	Desalinated water
Syrian Arab Republic	1987	Irrigation		0.89-1.6	0.079-0.143	Surface water & groundwater
GCC countries	1992		Average total	1.87-9.38	0.5-2.5	Desalinated water

Source: ESCWA, "Review of the impact of pricing policy on water demand in the ESCWA region, with a case study on Jordan" (E/ESCWA/ENR/1997/6.

TABLE 2. COST OF DEVELOPING NEW WATER SOURCES INCLUDING NON-CONVENTIONAL SOURCES

Source of water	Cost (in US dollars per cubic metre)
Desalination	0.500-2.500
Brackish desalination	0.400-0.800
Reuse of treated wastewater	0.70-2.200
Tankers	1.250-7.500
Rubber bags	1.700-2.200
Icebergs	0.020-0.850
Proposed pipeline	0.735-1.758
Surface water (Nile)	0.004-0.006
Groundwater	0.011-0.015
Treated groundwater	0.410-1.5

Source: ESCWA, "Review of the impact of pricing policy on water demand in the ESCWA region, with a case study on Jordan" (E/ESCWA/ENR/1997/6).

Recent data indicate that the total cost of water production over the past ten years, including operation and maintenance, in countries with perennial river flow such as Egypt, Iraq and the Syrian Arab Republic is lower for irrigation than for domestic use. The cost of irrigation water (surface water) ranges from US$ 0.006 in Egypt to US$ 0.08 per m^3 in the Syrian Arab Republic. For municipal purposes, the cost per m^3 of water ranges from US$ 0.12 in Iraq to US$ 0.29 in Egypt. The higher cost of municipal water derives from the use of distribution and treatment facilities.

Production costs for ESCWA members such as Jordan, which depends mainly on groundwater, and Palestine and the GCC countries are much higher than those reported for countries that depend on surface water. During the past ten years, groundwater development costs, including pumping, in the areas under the Palestinian Authority have ranged from US$ 0.1 to US$ 0.2 per m^3 for shallow wells, and from US$ 0.28 to US$ 0.34 per m^3 for deep wells. In the Gaza Strip, user costs have reached US$0.79 per m^3. The high cost of water is directly related to topography and to energy costs.

In Jordan, capital costs for water production for all water projects combined were estimated at US$ 0.68 per m^3 in 1998; operation and maintenance costs in 1988 were estimated at US$ 0.28 per m^3. The cost of irrigation water is lower than that of municipal water owing to easy accessibility and the fact that the water is untreated.

Data for Yemen for the past 10 years indicate that costs associated with the development of groundwater from the alluvial wadi formations have ranged from US$ 0.02 to US$ 0.1 per m^3. Costs of groundwater production from major aquifers in the Syrian Arab Republic ranged from US$ 0.034 to US$ 0.34 per m^3. In Qatar, the cost of groundwater development in 1974 was estimated for municipal purposes at US$ 0.17 per m^3 and US$ 0.03 for the agricultural sector. High domestic municipal costs are generally attributed to treatment and transportation. The cost of groundwater development in Kuwait in 1996 was estimated at US$ 0.18, with additional transportation costs of US$ 0.44 per m^3. Private vendors charge for groundwater supplies in Jordan, with prices ranging from US$ 1 to US$ 3 per m^3 in summer; in Yemen the charge is approximately US$ 5.

D. Water Pricing in the ESCWA Countries

Water charges differ greatly between the ESCWA member countries, as well as between the sectors within each country. However, these charges are largely imposed as a means of partial cost recovery and limited revenue generation rather than a means of managing demand. Water charges in all sectors, particularly in the agricultural sector, are much lower than the total cost of water production.

In setting up water charges in the domestic sector, the tendency has been to use what is known as a "lifeline rate schedule" for water, which does not encourage water conservation. In the ESCWA region, this system includes a very low block rate for small water consumers, incrementally increasing to a high "penalty" rate for large consumers. The lifeline rate is based on the concept that potable water should be accessible to the poor. Within this context, the low block rate has been used to achieve some income distribution. The rationale for selecting a given block rate in the region is based on the desire to meet minimum public water requirements without imposing undue financial burdens on consumers.

During the past 10 years there have been minor rate changes in pricing structures in the ESCWA region, except in Bahrain and Jordan. Water charges are substantially lower than production costs in countries that depend on desalination. A careful examination of charges for the domestic, industrial and agricultural sectors reveals a number of facts. In the domestic sector, Bahrain, Jordan, Saudi Arabia, the Syrian Arab Republic, Yemen and the areas under the Palestinian Authority are using a progressive block rate charging system. Egypt has only two blocks in its rate structure and thus cannot be considered to have a progressive block-charging rate. However,

Egypt is applying a more progressive rate for water consumption in the industrial, commercial, tourism and governmental sectors. Water rates in the domestic sector are shown in table 3 (refer to Annex A for definitions of pricing structures).

In Egypt, in the late 1980s, a fixed rate was set for bulk supplies, particularly for government institutions including ports. The domestic rate for volumes of up to 10 m^3 was set at US$ 0.012 per m^3, and above 11 m^3 at US$ 0.0187. For industrial and public purposes, consumers were classified according to the date of connection, either before or after 1976. Connection rates for established customers were set at US$ 0.0492 per m^3; for new customers or for those using more than of the limits set in 1976, the rate was US$ 0.0738. Government institutions and ports had charges of US$ 0.092 and US$ 0.068 m^3 respectively. Bulk supplies of up to 500 m^3 per day were set at US$ 0.172, and for volumes greater than 500 m^3 the rate was US$ 0.338. Iraq uses the increasing block rate structure as well: for domestic water consumption of up to 60 m^3, the rate is US$ 0.04 per m^3.

Some ESCWA members apply a progressive block rate for irrigation water as well, though groundwater for irrigation is often provided free of charge once the appropriate permit for well drilling and water use is obtained. In the Syrian Arab Republic, charge for surface water for irrigation is based on a flat rate per unit (hectare) of land irrigated, regardless of the volume of water used. Kuwait also charges farmers a flat rate for brackish water for irrigation, but the charges are based on the volume of water consumed. In Saudi Arabia, Oman, Yemen and the areas under the Palestinian Authority users are not charged directly for irrigation water. Both Jordan and the Syrian Arab Republic have updated their irrigation charge systems several times in an attempt to cope with both cost increases and water scarcity. Water charges in the irrigation sector for selected ESCWA members are shown in table 4.

TABLE 3. DOMESTIC WATER CHARGES IN SELECTED ESCWA MEMBER COUNTRIES

Country	Year	Water resources	Consumption bracket (m^3)	Rate/m^3		Comments
				Local currency	US$ /m^3	
Bahrain	1996	Desalination and groundwater	0-60	0.025	0.067	Monthly charge
			61-100	0.080	0.212	
			> 100	0.200	0.532	
			Minimum charge	1.500	3.990	
Egypt	1988/89	Surface water	1-30	0.10	0.0295	Rates are for water only; they do not include charges for sewerage. A surcharge of 15 Egyptian pounds (LE) on water bills was to be applied for sewerage in some cities in 1997.
	1993/94		1 to 30	0.23	0.069	
			>30	0.30	0.088	
Iraq	1985	Surface water	0-60	0.012	0.04	
			60-90	0.015	0.05	
			>90	0.021	0.067	
Jordan	1996	Groundwater	0-20	0.10	0.11	
			21-40	0.190	0.268	
			41-70	0.45	0.636	
			71-100	0.55	0.776	Amman
			101-250	0.70	0.989	

			>250	0.73	1.031	
		Groundwater and surface water	Minimum charge	0.20	0.282	
	1996		0-20	0.065	0.097	Outside Amman
			21-40	0.090	0.135	
			41-70	0.320	0.415	
			71-100	0.52	0.735	
			101-250	0.70	0.989	
			>251	0.730	1.031	
			Minimum charge	0.02	0.282	
			Water tanker	2.0	2.825	
	1996	Surface water and groundwater	0-40	0.065	0.097	Jordan Valley
			41-70	0.130	0.184	
			71-100	0.270	0.381	
			101-150	0.45	0.636	
			151-250	0.65	0.918	
			7.250	0.73	1.031	
			Minimum charge	0.015	0.021	
Kuwait	1997	Desalinated water		0.176	0.590	Meter area
				0.066	0.222	Tanker
	1997	Brackish water	Daily charge	0.30	1.01	0.5-inch connection
				0.50	1.68	0.75-inch connection
				0.8	2.68	1
Lebanon	1993	Surface water and groundwater	Monthly charge	60.00	8.71	
Qatar	1996	Groundwater and desalination	No limit	4.4	1.210	For non-Qataris
				200.00	55.000	Value per tank (not per m^3)
Syrian Arab Republic	1990	Surface water and groundwater	Fixed/month	36.00	1.600	
			1 to 20	1.25	0.11	
			21-30	2.0	0.18	
			>31	6.0	0.53	
Oman	1996	Groundwater and desalination	No limit	0.44	1.140	
United Arab Emirates	1996 1997	Desalination and groundwater	No limit	50 2.2	13.62 0.6	Monthly charge

Source: ESCWA, 2003

TABLE 4. IRRIGATION WATER CHARGES IN SELECTED ESCWA MEMBER COUNTRIES

Country	Year	*Water source*	Consumption bracket (m^3)	Rate/cubic meter		Comments
				Local currency	US$	
Jordan	1961	Surface water and groundwater	*Any quantity*	0.001	0.0014	Rates are for the Jordan Valley only, not the highlands
	1966		1-1800	0.001	0.0014	
	1974		*Any quantity*	0.003	0.0042	
	1989		*Any quantity*	0.006	0.0085	
	1995		1-2,500	0.008	0.013	Increasing rates applied in 1995
			2,501-3,500	0.015	0.0212	
			3,500-4,500	0.020	0.0282	
			>4,500	0.035	0.0494	
			Average price	0.015	0.0212	
Kuwait	1977	Groundwater and desalination	0-36	0.022	0.074	0-50 dunums (area)
			37-72	0.011	0.37	50-100 dunums
			73-150	0.005	0.018	100-200 dunums
			15-227	0.004	0.012	Monthly charges
Syrian Arab Republic	1970	Surface and groundwater		75	6.68	5 Syrian pounds of rate is for operation and maintenance
	1989			1 275	1 132.59	LS 200 of rate is for operation and maintenance

Source: ESCWA, "Review of the impact of pricing policy on water demand in the ESCWA region, with a case study on Jordan" (E/ESCWA/ENR/1997/6).

A comparison of cost estimates for water production with water charges reveals a substantial difference between water charges and the actual cost of water production and delivery. In Jordan, for example, the price of irrigation water in the highest block represents no more than 58 per cent of the average cost of water, and the average price per m^3 barely covers the operation and maintenance costs for surface irrigation. In 1992, only 41% of operation and maintenance costs were recovered from farmers.

In general, current agricultural pricing policies in the ESCWA member countries provide no incentive to boost irrigation efficiency or to encourage conservation through modified agricultural production. At the same time, revenue from the agricultural sector in some countries is not sufficient to cover even the operation and maintenance of irrigation facilities.

D.1. Irrigation Water

In the region, approximately 87 percent of all freshwater resources in the region are used in low-value agriculture.[2] However, skewed water pricing in the agricultural sector has allowed for the continued inefficient dominance of agriculture in water use. Free or heavily subsidized irrigation water obstructs market signals, encouraging farmers to use this scarce resource beyond its economic and agricultural optimum. Underpriced water also stifles incentives to invest in maintaining and improving existing dams, irrigation canals and other

[2] World Bank. "Water Scarcity in the Middle East and North Africa." World Bank: http://www.worldbank.org.

water conveyance systems, which are often plagued by poor drainage and inefficient distribution systems. The result is significant water losses, and mismanagement and wasted water.

Underpriced irrigation water, in the most water scarce resource region of the world, encourages farmers to treat water as an abundant resource when it is in fact extremely scarce. Cheap water, or water that is priced below its costs, often becomes a substitute for other inputs of production such as land improvement and soil conservation. Over-irrigation by farmers leads to waterlogging, salinization and alkalization of soil. The consequences can be reduced crop yields, reduced fertility of irrigated lands, and increased salt loadings of aquifers and return flows. Downstream effects include erosion and siltation of deltas. Water charges do not reflect the increasing opportunity cost of water that stems from increasing scarcity.

Underpricing of irrigation water also leads to both inefficient and inadequate maintenance of irrigation systems, resulting in water losses, poor drainage and waterlogging. Maintenance problems also often result in inefficient use with significant amounts seeping out or evaporating from unlined or obstructed canals and distributaries.

D.2. Water Cost Recovery

In the region there is an absence of effective financial cost-recovery mechanisms. Even at low-maintenance levels, the revenues collected by water users recover only a fraction of operation and maintenance costs. A comparison of cost estimates for water production provided in table 1, with water charges for domestic use and irrigation provided in tables 3 and 4 respectively reveals a substantial difference between water charges and the actual cost of water production and delivery. The large discrepancies in costs and price demonstrate the need for water pricing to reflect at least its cost of production and delivery, let alone its scarcity.

Most governments in the region have not attained a full cost recovery from public irrigation schemes. Rather, they attempt to absorb the capital costs of supplying the irrigation system, setting water charges and taxes at a level that will allow recovery of the operation and maintenance costs. Often times the costs of user fee collection on the irrigation system is too costly, that many governments opt to recover the costs from general taxation. This dilutes the price scarcity signal, further encouraging farmers to consider water as an abundant resource. The price does not reflect the scarcity value or opportunity cost of water, and water-pricing policy is not used effectively as a water demand management tool.

In the region, as Table 3 demonstrates, at the municipal level, the price of water in the highest consumption brackets exceed the average cost, but the average price still falls short of covering these costs. This is because the majority of municipal water consumers fall into the lowest consumption brackets, and revenues are insufficient to cover costs. In Jordan, revenue covered only 49 per cent of domestic water costs and just 16 per cent of irrigation costs.

In Egypt, municipal water charges do not even cover operation and maintenance costs. The same is true for irrigation water in the Syrian Arab Republic. For Egypt, the price of water in the higher blocks represents about 29 per cent of operation and maintenance costs, and no more than 13 per cent of the average cost of municipal water. Water prices in the industrial sector rose tenfold during the period 1970-1990; however, revenue covered only 20 per cent of marginal costs at most, during that period. In the majority of GCC countries, charges for desalinated water in the domestic sector are far below the actual production cost per m^3.

As for the industrial sector, low industrial water tariff in the region not only encourages inefficient consumption but also discourages investment in recycling or water treatment as part of the technology and long-term capital investment. In Egypt, a clear link has been established between low water prices and the limited extent of recycling in the industrial sector, and mainly in the power industry, which consumes about 79 per cent of

industrial water. The treatment and recycling of cooling water could become economical in the power sector if water charges were increased.

F. Water Pricing Policy as Demand Management Tool

Water in the scarcest region of the world is severely underpriced. The scarcity of the resource is not reflected in its price, but rather underpriced water has resulted in inefficient and wasteful use by all users. Ineffective cost recovery for water production, treatment and delivery has not allowed for adequate maintenance of water delivery systems, resulting in significant water losses. Water losses in municipal distribution systems often exceed 50% of the water supplied for urban use. Unaccounted for water for urban use approaches or exceeds 50% in many of the region's cities, such as Damascus, Amman, Sana'a', and Hebron Approximately 87 percent of all freshwater resources in the region are used in low-value agriculture, but out-dated irrigation techniques and skewed water pricing have allowed for the continued inefficient dominance of agriculture in water use. Irrigation water losses often exceed those water resources effectively used by the irrigated crops by 50%, due to irrigation system losses and the lack of re-investment in upgrading of delivery systems. Despite its scarcity, water in the region is supplied to farmers at a cost below the cost of supply, contributing to the inefficient use and waste of scarce water resources. In general, inefficient use, overexploitation and lack of investment in delivery systems and regeneration of water resources stem largely from inadequate water pricing policy. Water pricing policy should be used as an effective demand management tool, particularly in the agricultural sector.

Empirical evidence in some of the GCC countries, including Kuwait and Saudi Arabia, shows that, when industries have to bear the cost of their water supply, they tend to rationalize their consumption and adopt conservative patterns of water use. In Saudi Arabia, total water consumption in the industrial sector has been reduced by 50 per cent since 1980, despite a several-fold increase in industrial production (Al-Dukheil, 1995) over the past decade. Refineries and other major industries have been forced to build their own desalination or reclamation plants to guarantee their water supplies at reasonable prices. For most of the GCC countries the implementation of progressive block rates in the domestic sector has been ineffective as an economic tool, as the rate has been set well below the incremental cost of supply. Pricing policy may be based on setting charges equal to the marginal or user costs, depending on the water source.

For surface water, it would be appropriate for most ESCWA members to use short-term marginal cost pricing reflecting operation and maintenance costs. Such pricing schemes may be gradually implemented or changed to include capital costs. Short-term marginal cost pricing would be easy to develop and administer as a first step towards promoting the efficient use of scarce water resources. The user cost concept may be appropriate for countries that depend on groundwater, especially from non-renewable sources. The true cost of water would reflect the future cost of subsidizing a new source such as desalination. Thus, the pricing of groundwater could approximate the actual cost of desalinated water. It should be pointed out, however, that appropriate pricing structures must meet certain social, political and economic criteria in the countries concerned. The implementation of an efficient pricing policy requires the modification of existing water laws and regulations, taking into consideration water market requirements and privatization schemes, price monitoring and enforcement mechanisms. Appropriate water legislation should provide the mechanisms for ensuring the most equitable economic and sustainable use of water resources, taking into account socio-economic conditions and the need for natural development in the respective ESCWA member States. Efficient development and management of water resources requires the implementation of a water pricing strategy. Formulating and implementing appropriate pricing policies constitutes one of the major challenges for decision makers throughout the ESCWA region, a challenge that must be met within each local context, given the sensitivity of attaching an economic value to water. Prior to the formulation of water pricing policy, social, economic, political and religious factors must be carefully evaluated. In order to ensure public acceptance, efforts must be oriented towards the formulation and implementation of a graduated pricing strategy. Water pricing guidelines are

suggested in the ESCWA study on pricing policy (ESCWA, 1997). These guidelines can be applied to pricing to decrease water demand in all sectors.

G. Water Allocation and Equity

Water has multiple uses and users. Water is not only used for irrigation, household consumption, drinking, and industry and energy applications, but also supports ecosystems, and provides environmental services. Users differ by water use, water needs, both in terms of quality and quantity required, and ability to pay for water; these should be reflected in the water pricing policy. Water allocation should reflect the scarcity of the resource. Achieving equitable use and allocation of scarce water resources thus possesses several dimensions. Allocating sustainable water levels to all users requires careful management of water resources and policy. The issue of equity becomes particularly salient in water pricing policy when setting water prices for the poor. Where water has traditionally been viewed as a God-given right, setting higher water prices to reflect the full costs of water for poor consumers is often politically difficult. The argument that water is too essential to deprive the poor of its use through pricing results in underpricing water for the poor, which creates heavy financial burdens on governments' limited resources.

In conclusion, water users should pay differentiated prices that effectively reflect the full costs of supply, delivery, depletion, and pollution treatment attributable to their use. Prices should be linked to the quantity and quality of use, thereby establishing a pricing policy which gears user's efforts toward more efficient use, conservation and minimization of pollution. Equity and efficiency objectives can be served through progressive water charges that reflect long-term supply costs.

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ANNEX A: METHODOLOGIES OF COSTING AND PRICING STRUCTURES OF WATER

A.1 Methods and Concepts for Estimating Water Cost

There are several types of water costing approaches, including the imposition of service charges, which incorporate operation and maintenance costs, marginal costs, and opportunity, average, and market-oriented costs. The selection of a particular pricing scheme depends on the sector in which it will be applied, the level of subsidies, equity, the ability of customers to pay, and the extent of conservation and poverty alleviation efforts (Sadik and Barghouthi, 1994). The best concept of pricing cost is one based on equating the price of water (P) with the marginal cost (MC) of water production (Saunders and Warford, 1980). The marginal price concept is efficiency- and conservation-oriented. For more details on costing principles refer to the annex in module 5.

A.2 Modes of Water Pricing

A well-designed rate structure can lead to the better management of supplies and provide an incentive for water conservation. Criteria for establishing water rate configurations can be based on the elements of cost recovery, equity among users, economic efficiency and local acceptability. The most important factor is user acceptability, represented by the customer's ability and willingness to pay. Economic efficiency is based on providing water services at minimum cost. Rate setting should take into account costs associated with the operation and maintenance of the water supply system and other related expenses. The second most important criterion is the achievement of equity; this derives from the sharing of water delivery system costs among customers in a fair manner.

The fixed rate charged by a municipality includes total costs represented by administrative overhead and billing costs and must be borne by all customers. These costs should be covered in either the first or second block rates. Economic efficiency is theoretically based on achieving a given objective at the least cost. It can be realized when the price of water is equal to the marginal cost, system repairs and expansion costs are adequately covered, and the rate reflects the true cost of water. Public acceptance can be decided by the local authorities to guarantee income distribution. Efficient rate structuring includes mechanisms for recovering the true cost of water services without resulting in under-pricing, over-pricing, or subsidizing some consumers at the expense of others.

The direct association of water availability and pricing with production costs should be considered within the context of prevailing social conditions in a country. The poor must be recognized as having a claim to potable water equal to that of the more affluent, at an equitable price. In certain circumstances subsidies may be used to satisfy minimum water requirements. The viability of water pricing schemes depends, at the very least, on the recovery of costs associated with the provision of water and water-related services. Water consumption practices may be influenced by price incentives, as well as by conservation tools and regulations, and more directly modified by mechanisms such as water pricing schemes. The public must be made aware of the importance of pricing policies as a means of managing water resources and of conserving them for future generations.

Water Pricing rates. Several different types of water charges are used in the domestic, industrial and agricultural sectors in various parts of the world. The price structure is typically influenced by the availability of water, consumer income, and certain socio-economic factors. Pricing systems applicable to municipal water consumption may not always be appropriate for pricing irrigation water, since a considerable proportion of water used in agriculture is not subject to volumetric metering. The following are commonly used water pricing rates applied mainly in the domestic sector:

Flat or uniform rates. A flat rate is charged for unlimited volumes of water for all consumer categories. A uniform rate is charged at a constant price per unit of time (month, three months, and so on). This pricing method is most practical in countries with abundant water sources. The method is simple to design and

administer and is the system most preferred by consumers. However, since the monetary rate is constant, the marginal cost of water to the consumer is zero, and there is no incentive to conserve or reduce consumption.

Block rates. Water consumption is divided into blocks representing ranges, and rates vary according to the volume sold. Larger consumers pay higher rates and smaller consumers lower rates per unit volume. Block rates favor small water consumers (the poor) with the aim of income redistribution. An increase in rates can be instituted to recover the full marginal costs of exploiting a new water source. Increasing the upper portion of the block rate may be justifiable when identifiable customer groups exist and it can be ascertained that they can absorb the higher charges.

Seasonal rate and peak rate. The seasonal rate structure differentiates between peak and off-season periods, with higher rates applied during certain seasons. The same type of rate structure can be applied to 24-hour periods as well as a seasonal basis, with customers charged premium rates for water during peak times each day. The peak rate is one method of sending price signals to consumers during high consumption period. Seasonal and peak rates are built upon two basic elements: the identification of peak and off-peak hours or seasons; and the application of a surcharge for high-level usage during peak periods.

Conservation rates. Several rate structures may be combined to achieve greater efficiency and conservation. A conservation rate structure might include a combination of progressive block rates, peak season rates and excess-use surcharges. These rates would directly influence water-use patterns, delaying the need for additional facilities for water supply and distribution (Duke and Montoya, 1993).

Capacity rate. This water pricing charge is based on the size of the house connection pipe or the size of the water meter. Under this rate structure, consumers pay for delivery system capacity in proportion to the capacity available to them. Another form involves fixture and appliance charges; customers are charged according to the number of water-using appliances they have.

The different types of water charging structures have been used mainly in the domestic sector and, to a limited extent, in the industrial sector. Volumetric tariffs, which charge according to the amount used, are more versatile than fixed charges and can provide incentive for careful use. Tariffs typically combine a fixed and variable element to cover overhead and operating costs respectively. In the domestic sector, a minimum charge is often imposed in the case of municipally metered water use, regardless of the consumption volume or price structure to cover overhead cost. However, minimum charges are considered inequitable from the economic standpoint, since they penalize low-volume consumers by charging for water that is not used.

Cost recovery charges for sanitation services are often levied on households and/or industry, typically as a surcharge on the water tariff, but are less easy to set and administer than water consumption charges. Charges are sometimes levied for the cost of connections to public systems, or for the provision of facilities.

Pricing or cost recovery for irrigation systems are beginning to be used, although irrigation water is often heavily subsidized. Volumetric pricing is still the exception, and proxies are used, such as acreage, type of crop, size of harvest; however, with modernization of irrigation systems, improved charging is feasible.

Direct cost recovery for environmental services or resource management is also rare but has been applied. Charges may be linked to environmental management (e.g. charges for abstraction licenses, or discharge permits).