



Thematic Week: Water Economics and Financing

Thematic Axis: Financial Solutions for Emerging Countries

Title: Economic and financial aspects-Water Demand Management –(A strategy to deal with water scarcity)

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Abstract:

Financial and economic policies and instruments are at the basis of Israel water resources management policy and its Water Demand Management strategy.

The paper will deal with a potential comprehensive strategy to combat water scarcities in water scarce countries and especially in the Middle East. Water scarcity in countries as well as in cities or agricultural projects present to day a potential condition which might accompany the national growth as well as the socio- economic policies for many global sites for many years.

That strategy is defined in times as Water Demand Management, and or Water Conservation as well as the Increase of Water Use Efficiency. These 3 definitions have become a major shift of paradigm from the conventional supply management of water to the management of the demand side-producing additional quantities of water for the immediate needs of the society ,through the creation of Virtual quantities of water, whether by conservation strategies, water markets or by increased agricultural and industrial production per unit of water, as well as the import of water intensive agricultural products and decreasing exports of such products.

The experience of Israel in Water Demand Management (WDM) is presented as a potential and powerful instrument to enhance socio-economic prosperity and growth with limited water quantities, available for the societies.

Israel was established in 1948, a semi arid country, having a population of 650000 , a GDP of \$300/capita and was using approximately 300 Cubic meters of water per person for all uses. In 2007 Israel has reached a population of 7.2 million persons, a GDP of \$25000/capita, and maintained its growth on a minimum approximate parameter of 250 of fresh Cubic –meters of water per Capita, supporting the large increase in personal and general income.

Despite being a semi-arid country, it balances its Agricultural production for consumption between exports and imports following the total development of its fresh natural water resources, an intensive national campaign of water conservation, improved efficiencies of water use as well as the initiation of a comprehensive waste water treatment and re use, marketing and trading treated effluents with farming fresh water allocations. In addition it adopted “Virtual Water economic and financial policy, importing grains and thus saving large quantities of water, all of which as part of its national water resources management and its Water Demand Management Strategy.(WDMS).

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The pioneering works and the resulted R&D efforts of Israel, financed by the public and private sectors, have already influenced a number of other countries and global regions, as Water Conservation is becoming an indispensable global tool and need.

As other countries in water scarce regions suffer from similar, or more acute levels of water scarcities; efforts have been and are going on in the present ,in order to influence and spread the concepts developed in Israel to them.

Keywords:

The global situation can be summarized in the following paragraphs, while the situation in many Developing countries is much more critical.

Recent studies claim that more than 40% of the world food and agricultural needs are produced on irrigated lands. In the developing countries the rural and especially the urban populations continue to grow at a rapid rate, the forecasted food and agricultural demand will increase the pressures on the dwindling water resources in many of the world countries especially, but not only, in the developing ones.

As most of the feasible water resources in river basins as well as in the aquifers, have already been connected and are being used in the various countries, one can not avoid asking the questions from where and how will the future demand for more food and water be met?

Water Economics issues related to Water Demand Management
(The following issues are at the basis of the WDM policies in all 3 sectors in Israel-Irrigation, Urban and industrial water use.)

In many countries and regions, when population grows, the water it relies upon becomes scarce: there is not enough water to satisfy the needs and wants of everyone around. In a world of 6+ billion people, water is becoming scarce, in many cities and countries even if remote rivers are discharging large quantities of water into the oceans. The distances from sources to consumption sites become financially or economic infeasible solutions.

In most cases, when water is scarce it is costlier to develop and to use. However, when a person, a farmer or an industry uses water in an area where water resources are limited, that quantity of water is not available to another farmer, neither a city nor an industry. The productive value of the water on the farm or the site where it is missing is the "**shadow cost of water**".
Comprehensive water metering ,progressive block rates and abstraction fees are few of the basis tools that Israel has implemented

An efficient use of water means that the contribution of water to human welfare is the optimum that may be achieved. Where people are poor and where food supply is not always assured, contribution to agricultural production is contribution to welfare. Where water is used for human consumption, in urban or rural areas, it should be allocated to satisfy basic needs of all. The basic need is Human Right.

Failure to realize that scarcity requires careful, financial and economic allocation of water and that such allocation is often not assured in a "hands-off policies", is one of the roots of inefficient use of water. The other problem is the failure, or the absence of political courage, to realize that over-utilization and pollution of water resources destroys the water and related economic resources—aquifers, rivers, soils, lakes, and habitats. This last failure is regarded sometimes as the creation of problems for future generations, however, these generations are already living with us, and suffer the consequences.

Experience, in Israel, has also taught us that wherever successfully applied, markets and water prices could become highly efficient instruments of allocation, and promoters of water use efficiencies and conservation, thus minimizing the impacts and risks associated with water scarcity.
They call for public financing to assist during the transition periods.

Adequate Water prices are cornerstones for economic policy in the sector and function, mainly, in the 2 following ways:

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We learned that the first role of prices, to provide essential information for correct management, is the least understood. The correct price will reflect the cost of water to society; that cost materializes **under scarcity. The product not produced where the water is missing is its cost. Shadow prices will thus reflect the cost of the resource, this was the basis , for the decision on "Abstraction fees" imposed in Israel, since 2000.**

When water prices reflect their real economic value, farmers, industries and households will utilize water more efficiently. Prices are not intended to encourage people to use less water; their aim is to promote people to use the right quantity of water—on the farm, the industry or in the household and the urban sector as a whole.

However, prices also transfer income. Failing to understand the information and allocation role of the prices, farmers and urban dwellers usually oppose the adequate price system. They see it only as a means of income transfer. But prices will encourage efficient use of water, they will increase, not reduce, income in rural and urban communities alike, and will reduce the reliance of water users on the whims of the political powers-to-be and their servants.

Israel policy assumes that: WATER IS INTENDED TO SATISFY THE BASIC NEEDS OF ALL MEMBERS OF SOCIETY THUS MUST BE UNDER PUBLIC CONTROL, ESPECIALLY IN WATER SCARCE REGIONS AND DRY ONES , WHEN PRICES BY THEMSELVES CAN NOT MAINTAIN THE NEEDED, JUST AND ADEQUATE DISTRIBUTION

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The National water resources management strategy

In order to understand the Water Demand Management strategy of Israel as well as its economic and financial instruments ,following is a summary of the main components of the national water resources development and the related water demand mgmt. program:

A) **The Supply strategy.** Completion of nation wide development of water resources (Surface and ground) as well as the construction of regional projects connecting all resources into an integrated network and then a national carrier was completed transferring surpluses of water from the relatively water abundant north to the water scarce center and south. This National Water Carrier (NWC) had intersected all regional projects thus completing the National Water System. (to remind readers Israel is a small country,500 km long, having an area of 20000 Sq.km. only.) (see map 3)

That investment enables the authorities to maintain a balanced national pumping patterns ,monitoring Hydro -Geological conditions at all times and throughout the country, basing it on comprehensive water metering for all uses, national water allocation system, water norms, and progressive water rates as well as water abstraction fees.

Desalination of brackish and sea water has become the main sources of water quantities when natural resources and re-use of urban waste water do not meet the growing demand for water.

B) The Demand Management strategy

Following are the main tools used to achieve the national demand water management objectives.

1. Legal basis , Pricing and economic policies –

In 1959 the Water Law was passed by Parliament declaring all water resources to be public property, establishing a water commission to regulate, monitor and manage the country water resources.

Total water metering system was completed as well as Progressive block rates (for every farmer, house, apartment and industry), prices are updated automatically with a cost of living formula, minimization of subsidies, and in 2000 total water abstraction fees have been approved by parliament, and implemented.

2. Re-use of sewage effluents.

Regulations have been legislated in order to increase the quality levels of sewage treatment plants and its effluents to maximize its re-use potential and minimize the health and environmental risks as well as enhancing the marketing/ trading potential for its exchange for fresh water allocations, mainly for irrigation purposes. Since the 90s the allocation policy for irrigation concentrates on reduction of fresh water quantities to the farming community and replacing it with treated wastewater effluents. (Total sewerage costs borne by the city, while the re use component costs are borne by the water sector.).Israel had reached a 65 % re use levels ,by 2007,almost 65% of the total irrigation sector water demand is now using treated sewage effluents-Tertiary and secondary levels.(see graph number 6.)

3. Water conservation/Improved efficiency of water use.

Continued policies in the agriculture esector, concentrate on mixed tools including: (a) allocations, norms and progressive block rates for each sector, and (b) research, development and implementation of agronomic techniques(the most famous of which were the large scale

implementation of Drip Irrigation techniques and automation of irrigation) changing of cropping patterns based on the product value per unit of water etc (see graph number 1)

In parallel wide scale implementation of technological means to improve water use efficiency and reduce water consumption in the urban and domestic sectors, commercial, industrial and the introduction of drip irrigation and automation to the urban parks and gardens.(see graph no 4 and 5)

4. Agricultural and Industrial production sectors-- Water allocation system.

The irrigation water allocations are based on norms developed by the agriculture

Research institutions together with the farmers community, reflecting the potential economic gains by introduction of new irrigation technologies, changes of cropping patterns ,and move away from crops where the product value per unit of water is relatively low, like Grains for example. A similar policy was adopted by the industrial sector where a survey was done in order to move toward reduction of water usage per unit of product as well as the reduction of the pollution caused by the industry. The implementation policy followed the surveys for prioritization strategy ,engineering work, establishment of special funding instruments for the R&D as well as for the replacement of worn piping and systems, imposing sanctions , the execution of nation wide program industry by industry, finally ending with a norm allocation system based on water quantity per unit of production.

(graphs numbers 1 and 2).

5. The urban sector--Water metering, replacement of older pipes , electronic monitoring and retrofitting campaigns

Double volume toilet flushing basins were redesigned and manufactured, introduced since the 70s and enforced by legal standards; flow and pressure regulators on taps and showers etc – were all the basis for a 25 years of a program which one can well see the results from graph no.4.

The urban consumption of Israel had hardly changed on a per capita basis, despite an increase of 300% in the GDP during the last approx.40 years.. Comprehensive and total retrofitting has yet to be completed. (see also graph number 5)

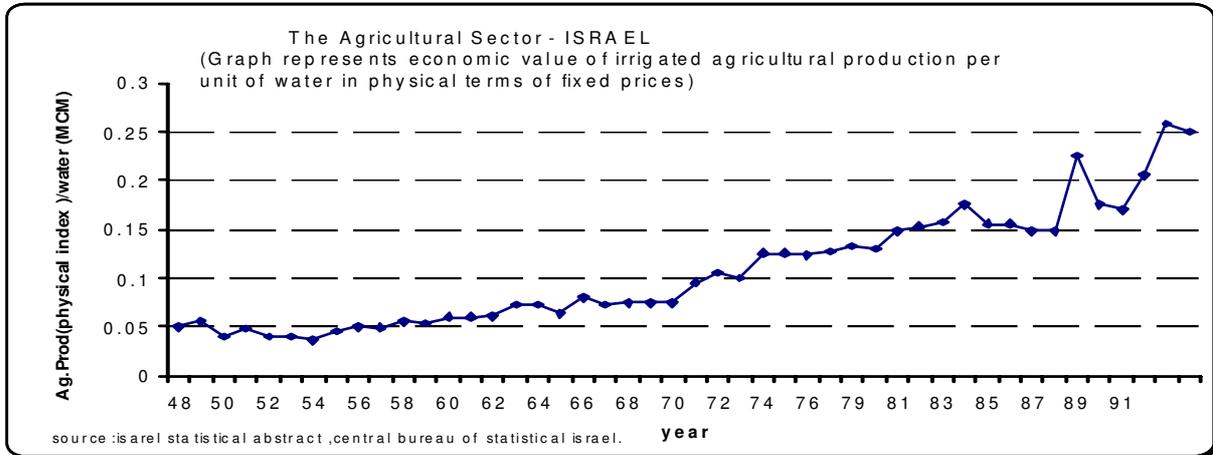
6. “Virtual water policy”—When realizing that water resources will not meet the demand the authorities have taken a most difficult decision, in the 1960s, to import the great majority of its grains needs instead of growing it in Israel. In today’s figures it means the “Virtual Import” of almost 3 Billion cubic meters of water annually, almost, twice the total availability of fresh water resources in Israel. A most important economic decision which lead to the present water use parameters.

7. Water markets (internal and possible external)

The authorities as well as Parliament have recently approved a change in the water code enabling holders of water allocations to sell their permanent or temporary allocations to others transferring the actual transaction via the national water carrier, thus opening the sector for a market like operation. A policy that the water commissioner office has been already doing for years al by trading fresh water with treated sewage effluents.

The market concept could well serve and even promote peaceful exchanges of water between the countries of the Middle-East.

Graph 1- Real Agricultural production per unit of water



8) Sea Water Desalination

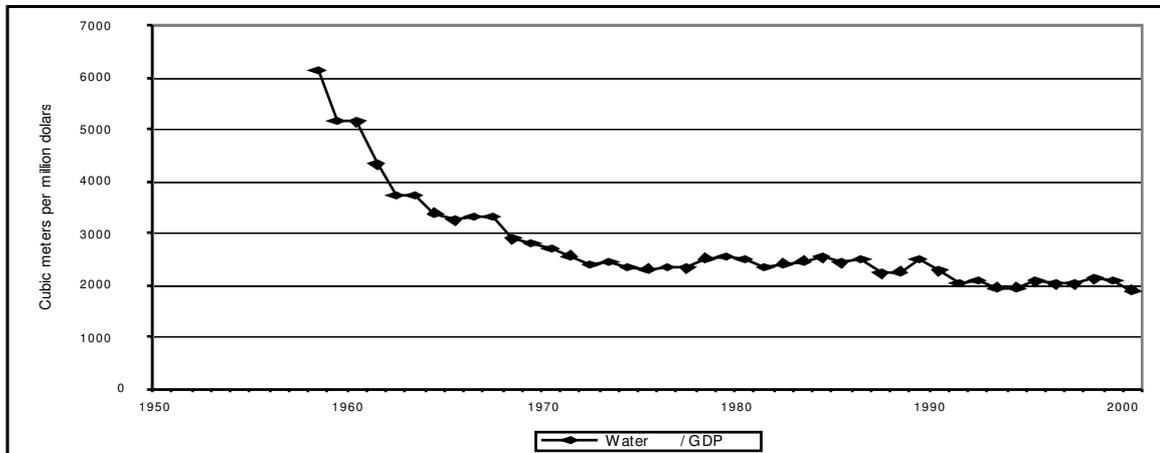
However, as a result of the recent dry spells and growing water demand beyond natural recharges the Government has decided to initiate and accelerate the construction of Reverse Osmosis Sea Water Desalination Plants (ROSWDP), adding in 2005-7 ,about 10% to the total fresh water availability of the country, while additional plants are already in the pipeline to reach 50% of the national fresh water resources, by 2015-2020. Following intensive R&D an significant costs reductions of ROSWDP, during the international tenders of Israel in 2001/2, based mainly on local changes in the design of these plants. Present ex plant costs of lasrge plants are less than 60-65usc/cubic meter.

The decision includes as well, the completion of a nationwide treatment and re-use of all its treated waste water, Tertiary and Desalinating most of the Secondary treated effluents, allocating these new sources of water to the farmers in exchange for their fresh water allocations.

Conclusions:

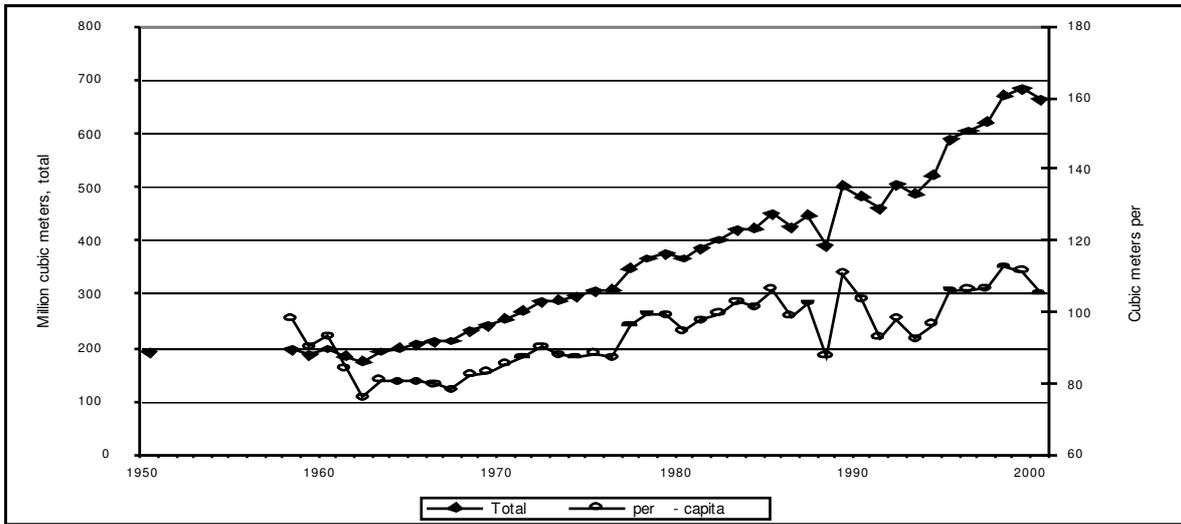
THIS POLICY AND INVESTMENTS WILL ALLOW THE COUNTRY TO CONTINUE, INDEFINITLY ITS SOCIO-ECONOMIC GROWTH DESPITE THE INCREASE IN POPULATION AND STANDARD OF LIVING, AS WELL AS OPENING THE DOOR FOR THE POTENTIAL SOLUTIONS OF WATER CONFLICTS BETWEEN ISRAEL AND ITS NEIGHBORS.

Graph No' 2 - The graph represents the National Industrial Water use per real term value of the Industrial production.

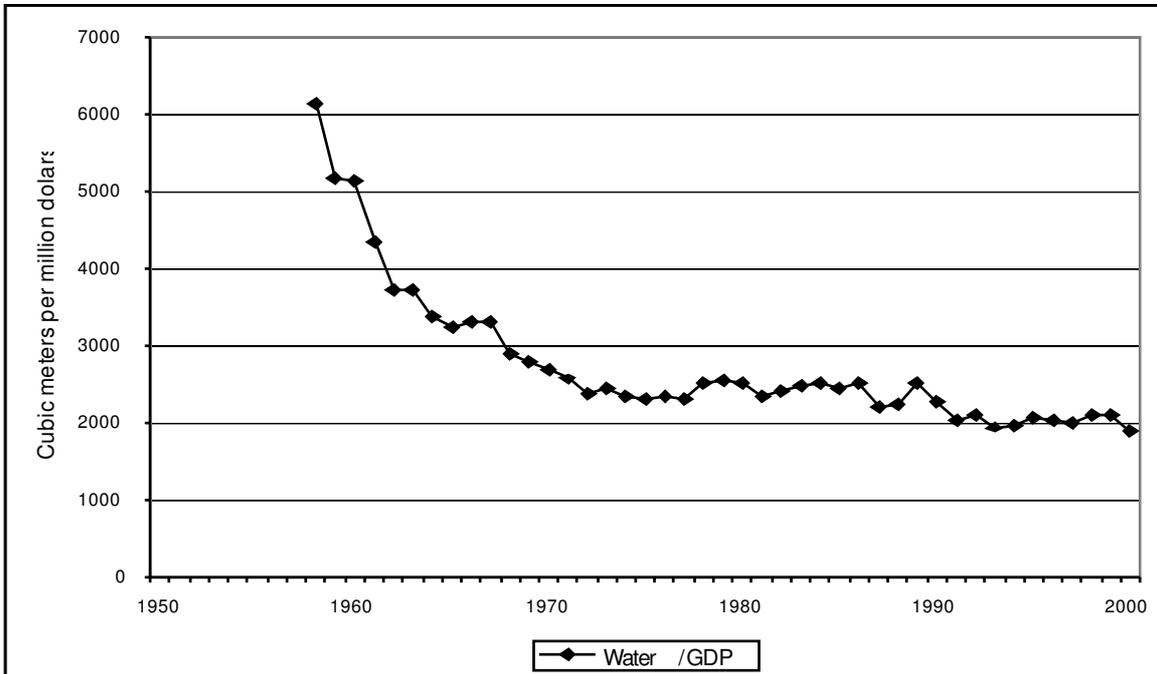


(Source: Prof. Yoav Kislev, Faculty of Agriculture, Department of Economics, Hebrew University)

Graph No' 4 -Urban Water Consumption Total and per Capita

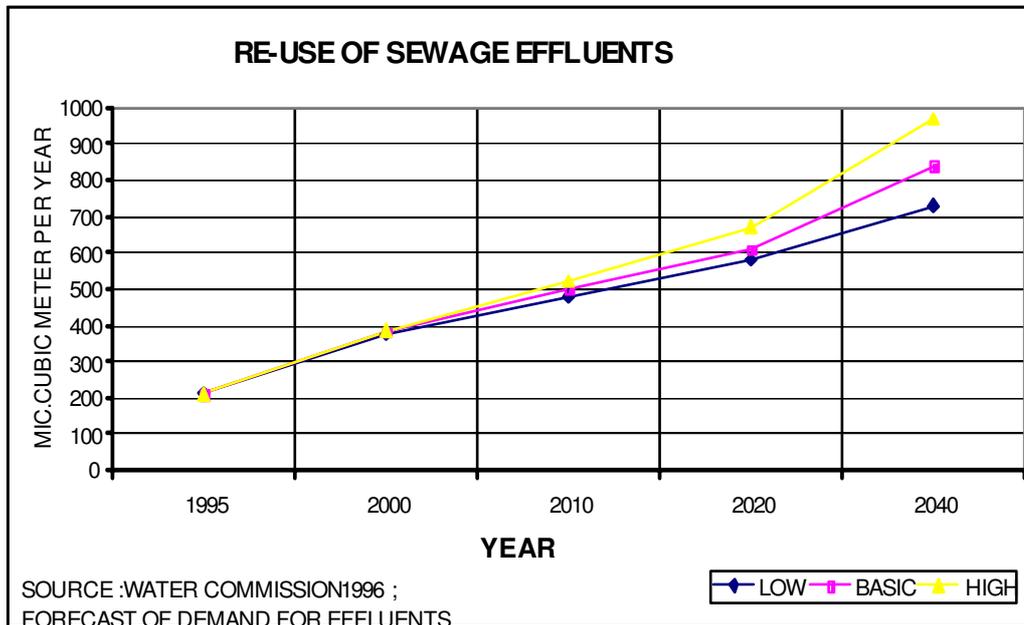


Graph No' 5 - Urban water consumption per national GDP)



(Source: Prof. Yoav Kislev, Faculty of Agriculture, Department of Economics, Hebrew University)

Graph No' 6 - Forecasted re use of treated sewage effluents



THE MIDDLE EAST REGION:

Many of the Middle East and North Africa countries face an environmental crisis, much of it as a result of water scarcity and the existing and potential pollution of their water resources. It is estimated that the investment needed to deal with and solve the problem could reach US \$70-80,000 million in the decade. (World Bank).

The hydro-geological conditions are in constant deterioration. As extraction from ground and surface water resources increases, so do the problems associated with low water levels and decreased quality. Inadequate human and industrial waste discharges as well as inappropriate waste water re-use programs lead to higher concentrations of chemicals and organic contaminants.

There is no doubt, in my mind, that unless political courage would lead to the adoption of a comprehensive Water Demand Management strategies the region will face serious water scarcity crisis.