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Water Charge, the Cyprus Experience

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ABSTRACT

Water resources in most Mediterranean countries are scarce and limited and for their conservation and development a great share of public funds is invested. Also great amounts of public money are spent for the management, operation and maintenance of the waterworks constructed for water development purposes, year after year. Usually domestic water supplies, which constitute a small percentage (15-30%) of the total water pay the full cost, where irrigation water, which constitutes a high percentage, is at present delivered free of charge or at a very low prices, which carries a very high subsidy usually paid by the tax payers. It is generally accepted that, low water prices lead to wasteful and inefficient use of the available water, where high prices discourage its use. Water charges are imposed under certain conditions for financial and economic reasons. From the point of view of financial reasons, enough money must be raised to finance further the water development in the country. The economic reasons are that, water being scarce, limited and highly expensive, must be used with the most efficient, effective and economic way. With water scarcity becoming a common situation in most Mediterranean countries due to population growth, better quality of life, human actions and climate change, better water governance is a must for a sustainable water development and sustainable development. It is estimated that by the 2025 the water demand in the Mediterranean countries is expected to increase by 35%. The development of additional water, will need a high investment which in one way or the other must be recovered, where on the other hand effective water demand measures must be implemented. All that water charge is an effective water demand measure and when combined with other financial, structural, legal, and institutional measures can be used as a management tool accepts it. This report will discuss in great extend, why we must impose water charges, under what conditions water charges are effective, the various methods of water costing using capital cost, O&M costs, the environmental cost and the resource depletion cost, the requirements of an effective irrigation water charge, the legal and institutional framework, the macro-policies that the irrigation project governing bodies must adopt, the factors, criteria and the guidelines to be used for setting the appropriate water charges. The Cyprus experience on water costing and water charging for irrigation water shall be presented.

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1. Water resources development in Cyprus

Cyprus with a typical Mediterranean climate, mild rainy winters and hot summers has an average annual rainfall of about 500mm, ranging from 290mm in the plains to 1060mm on the mountains, falling mostly in the months of October to April, where evaporation is around 2000mm per year. Cyprus being an island relies entirely on rainfall for its water needs. The total population is around 1,00 Million including illegal settlers brought by the Turkish troops[2] and the total water resources are estimated around 790 MCM, 510 MCM as surface and 280 MCM as groundwater. None of the river flows perennially and the aquifers are situated in the river valleys and the plains.

Groundwater, being easier and cheaper to develop, was the first to be used and by 1960, most of the major aquifers were already over-pumped. In 1960, after independence from the British, development of the surface water resources and recharge of the aquifers started in parallel to the irrigation water use improvement project. In 1967 the Government started with the assistance of the Food and Agricultural Organization, the preparation of the Cyprus Water Master Plan, which was completed in 1972. Implementation of the Master Plan started in 1974 and by 2000 it was almost completed. It provided for the construction of five main projects, the Pathos Irrigation Project, the Vasilikos-Pendakinos Project the Khrysokhou Project, the Southern Conveyor Project and Morphou Tylliria Project. The constructions of the first three projects was completed in the 1980's and are fully operational, where the fourth is almost completed and operational, where the construction of the fifth was postponed because part of it lies in the area occupied by the Turkish Army. At present the water demand is around 230MCM per year, 120 MCM coming from groundwater, 80 MCM from surface water and the remaining from desalination plants. The water balance, at the time of the plan preparation, envisaged for water demand satisfaction from fresh and recycles water up to the year 2010. Figure 1 shows chronologically the surface water storage capacity that increased from 6 MCM in 1960 to 304 MCM in 2000.

Irrigated agriculture consumes almost 160 MCM or 70% of the natural water resources for the growth of Citrus, Deciduous, Potatoes and other vegetables. Agriculture contributes about 5% to the GNP and employs around 12% of the active population. The domestic tourist and industrial sectors consume the remaining 70 MCM or 30% of the total water

[2] *In 1974 Turkey invaded Cyprus and since then it occupies 37% of the area of the Republic of Cyprus.*

resources. Water to the farmers is delivered through pressurized networks and on farm irrigation is applied with modern efficient irrigation systems (drip, sprinkler, mini sprinkler, etc.) The supply to each consumer is metered and charged on the basis of approved tariffs. Treated sewage reuse schemes have been implemented since 1980 but mostly on an individual small scale projects promoted by the tourist industry, that used the treated effluents from small sewage treatments to irrigate hotel lawns and gardens. The domestic water supply to almost all the population is made through closed pressurized systems.

2. The need for water management

Human existence depends on water and life is the gift of water. All life, human, animal, and plant need water to exist. The importance of water is not new. Ancient civilizations that developed the ability to manage their water resources for irrigation and domestic use (from Babylon to China and from Rome to the Incas Empire) developed into sophisticated prosperous societies. Still today development is largely dependent on our ability to manage effectively and efficiently our limited, definite and scarce water resources.

To day, it is realized more than ever that water is an increasingly scarce, and valuable resource of finite supply. Water scarcity is brought by human actions in three ways: a) through population growth, b) misuse and c) inequitable access. Population growth contributes to scarcity simply because the finite available water must be divided among more people. Misuse means overuse and pollution of available water, such as aquifer depletion, seawater intrusion, disposal of untreated wastewater, water salinization, etc. Demand for water in this century has increased tremendously due to the rapid growth of population, expansion of agriculture, the rising of the standard of living, the urbanization and industrialization. During the last fifty years the water use in Cyprus has doubled and the per capital consumption has increased by 50 percent.

When water is plentiful, relative to demand, the water management rules, such as water policies, laws etc. are relatively simple. However with increasing competition between agriculture, industry, and cities for limited water, reallocation will take place transferring water from less competitive users to more competitive users, and since agriculture (mainly irrigation) is the relatively low-value low-efficiency and highly subsidized use, will be the looser.

3. Why irrigation

The role of Irrigation in food production is well known and accepted. Globally there are about 235 million hectares of irrigated lands (amounting to 17 percent of the arable land) producing around 35 percent of the global total food production. The irrigated areas yield on the average about two and a half times as much per unit area as non irrigated land, which shows that irrigated land yields are much higher. With population growth, food demand will increase and irrigation will be one of the means to increase food production. However, due to the transfer of irrigation water to the other sectors of the economy, the remaining water must be used more efficiently.

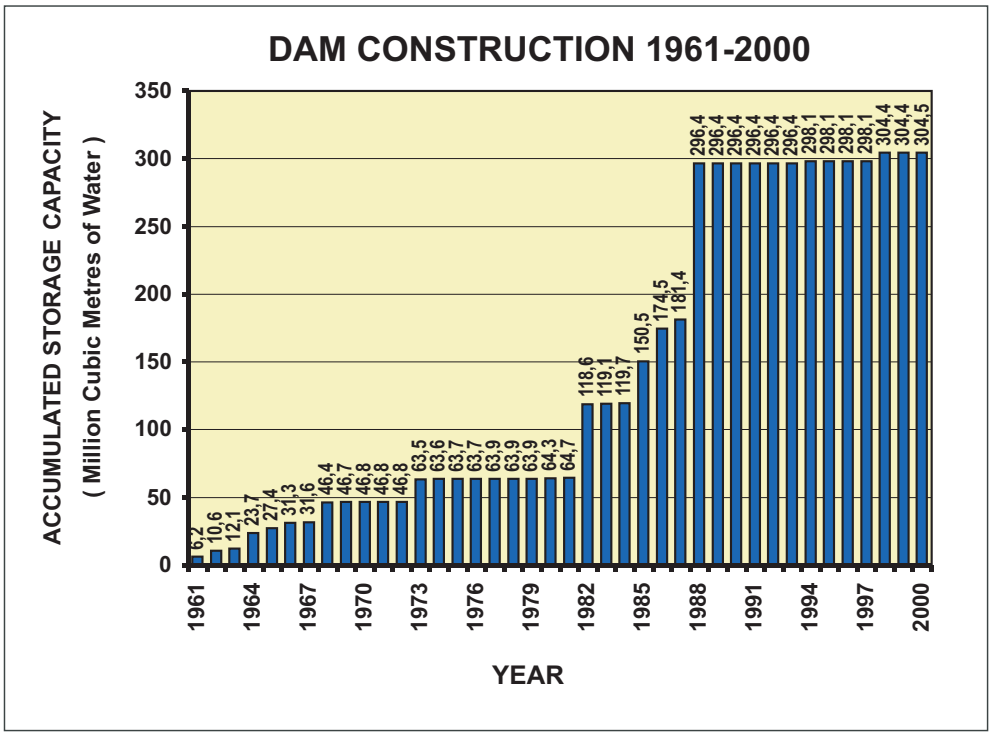

Figure 1. Surface Storage in Dams

4. Why apply an irrigation water charge.

Governments and individuals invest high capital cost and spent annually huge amounts of money for safeguarding water supplies for irrigation. Investments by privates concern the development of groundwater, which is usually much cheaper and much easier to develop and usually pay the full cost of the water. On the other hand surface water

is much more difficult and much more expensive to develop and its development is usually undertaken by the State, which also pays all necessary investments, and undertakes the operation and maintenance of such projects and sells water to the users at some price. Although capital investments are high and annual operation and maintenance expenses are rising the irrigation water charge is comparatively low or nonexistent. In some countries water is considered as the "gift of God" and in others it is heavily subsidized (covering only a small portion of the annual operation and maintenance expenses). Total cost on irrigation water is paid only in cases where water is developed by individuals (from private boreholes or springs), but in these cases the cost is relatively low if environmental and resource depletion costs are not accounted for. There are arguments why not water charge should be imposed and arguments that water charges should be imposed. Following are the arguments why water charges must be applied:

- **For economic reasons:** If a commodity is not priced properly it is not respected and its utilization is not very efficient. The same happens with water. If the water charge is non-existent or very low then water is wasted or wastefully used increasing excessively the demand, leading to groundwater depletion, groundwater seawater intrusion and groundwater pollution by return flow.
- **For financial reasons:** Water development requires high capital investment, and O&M costs which must be recovered either by taxing all the population or by imposing water charges to the beneficiary. The best method would be to apply the principle the "beneficiary pays" thus imposing a direct water charges to the irrigators. This will allow the recovery of the majority of the capital and of the O&M costs for continuation of the water development investments and proper operation and maintenance of water projects.

5. Water charge and the Cyprus legislation

5.1 General

According to the Government Water works Law all surface water running to waste and all groundwater not brought to the surface before 1929 belongs to the Government. This means that more than 99 % of the water resources of the island belong to the State. In accordance to the same law the Government has the right to plan and construct waterworks and sell the water prices that must be in accordance to certain provisions of the same law. Although the law is very old it has provisions for the

implementation of water charges in general and it is very specific on how to calculate the cost of the water, how to decide on the fixing of the prices and how to collect the tariffs. In the following clauses of this report details of the provisions of the law are given.

5.2 Right of the Government to implementation a Water Charge

The law recognizes the right of he Government to impose a water charge to the beneficiaries of water by the issue of Regulations, which may provide for the following.

The maximum amount of charges or rates and any other money compensations, which can be imposed and collected from any person benefiting from water supplied. The above may be fixed either per unit of area irrigated, or by the type of crop, or per unit of volume (m3 or other) used, or per unit of time of use of water or in accordance to the benefit which may have or can have from the water or from a waterwork. The above mean that

a) the Government has the right to impose a water charge or compensation on any person for the benefit direct or indirect accrued from the use of water or from a waterwork.
b) The Government has the right to impose a water charge either **per unit of area** benefited from the use of water or **by unit of volume** of water used, or per type of crop irrigated, or in accordance to the benefit accrued.

5.3 Method of calculating the cost of water.

The law is very specific what must be taken into account for calculating the cost of the water from a water project, which are the following

i)The interest on the capital cost

ii)The amortization of the capital cost over a reasonable period (economic life of the project)

iii)The insurance cost of works

Iv)The operation, maintenance, the energy cost and management cost for the project.

To calculate the average cost of the water the annual cost method or the Present Worth method may be used.

Annual cost method: In this method the costs and water are converted into equivalent annual figures. The capital cost is amortized over the economic life of the project using a proper lending rate of interest calculating the annual cost of repayment. By adding to this annual cost the O&M annual cost, and the Energy cost the total annual cost is calculated. By dividing this total cost with the available water for sale in an average year the average cost of water is calculated.

Present Worth Method: In the present worth method all costs and water quantities are transformed into present worth and by dividing the sum of the present worth cost by the sum of the present worth of the water quantities we get the present cost of the water. Again here a proper lending rate has to be chosen and the economic life of the project components has to be decided.

5.4 Maximum irrigation water charges

According to the same law the maximum water charges may be as follows.

- Not be more than 40% of the weighted average cost of the irrigation water per cubic meter.
- In exceptional cases where the cost of a certain irrigation project is very high and after taking into consideration, the economic capacity of the beneficiaries, the types and return of the crops grown, the soil fertility, the methods of irrigation adopted and other parameters, the charge may be raised up to 65% of the weighted average cost of the water per cubic meter.

The weighted average cost of the water per cubic meter is the cost that is calculated when the sum of the annual costs of all existing water projects is divided by sum of all irrigation water quantity from all the existing at the time projects.

5.5 Approval of the water charges

The water charges are set by the Council of Ministers and accordingly may be approved by the Parliament or applied directly. In cases where the water charges are applied by regulations they have to be approved by the Parliament wherein cases they are accompanied by regulations a decision by the Council of Ministers is enough.

5.6 Water Charge and water measurement

Water in Cyprus is a very scarce commodity and as such the water charge is implemented in money terms per cubic meter. Because of this every consumer is equipped by an accurate reliable water meter, which measures with accuracy of ±2% the quantity of water consumed. For charging purposes the water meter indication is taken every two month and a bill is send to the consumer for settlement.

5.7 Settlement of the water bills

The relevant law has provisions for the method of payment of the water charge imposed to the farmers as follows.

- The bill has to be settled within 90 days from the date it was issued.
- If the farmers does not settled the total amount of the bill or part of the bill within the above period then for the non settled amount an interest is added at a rate of 8% per year.
- If the farmer refuses to settle the bill or the remaining amount within 60 days from the date fixed for settlement, or 150 days from the date of issue of the bill, then the water supply authority has the right to cut off the supply of water and bring the case to the court demanding the payment of the arrears. In case the person is condemned in addition to the order of settling the bill the court has the right to impose a fine up to 1000 Us Dollars.
- The water supply authority has the right to bring to the justice anybody who refuses to pay for water he has consumed.

6. Financing agreements and water charges

6.1 General

During the implementation of the major water projects in the years 1970-2000 Cyprus has applied for loan to international financing agencies such as The World Bank, the Kuwait Fund and the European Bank. In the Loan Agreements, which were signed between the Republic of Cyprus and these Institutions were some clauses related to the water charges as follow.

- The potable water prices should be such that the Government recovers the full cost, including interest on investment, the amortization of investment the Operation and maintenance costs, the insurance costs and energy costs.

- The irrigation water prices should be fixed at such levels so that the Government recovers at least 38% of the weighted average unit cost of the water as defined above.

7. The cyprus practice and experience

7.1 General

Cyprus, with a semi arid climate, with a low rainfall, unevenly distributed, and of unreliable pattern, has an acute water problem, which make irrigation projects very expensive to construct, and manage. Like every good or service offered, water has a price for which consumers are asked to pay and prices are charged for two reasons (a) financial and (b) economic. The financial one is that enough money must be raised to pay, the cost (or part of the cost) of operation maintenance and management, the capital cost (or part of the capital cost), the interest on capital and the insurance cost incurred for providing the water to the farm outlet. The economic is that the quantity of water the consumers will buy and use will depend on the price, i.e. if the price is very high this will discourage the farmers from using the water or use it only for the irrigation of very high return crops (limited use) where low prices will encourage the wasteful use of the water. In broader sense pricing also has a social function related to the multidimensional nature of social welfare where price levels influence income distribution, economic stability, and other social goals and to some extend the foreign trade balance.

7.2. Water charge function and the law

The Cyprus Legislator foresees the importance of the water charge level for water from the Government Waterworks. In 1968 the Government Waterworks Law was amended to provide guidance for water charges from such projects. Details about the water costing, the level of the water charge, the method of billing and the collection of the charges are given in section 6 of this report.

7.3 Criteria for fixing prices:

During the last forty years the Cyprus Republic has been implementing water charges. For fixing the irrigation water charges for the irrigation water from the Government projects, certain criteria and guidelines are considered since they are envisaged in the relevant law. These are

considered essential for both the consumers and the supplier since they take into consideration the various factors and parameters of agricultural production costs and largely the best utilization of water. These guideline and criteria are the following.

7.3.1 The unit cost and weighted average unit cost of water

The weighted average unit cost of water is an essential parameter for setting the water charge, since the proposed charge according to the Law and the Loan Agreements, it should be on the average at least 38 percent of this. In addition, according to the government Waterworks Law the charge should not be more than 40 percent of the weighted average unit cost and in certain exceptional cases it can be allowed to go up to 65 percent.

The unit cost of water of each project is made up by the capital cost and the annual operation and maintenance cost. The capital unit cost is calculated by the "present worth method" in which all capital costs and water quantities that occur during the economic life of the project are transformed (compounded in the case of past expenditure or quantity and discounted in the case of future expenditure or quantity) into present worth values and dividing the present worth values of capital cost by the present worth values of quantities of water. The rate of interest used is eight (8) percent and the economic life of the projects is 40 years after commencement of operation. The annual cost, which is added to the unit capital cost, to form the unit cost of water of a project is made up of the operation, maintenance and energy costs, materials, operation and maintenance equipment, and project wages and salaries and administration costs of the Water Development Department staff.

7.3.2 Government Waterworks Law

The Government Waterworks Law Clause 24 specifies the **maximum** and **the special maximum** water charge that the Government may impose. The maximum charges or fee or any other money consideration would be such so that it does not exceed 40 percent of the weighted average unit cost of water from all the Government Waterworks (maximum charge). Of course in exceptional cases, after taking into consideration the high cost of the works or financial and social conditions prevailing in the area where a scheme is located or the financial condition of the consumers, the kind of crops, the fertility of the land, the methods of water irrigation and other related parameters, the charge may be increased

up to 65 percent of the weighted average unit cost of the water (special maximum charge) So the charge should be in line with the above requirements.

7.3.3 Loan Agreement for Project financing

The government of Cyprus has made loans to finance the construction of the waterworks. In the loan agreements there are some conditions, which set some requirements for the sale of irrigation water charges. The loan agreements stipulates that the minimum charge for irrigation water should be set at 38 percent of the weighted average unit cost of water from all projects.

7.3.4 Ability of farmers to pay

The charge an individual or a farmer will pay for the irrigation water depends on his income in general. Pert-time farmers with income from other business or employment will afford to pay water charges even during the early stages of permanent crop growth. The same may happen with commercial enterprises where full time farmers with small field holdings and low income will not afford to pay such charges. Therefore the charge level must take into consideration the ability of the farmers to pay for the water they consume since high charge will discourage the farmers from using the water where low charge will encourage the wasteful use of the water.

Generally it can be said that the water charges fixed in accordance with the respective Law and the loan agreements are not prohibitive for water use and cannot be considered low to encourage wasteful use. Furthermore the farmer's ability to pay for the water they use is considered satisfactory.

7.3.5 Benefits Received

- If a project is assessed as being feasible in economic terms any level of charge up to the total unit cost of water can be pursued. However there are different returns per cubic meter of water. Using the Norms Input Output data, the net return per cubic meter of water for the main crops was calculated by taking into account the following.
- All fixed and annual costs except water cost are recovered.
- Family and hired labor costs are included in the costs

- Normal yields are considered being the average yields of well-managed crops.[3]
- Prices: These are the producer's prices for the crops under consideration. Early and off-season product prices are not considered
- Water Consumption: This is the average volume of water required to sustain a certain crop
- These figures represent actual quantities of water consumed.

7.3.6 Water Quality and Service Offered

The quality of the water supplied from the Government Waterworks is not of great importance because the deference between the projects is insignificant. However, there are differences between the services offered by the different projects.

The services offered are the following:

- **Dependability of Supply:** The dependability of supply of irrigation waters varies from project to project depending on the project characteristics.
- **Water Delivery Mode:** The mode of water delivery to the farm outlet is a characteristic of the distribution system. Different modes of water supply offer different services to the farmer. For example, an on demand service gives to the farmers the benefit of irrigating as they wish, providing to them all facilities i.e. sufficient constant pressure, constant fixed flow rate and continuous dependable supply. Other modes of water delivery are on rotation with or without enough pressure and not fixed flow rate.

According to the services offered the various projects are classifies into four categories as follows:

a. **Excellent service projects:** In these projects the water is delivered to the farm gate "On the demand or modified demand mode", at the right pressure, the right rate of flow and at the right time in satisfactory quantities.

b. **Very good service projects:** In these projects the water to the farm gate is delivered without any control on the pressure or on the flow rate with possible variations on one or both. This forces the farmers to provide extra pressure control and or use their own flow control devices.

[3] Norms input-Output Data for the Main Crop and Livestock Enterprises of Cyprus.

c. **Good service projects:** In these projects the water to the farm gate is delivered without enough pressure and not at fixed rate of flow where for the implementation of modern irrigation methods additional inputs by the farmers are required.

d. **Special Case Projects:** These are schemes where the water delivery is not made at the farm gate but at a point far away and the farmers have to make all necessary arrangements for the transportation of the irrigation water from the hydrant point to the farm gate and to provide the extra head for irrigation by modern irrigation systems.

7.3.7 Comparison of Charge of irrigation water from the Government Waterworks with the actual cost of irrigation water from the Irrigation Division Projects

Irrigation water is an input to agricultural production. Therefore the charge that a farmer will pay will have an impact on the cost of the final product. If the water charge varies greatly between the different producers (users) then there may be a distortion of the mechanism of setting the selling prices of certain crops. Of course such a situation may be caused from other factors such as the soil productivity, the methods of production adopted by the farmers, the fertilizers prices, the farm labor cost e.t.c. The aim would be to adapt charges at such levels so that no distortion of economy is caused and the consumers are treated equally

Using all above criteria and guidelines the irrigation charges are fixed and are revised periodically. The approval of the council of ministers and the ratification of the House of Representatives are necessary for the adoption or revision of the existing water charges.

8. Water charges implemented

Since the 1960's different water charges were implemented based on the above criteria and the general agricultural and irrigation policy as follows.

Period 1964-1980, Charge according to type of crop: The water charge from Government waterworks was fixed in accordance with the type of crop irrigated by categorizing the crops into permanent crops and annual crops. The permanent crop water charge was smaller by approximately less than 15% than that of the annual crops that emphasized the policy to promote the extension of the permanent crops.

Period 1980-2002, Uniform Charge for all crops of a certain project. This period water charges were the uniform for all crops irrigating from a

project but the other parameters such as service offered, water dependability and capability of farmers to pay play a more important role. The upper level of charge was decided by the criteria of the benefits received.

The last time the irrigation charges were revised was in 1992 and the charge at that time represented around 34 % of the weighted average unit cost of irrigation water. Since then no revision of the water charges was made due to a series of droughts that made the decision by the Government and the Parliament politically and socially very difficult.

9. European union directive and water charge

In an effort to harmonize the water policies concerning the water resources management by all member countries, the European Union has adopted the Water Framework Directive, which among others provides for the calculation of the real cost of the water and the implementation of water charges. According to the Framework all member countries should, by the year 2010, implement such charges, so that the beneficiaries pay the full cost of water. In the full cost in addition to the service cost, as explained in section 5.3, the environmental cost and the resource depletion cost has to be included. This is expected to cause a disproportionate increase to the irrigation charges especially for the Mediterranean EU member states due to the water scarcity, the high cost of water development and the high water demand by the irrigated crops.