



Evaluating Economic Policy Instruments for
Sustainable Water Management in Europe

WP6 IBE EX-POST Case studies

Urban Water Price Setting under Central Administration

Deliverable no.: D6.1 – IBE Review reports
3.12.2011





Deliverable Title	D6.1 – IBE Review reports
Filename	Urban Water Price Setting under Central Administration
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Date	3.12.2011

Prepared under contract from the European Commission
Grant Agreement no. 265213
FP7 Environment (including Climate Change)

Start of the project: 01/01/2011
Duration: 36 months
Project coordinator organisation: FEEM

Deliverable title: Review reports
Deliverable no. : D6.1

Due date of deliverable: Month 11
Actual submission date: Month 12

Dissemination level

<input checked="" type="checkbox"/>	PU	Public
<input type="checkbox"/>	PP	Restricted to other programme participants (including the Commission Services)
<input type="checkbox"/>	RE	Restricted to a group specified by the consortium (including the Commission Services)
<input type="checkbox"/>	CO	Confidential, only for members of the consortium (including the Commission Services)

Deliverable status version control

Version	data	Authors
1	December 2011	Iddo Kan and Yoav Kislev (The Hebrew University of Jerusalem)



Executive Summary

Definition of the analysed EPI and purpose

According to the Israeli Water Law, all water sources in Israel are public property, and as such, the government exclusively administrates water. The objective of this legal regime is to enable the government to correct market failures related to water management; particularly, to internalize externalities associated with water pollution and extraction from common water resources, to control supply by natural monopolies, and to design long-run nationwide investments in infrastructure and extraction from water resources under the scarcity and uncertain natural enrichment characterizing the Israeli climate. Our EPI case study comprises two aspects of this centralized management approach. The first is an institutional reform initiated in 2001, whereby local water and sewage services that were formerly provided by municipal departments, became the responsibility of newly created companies (corporation, in the popular terminology). The rationale of the corporatization process was to improve efficiency by ensuring that municipalities do not use water revenues for other purposes, and utilizing economies of scale by merging water services of adjacent localities. The reform process was expanded in 2006 at the national level where, in order to improve management efficiency, most of the regulations related to water, which were previously divided among a number of ministries, were concentrated in the hand of a new regulatory entity, the Water Authority. The Water Authority has also been made the price setter of all types of water, including the (wholesale) prices of water delivered by Mekorót (a government-owned company) at the municipalities' gates, and the (retail) prices paid by the end-users, urban consumers. The second aspect of our EPI is related to the pricing scheme: urban water prices are set by the regulator subject to the constraints of overall cost recovery at the national and municipal levels, combined with an egalitarian policy; the latter is expressed in identical municipal end-users tariffs. This pricing technique replaced the previous policy, under which costs were partly covered by the government's and municipalities' budgets, and prices were only partially identical – sewage treatment tariffs and connection fees were not uniform. To enable evaluation of these institutional arrangements and the pricing mechanism based on historical data and projected future trends, we assess the EPI's features in comparison to the ones it has replaced, which therefore constitute our baseline scenario.

Results and impacts of the EPI

The water and sewage corporations are gradually replacing the traditional urban water departments; they are operating under a business-economic model and under the professional supervision of the Water Authority. Each corporation is required to follow a set of rules for operation and maintenance expenses, as well as targets for



steady reduction in water losses; this requires investments, which affect the cumulative assets value owned by the corporations. In turn, the assets value are considered by the Water Authority when setting the prices paid for the water purchased from Mekorót -- higher values may reduce this price; by this means the incentive to invest is formed. Indeed, despite the short time passed since the corporatization was launched, significant improvements in some aspects of the water services can already be observed: The corporations can now recruit workers from outside the rigid employment constraints of the municipal sector. All incomes and costs are earmarked and transparent. Monetary reports of the corporations are standardized and are available to the public through the Water Authority's website. Operation and maintenance of the municipal water system does not depend anymore on the municipality's financial situation, and the corporations are able to approach the capital market for financing their activities; consequently, investments in infrastructures and in advanced technologies for metering consumption and monitoring water and sewage flows have sharply increased.

Yet, more than a few municipalities have refused to join the corporatization process, and for several reasons. The inflow of payments for water and sewage services helped budgetary management and these inflows are lost once services are turned over to the corporations. Moreover, by establishing a water corporation the municipality loses the ability to block water supply as an enforcement tool for municipal tax collection. The outsourcing of services may weaken local democracy; municipalities lose flexibility in defining preferences regarding the allocation of resources among services; it is uncertain that the marginal benefits of water-leakage prevention equal the marginal cost when opportunity costs (e.g., schools, parks) are taken into account. Corporations operate on local infrastructures; hence, there is high likelihood for disputes between them and the local authorities over domains of responsibility.

Regarding prices, in order to combine both cost-recovery and equity, the prices paid by the corporations for Mekorót water are not identical: Corporations whose approved internal cost is high pay Mekorót a low price, and vice versa. In this way, low cost corporations indirectly support the others and a uniform tariff structure is maintained only at the end-users level. However, this mechanism incorporates a structural incentive problem, since it doesn't make sense for a corporation to increase its efficiency; in order to reduce the price, the management of every corporation will attempt to convince the regulator that its costs are especially high. The government for its part will not be able to allow the corporations to accumulate profits, and even less to let them accumulate losses and go under, particularly given the governmental extensive support of the corporatization process; in other words, a regulatory capture may emerge.

The EPI has distributional effects. Most of the governmental income is derived from the high-income sector, it pays the lion share of taxes. As water is an essential commodity, the share of expense on water consumption in low-income households' budget is larger than that of the high income ones. Given these two facts, by abolishing the financial support to Mekorót from the government's budget, and



instead setting higher water prices so as to cover Mekorót's costs only through its water sales, the EPI imposes larger burden on the low income sector.

Two types of institutions have influenced the shape of the EPI and its success. The municipalities form the first type, so far they successfully blocked the formation of many regional corporations, and, according to a recent governmental decision, will even increase their hold and impact on the corporations. The second are political parties representing low-income sectors, who prevented the original intention of the law to set different end-user prices in different urban corporations, in each case to cover locally specific cost, in order to enhance water-supply efficiency.

A direct environmental impact of the EPI is associated with the creation of incentives for improving municipal water infrastructures, and thereby reducing the occurrence of collapsing pipes, water eruptions and sewage discharges to reservoirs, waterways and the sea. In addition, due to the full-costs recovery policy, prices have increased, and thereby reduced municipal water consumption. This, together with reduction in water losses, enables alleviating the pressure on natural water resources and allocating more freshwater to nature. On the other hand, both the corporatization process and the higher water prices entail reductions in watering of private and public gardens. Moreover, less urban water use implies lower releases of treated wastewater for agricultural irrigation.

Conclusions and lessons learnt

The effects of institutional and economic changes are recognized in the long run; it may now be too early to identify and assess the full range of aspects associated with the EPI. We do believe, however, that two lessons can already be learned.

The first lesson learned is associated with the way a reform in EPIs is implemented. Mayors may favour reducing costs by postponing the expensive investments in replacement of non-visible water-supply infrastructures; thus allowing increased water losses. A preventive measure may be to separate financially the water services from the other municipal functions, which doesn't necessitate the establishment of separated corporations. However, in some municipalities in Israel, water and monetary losses are particularly high, due to failure of enforcement which are attributed to cultural and political customs that limit the power of local authorities, and even that of the central government. In such municipalities, corporatization is justifiable for separating between local politics and water services. However, the government did not distinguish between municipalities and has been trying to establish corporations in all of them. The plan was to exploit economies of scale and establish several regional corporations each servicing 20-30 municipalities. But hastily, the government permitted the creation of many single locality corporations. It will now be difficult to merge them into regional entities. Moreover, the mayors of the affected municipalities, who feared losing power, succeeded in forcing upon the government changes that may eventually make the corporations again subject to local political control. They will lose their independence. From the regulator perspective, the lesson can be summarized by the phrase "grasp all, lose



all.” EPI reformation should take account of unattainable objectives; in this case, “sanitizing” the political factors from involvement.

The second lesson learned is associated with the challenge of designing a pricing mechanism that simultaneously achieves several potentially contradicting targets: costs recovery, creation of incentives for efficiency, and equality. Also here the mechanism was distorted by political pressures. The consequential increase in the burden on the poor sectors stimulates political criticism of the method, particularly when costs increase and therefore prices have to be hiked. Indeed, trying to avoid criticism, the Water Authority recently refrained from increasing prices, and costs are to be partly covered by the government. It can be concluded that, according to the social norms as they are reflected by this policy making, equality overwhelms efficiency.



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1 EPI Background

a) The baseline before the EPI was implemented

Israel's water supply is comprised of two interdependent, yet separate systems of supply and service. One is the nationwide system covering the water sources and their reservoirs, the nationwide delivery system, the desalination plants, and the effluent recycling facilities. The second system is the urban water system covering the intra-urban water supply, sewage removal, and the wastewater treatment plants. The two systems are interdependent: 15% of urban water supplied is withdrawn by the municipalities from resources that are actually part of the nationwide supply, with water purchased at the city gate, usually from Mekorót (a government-owned company), covering the rest. The two systems are administered as separate entities, as each deal with its own particular issues and challenges. However, both systems are regulated and inspected by the government, who also indirectly affects their activities through price setting and financial support. The cornerstone of this centralized management framework has been set by the enactment of the "water law" in 1959. According to this law, all water sources in Israel are public property, and as such, the government exclusively manages water. The objective of this legislative structure is to enable the government to correct market failures related to water management; particularly, to internalize externalities associated with water pollution and extraction from common water resources, to control supply by natural monopolies, and to design long-run nationwide investments in infrastructure and extraction from water resources under the scarcity and uncertain natural enrichment characterizing the climate in Israel.

The Israeli centralized management framework and its legislative base are of interest for comparison with more decentralized legislative schemes that are based on the assignment of property rights and motivation of efficiency by free trade (e.g., in the US). Such systems differ with respect to many aspects, including the implications of property right assignment, transactions costs and independency of local communities. Our EPI case study focuses on two aspects of the centralized management approach prevailing in Israel: The first is associated with institutions and organization of decision making and with allocation of responsibilities in the water economy; the second aspect is related to the pricing scheme, according to which urban water prices are set by the regulator subject to the constraints of overall cost recovery at the national and municipal levels, combined with an egalitarian policy; the latter is expressed in identical municipal tariffs. This pricing technique replaced the previous method under which costs were partly covered by the government's and municipalities' budgets, and prices were only partially identical -- sewage treatment tariffs and connection fees were not uniform.

b) The key features of the EPI and the settings that made it operational

The original water law has been changed twice during the last decade. First, starting at 2001, the government, by offering subsidies, encourages municipalities to establish



regional water corporations as substitutes to the traditional municipal water departments. The rationale was to improve efficiency of the urban water systems by ensuring that municipalities do not use water revenue for other purposes, and utilizing economies of scale by merging water services of adjacent localities. The second reform was enacted in 2006 in order to improve management efficiency at the national level; hence, most of the regulations related to water, which were previously spread among a number of ministries, were concentrated at the hand of a new regulatory entity, the Water Authority. The Water Authority has also been made the price setter of all types of water, including the prices of both waters at the municipalities' gates and at the final urban consumers. The corporatization and the establishment of the Water Authority constitute the organization aspect of the EPI.

The pricing element of the EPI encompasses prices set by the regulator for urban use in both the municipality and the household levels. The regulator -- the Water Authority in the case of Israel -- is responsible for setting the prices paid by municipalities and municipal water corporations, either directly to the government as a pumping tax in case of self extraction from rivers, lakes and aquifers, or to the national supply company, Mekorót. The prices paid for Mekorót's deliveries are set such that the total payments of the intermediate consumers -- the municipalities -- (and by agricultural consumers) cover Mekorót's costs. The regulator also monitors and authorizes operational activities and investments by municipal corporations, and sets the prices paid to Mekorót by each corporation while accounting for the corporation's supply efficiency and costs, such that inefficient corporations pay lower prices. This creates cross subsidization across municipalities. At the same time, the regulator is responsible for setting the price paid by households and other urban users to the municipal water corporations, while accounting for social considerations; equity in particular. Hence, while prices at the city gate (wholesale prices) may differ across municipalities, households everywhere pay identical (retail) prices.

The centralized structure exposes the government to political pressures by two major interest groups. The first are political parties representing low-income sectors; by waving the "equity principle" flag, they opposed the original plan to increase efficiency by differentiating prices at the household level in order to reflect spatial variation of costs, and successfully enforced the Water Authority to set identical retail prices. The second group includes city mayors who resisted the water-corporations program that would result in reduction in the cities' income and flexibility in financing various municipal activities. They also rejected the plan of establishing regional water corporations, probably because of their concern of losing their independence in the long run. As a result, instead of the original plan of establishing only 15 corporations that would serve all the 251 municipalities throughout Israel, there are today as many as 52 corporations serving only 132 municipalities. The city-mayors lobby persistently struggles to reduce the independence of the water corporations, with some recent success in reforming the regulations by increasing their representation in the corporations' directorates.



2 Characterisation of the case study area

a) Environmental Characterisation

Israel's area is about 22,000 km², of which 5.2% is constructed areas, 0.4% is public open areas, 11.5% is forests, 18.4% is agricultural lands and 64.5% is other open areas (CBS, 2011). While the northern part occupies 25% of the area, the center 10% and the south 65%, most of the population (57%) reside in the center, 29% in the north and only 14% in the south; this makes Israel's central area one of the most dense regions in the world (2,075 people per km²).

Israel is located on the boundary of a desert, its north rainy, and its south dry. Rain falls in the winter only, yet water consumption is highest in summer. Rainy years alternate with dry years in no discernible pattern. The main and traditional role of the natural water system is to collect the winter rainfall from rainy years and store it for use in dry years; and to deliver water from the north southward to Israel's populated center and to the Negev, where modern agriculture cannot be engaged in without irrigation.

Israel's main reservoirs are the Sea of Galilee, the Coastal Aquifer, and the Mountain Aquifer. Other aquifers are to be found in the Western Galilee, under the Carmel Coast, in the Jordan Rift, and in the Arava. The national water system, run by Mekorót, covers most parts of the country (see Map 2.1); the national carrier delivers water from the Sea of Galilee westward and southward; and other systems, most of which are linked to the national carrier, supply water to the Upper Galilee, Western Galilee, the big cities in the center, and the Negev.

With the expansion of supply of desalinated seawater along the Mediterranean coast, most of the water supply is expected to shift, and in certain segments of the system water will flow from south to north. Systems not linked to the national carrier serve the Arava and the Jordan Rift. In addition, as per agreements, Israel supplies water to the Palestinian Authority and The Kingdom of Jordan.

The national carrier was first operated in 1964, and the main use of water at that time was in agriculture. Since then Israel's population has grown, and much water has been diverted to the urban sector, which today is a large consumer of potable water. During the same period, the use of potable water in agriculture has decreased, while use of marginal water—brackish and recycled wastewater—has increased.

The main use of water in the urban sector is not drinking, but rather landscaping, bathing, cleaning and other household chores, and removal of contaminants. Thus the volume of wastewater in the urban sector now exceeds half the potable water used. Almost all the sewage is collected and transferred to wastewater purification and treatment plants. The treated wastewater is taken into recycling facilities, where it is stored and transferred in season to agriculture and natural habitats. While many of the wastewater treatment plants are local, two are large: the Shafdan, that treats wastewater from Israel's center and diverts it to the southern and western Negev (Map 1.1); and the Kishón plant, which treats Haifa and environs' wastewater and delivers it to the Jezre'el Valley, the Harod Valley, and the

Lower Galilee.

The natural sources receive the water stored therein from precipitation, which in recent years has recorded a marked reduction, especially in the North, the region that feeds the Sea of Galilee, possibly as a result of global warming.



Map 2.1. Water system in the case study area

b) Economic Characterization

Although the share of water's contribution to Israel's GDP is only 0.5% (Kislev, 2011), it is consistently a subject of public debate. The development of the mechanism of urban water price setting considered in this EPI case study cannot be disentangled from the evolution of Israel's economic conditions and its governmental economic policy. There has been a long run process of reduction in the share of the government in the economic activity of the country; this is reflected by steady reductions in the public expenditures and transformation of responsibilities for the finance of services from the public to the private sector. This process has been accelerated in the early

2000s due to the Second Palestinian Intifada (uprising) and the global recession at that time, that have resulted in a dramatic decline in Israel's GDP (Figure 2.1). Following this political trend, the government has established a mechanism according to which Mekorót's costs are no longer supported by state budget, but rather covered completely by revenue collected from users. Water prices are adjusted to meet this goal. The recent period has also experienced increased income inequality (see the trend of Gini inequality index in Figure 2.1) and this change was among the drivers of the political pressure described below.

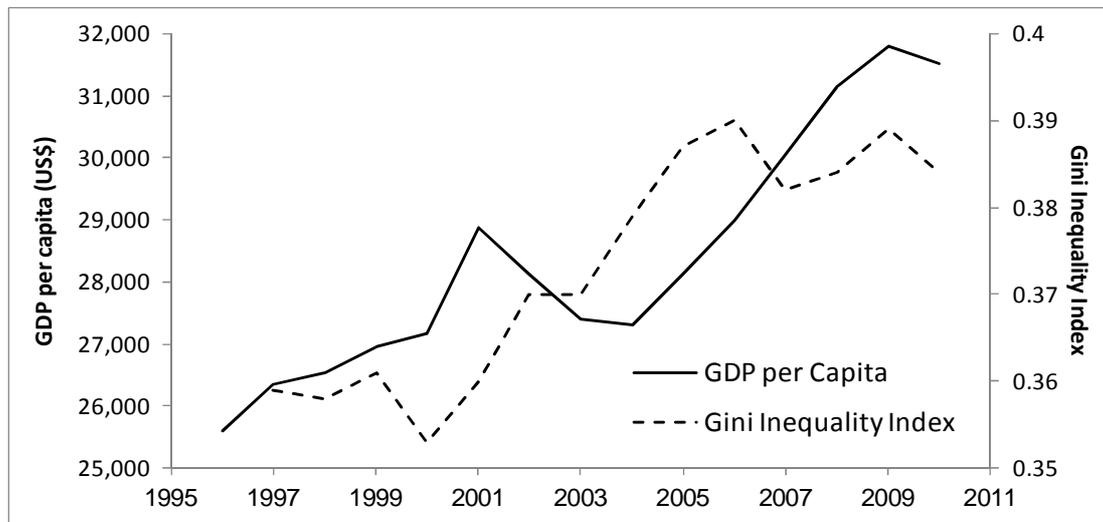


Figure 2.1. GDP per capita and Gini inequality index in Israel (CBS, 2011)

3 Assessment Criteria

As explained earlier, the EPI under consideration has been established under a legal framework dictating a centralized water management approach. While the assessment of this legal framework in comparison to less centralized structures is of interest, it is beyond the scope of this study. Here, in order to enable evaluation based on historical data and projected future trends, we concentrate on the assessment of the EPI itself in comparison to the one it has replaced, which therefore constitutes our baseline scenario. The main differences between the two are:

- a. Institutional arrangements: Under the current EPI, (1) regulation and management of the water economy is at the hand of the Water Authority in contrast to the spread of authorities across ministries and institutions in the baseline scenario; (2) there is a corporatization process in the municipal sector, which replaces the traditional municipal water departments.
- b. Under the current EPI, (1) wholesale prices are set such that Mekorót's costs are fully covered by its water sales, whereas costs were partly covered by the government under the baseline scenario; (2) prices paid by the final water



consumers (retail prices) are identical and those paid to Mekorót (wholesale) may differ across municipalities, whereas under the baseline scenario both types of price were generally identical.

3.1 Environmental outcomes

The environmental outcomes of the EPI under consideration are associated with changes in pricing and income allocation within the municipal sector and reduction in water consumption and losses.

The direct environmental impact of the EPI is associated with the creation of incentives for improving municipal water infrastructures. This implies fewer events of pipes collapsing, water eruptions and sewage discharges to reservoirs, waterways and the sea. Such events may end up with environmental damage, health hazards, leisure constraints (particularly prohibition of sea swimming) and nuisances. For example, Weinberg (2008) estimates a damage of €0.9/household per month due to irritations associated with the presence of mosquitoes during the summer in the Tel-Aviv metropolitan area.

Another environmental effect of the EPI is related to the reduction in water consumption and water losses. Due to the implementation of the policy of full-costs recovery, the EPI has increased prices compared to the baseline scenario, and thereby reduced municipal water consumption. The overall savings in freshwater enable reduction in the pressure exercised on natural water resources, extraction rates have been decreased. The main impact is on the Sea of Galilee -- the single large lake in Israel. The basin of the lake is the source of nearly 25% of Israel's freshwater provision, and the lake's water level is heavily dependent on pumping rates to the national carrier (see Map 2.1). The water level, in turn, affects the lake's ecosystem, its water quality, the basin's natural environment and tourism. Figure 3.1 presents the evolution of the lake's water level during the last 7 years; also presented are the per-capita urban water consumption, the development of seawater desalination and agricultural fresh- and recycled-water consumptions in Israel, and the rainfall in Canaan Mountain, which is located within the basin of the Sea of Galilee. The management of the lake's water level is restricted by high- and low-level red lines. The high-level red line signals the risk of floods, which are avoided by releasing water to the southern Jordan river through the Degania Dam. Water levels below the red line are considered harmful to the lake's ecosystem. In addition, a low-level black line has been defined, indicating irreversible damages. Since 2004, the lake's water level has steadily declined, until the summer of 2008, when it crossed the low-level red line, and then stabilized. The main reason for the decline is the series of drought years: since 2004, precipitations were below the 1971-2000 annual average. The stabilization is attributed to the establishment of desalination plants, the replacement of freshwater by treated wastewater in agricultural irrigation, and the reduction in domestic water consumption; all of these steps enabled reducing water withdrawal from the lake.

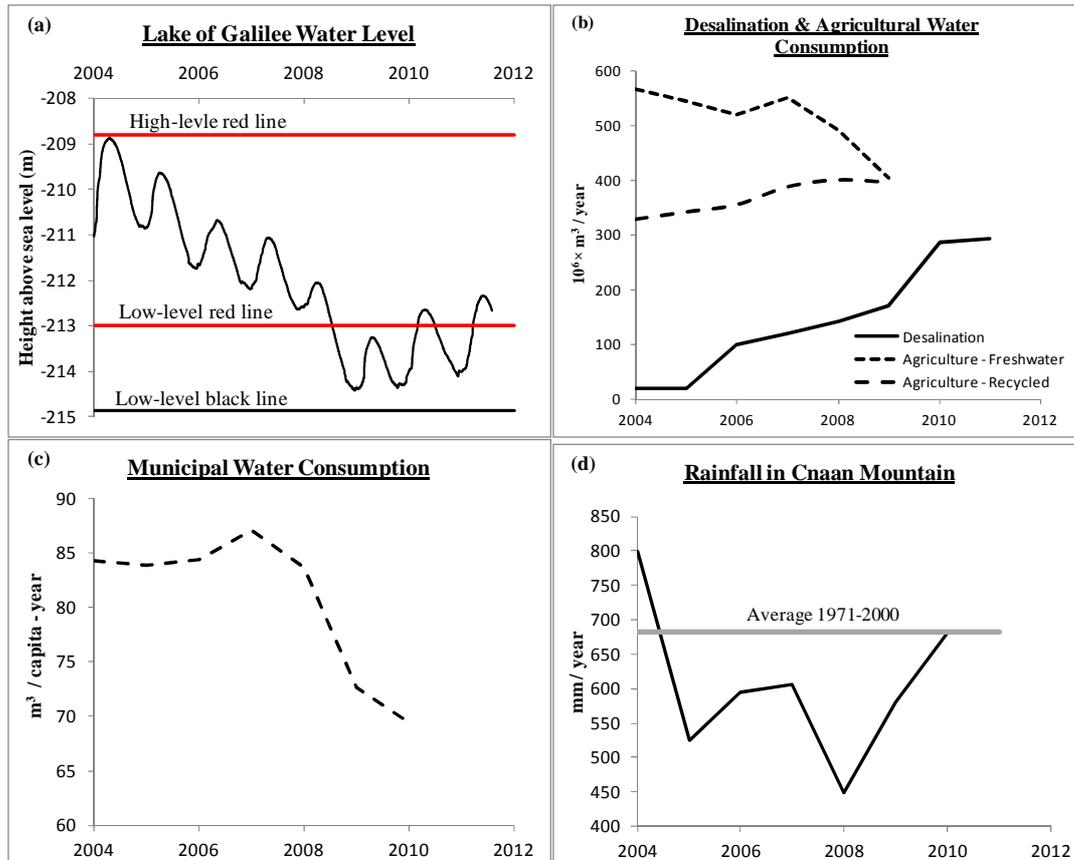


Figure 3.1. Trends of water levels in the Sea of Galilee, desalination capacity, agricultural use of fresh- and treated waste-water, municipal water consumption and rainfall.

Larger water stocks also allow higher provision of ecosystem services through allocation of more freshwater to nature. Barak (2010) evaluates a total willingness to pay of about €50 per household in Israel for rivers rehabilitation, of which half are related to water-use values. According to decision no. 2117(Econ./46) of the Israeli government from 18.7.2000, 50 million cubic meters per year are to be allocated to the nature (MoEP, 2011). However, the recent series of drought years and water crisis that came in its wake, effectively postponed the application of this directive.

An additional environmental implication of the EPI is associated with the impact on gardening. Quotas of water for watering private gardens, which were previously sold at a lower price, were cancelled, and thereby led to a reduction in watering of private gardens. Irrigation of public gardens exhibits a similar tendency. Previously, municipalities have tended to avoid complete metering of their irrigation water consumption; utilizing the asymmetric information, they have reported to the Water Commission self-consumption amounts that fit a predetermined target of water loss in order to avoid penalty charges (see Section 3.2). Once the EPI came into power, the municipalities, in addition to the loss of income that have been previously derived through the supply of water to their residents, are now facing higher expenses since they are charged by the water corporations full price; moreover, the latter are facing the incentive to count every water drop. An evident of the welfare implications is the willingness to pay for installation of water-related items in public urban gardens in



Tel Aviv, as estimated by Ben Shlomo (2010) to amount to €4.0 per household a month.

Following the reduction in freshwater consumption for domestic purposes, the amount of treated wastewater also decreased. This implies lower allotments of recycled water for agricultural irrigation, which in turn leads to changes in the landscape services provided by rural areas (see Fleischer and Tsur, 2009; Kan et al., 2009). Moreover, municipalities have now a higher incentive to use the recycled water for irrigation of public gardens and parks; this entails the need for stricter regulations regarding sewage treatment, with the associated environmental and health implications.

3.2 Economic Assessment Criteria

In our economic assessment we analyze a range of economic aspects related to the EPI's impact on water management in the municipal sector and nationwide. The discussion focuses on two elements of the EPI: the corporatization process in the municipal sector and the countrywide regime of cost-recovery prices. In each element we discuss the EPI's success in obtaining its intended objectives and the failures in relation to gaining efficiency, creation of incentives and overcoming obstacles associated with asymmetric information.

a) Corporatization in the Municipal Sector

For years the municipalities (local authorities) have been responsible for water and sewage services in their jurisdictions. Because water is an essential commodity, the fact that one's water bill was attached to one's municipal tax charge helped, in many peoples' opinions, to expedite collection of this tax, thereby constituting a stable cash flow into the municipalities' coffers. Yet, this arrangement did present difficulties. Water services were provided as part of the overall activity of the municipalities, i.e., there was no separate, full accounting of the water supply on its own, such that it was impossible to know its proportion in the total municipal budget; neither was it possible to evaluate its efficiency. Political and other considerations made it easy for some municipal leaders to postpone costly works needed on their water and sewage systems, and instead, divert the accumulated funds to other tasks, particularly to the more visible ones (public buildings, pavements, etc.). In local authorities that failed to run a proper payment regime, water loss was high, and wastewater was not properly collected and treated. In light of incomplete information on what was occurring in the urban water sector, assessments by professionals invariably resulted in conclusions that the system was not efficient and was exhausting its own capital. As such, as early as in 1962, the agriculture and interior ministers decided to require local governments to establish a "closed monetary system" in the water and sewage sector. Other directives in this spirit were issued over the years, yet to no avail. Only in 1993 the Israeli government has decided to transfer the administration of the urban water supply to independent companies (corporations in the popular parlance), and a committee was appointed to examine the issue and draft a bill, which was enacted into law in the parliament in 2001. As per the original law,



municipalities were authorized to form corporations to supply water and sewage services, which would be, at least initially, owned by the local governments themselves. The water system's assets would be transferred to the new companies, which would then take over provision of services. In a 2004 amendment to this act, the formation of corporations was made obligatory.

To expedite the corporatization process, the government, on the one hand, penalizes municipalities that did not form corporations (by cutting financial assistance and imposing restrictions on the use of water revenue) and, on the other hand, it provides hefty monetary assistance to those municipalities that form corporations. These subsidies amount to a total of more than €400 million from 2003 until March 2010 (Water Authority, 2010). Apparently, the effectiveness of these incentives has been also enhanced by the historical pricing policy of the government itself, as can be learned from Figure 3.2. The figure shows four price schedules and their evolutions over the past three decades: the Mekorót "city gate" price, and three household block rates. The increase in both Mekorót's price and the rates household paid up to the 1990s reflects rising costs of provision, particularly electricity. Thereafter, while Mekorót's prices continued to rise, the block rates households were charged dipped significantly; then rose again after 2005. The scissors effect of a drop in consumer prices on the one hand, and a rise in Mekorót prices on the other, subtracted hundreds of millions of Euros a year from the water income of the municipalities. The explanation for the oscillation of the prices is apparently related to the corporatization process and to the Finance Ministry policy, which prior to the formation of the Water Authority was the dominant factor in setting urban water prices. As indicated above, while the Corporation Law was passed in 2001, long before that, the prevailing view, particularly at the Finance Ministry, was that the municipalities used their water income for purposes other than that for which it was intended. Price decreases and reduction in proceeds between 1991 and 2004 made it difficult for the municipalities to maintain their water systems, thus supposedly encouraging them to transfer their water departments to corporations.

The water and sewage corporations gradually replace urban water departments; they are operating under a business-economic model and under the professional supervision of the central regulator - the Water Authority. Each corporation is required to follow a set of rules for operation and maintenance expenses, as well as targets for gradual reduction in water losses; attaining such reductions requires investments, which affect the cumulative assets value owned by the corporation. In turn, the assets value are factors considered by the Water Authority when setting the prices paid for the water purchased from Mekorót -- higher values may reduce this price; by this means the incentive to invest is formed.

Indeed, although only a short time passed since the corporatization reform was launched, significant improvements in some aspects of the water services can already be observed. The corporations, although forced to employ the workers previously employed by the municipal water departments they have replaced, can now recruit additional workers (particularly in the managerial level) from outside the rigid employment constraints of the municipal sector; i.e., at lower salaries. All incomes



and costs are earmarked and transparent. Monetary reports of the corporations are standardized according to the instructions of the Water Authority, and are available to the public through the Water Authority's website. Operation and maintenance of the municipal water system is not conditional on the municipality's financial situation anymore, and the corporations are able to approach the capital market for financing their activities; consequently, investments in infrastructures and in advanced technologies for metering consumption and monitoring water and sewage flows have sharply increased. For instance, the investments in the corporations of the Eilat city have more than doubled, and water losses in some cities have been reduced (Water Authority, March 2010). These investments also encourage the Israeli water-related industry. However, the results of these efforts in terms of water loss reductions in the national level are not seen yet; on the contrary, as shown by Figure 3.3, as the size of the population served by water corporations increased, the reported nationwide water losses have also increased. This phenomenon may be attributable to two effects, both related to asymmetric information between the Water Authority and its inspected agents: First, the "loss" is actually non-revenue water: the difference between the quantity purchased from Mekorót or withdrawn locally, and that recorded as supplied to the end user. It includes metering errors, public landscaping in locales where irrigation water is not metered, fire hydrants, thefts, and estimates of leakage and burst pipes. It is estimated that less than half of the loss is actual physical leakage (Bilik, 2009). By the regulations, municipalities that record high losses are fined, but fines were not imposed in recent years. In the past there was also suspicion of skewing the figures in some municipalities that sought to show low loss numbers (State Comptroller, 2009). It is likely that the cessation of fining, and the establishment of water corporations who are now metering and charging municipalities according to their water consumption, caused the appearance of high loss rates in several communities in recent years. Second, corporations, once established, may have interest in reporting high initial levels of water loss, in order to demonstrate improvements afterward.

Yet, the formation of the corporations also raises certain problems, because of which more than a few municipalities have avoided or postponed joining the corporatization process. The inflow of payments for water and sewage services helps the budgetary management of the municipalities, even those wherein these incomes remain within the domain of water services; this cash source will now dry up. Moreover, a municipality that establishes a water corporation loses the ability to prevent water supply as an enforcement tool for municipal tax collection. Removal of the responsibility for water and sewage services from the municipalities may weaken local democracy; municipalities lose flexibility in defining preferences regarding the allocation of resources among services, and it is uncertain that the marginal benefits of water-leakage prevention equal the marginal cost when opportunity costs (e.g., those associated with education and culture) are taken into account. The outsourcing of services and the resultant distancing of accountability for the services raises difficulties for residents, who up until now had direct contact with the local water department heads; the corporations, particularly those serving a few municipalities,

are likely to become “foreign entities” in the communities, and run into problems in gaining the cooperation of residents and their representatives; the fact that corporations operate on local infrastructures such as roads and parks raises the likelihood of disputes between them and the local authorities over domains of responsibility, thereby rising costs to the community as a whole.

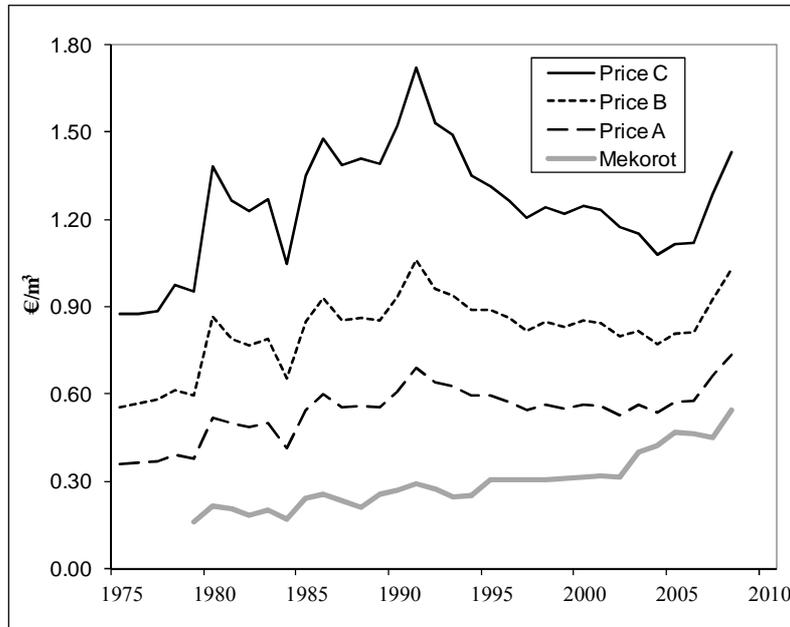


Figure 3.2. - Evolution of end-user block-rate water tariffs and the price paid to Mekorot at the city gate (in 2008 Euros); Source: Bar-Shira, Cohen, and Kislev 2007, completed by Plessner 2009.

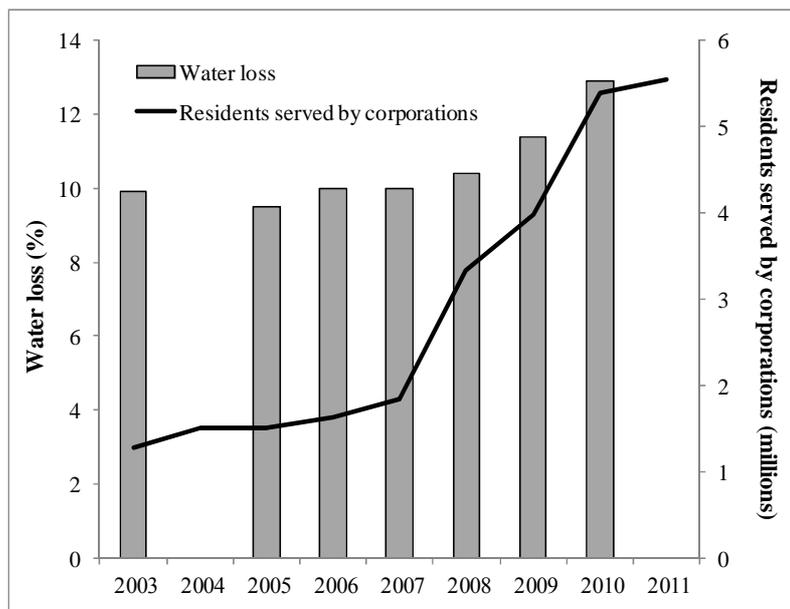


Figure 3.3. - Evolution of corporatization and water losses; Source: Water Authority 2010, consumption annual reports.



b) Cost-Recovery Pricing

In order to combine the two principles of the water management at the national level— cost-recovery and uniform consumers' rates — the prices paid by the corporations for Mekorót water are not identical: Corporations whose recognized internal cost is high pay Mekorót a low price, and vice versa. In this way, low cost corporations indirectly support the others and a uniform tariff structure is maintained for the end-users level.

The Water Authority sets prices based on recognized cost per cubic meter of water. The recognized internal cost for corporations contains several components, such as labor, interest, and return on equity. Three items form most of the differences between corporations in their recognized costs: One is the capital invested in the local water system (assessed in a property survey conducted when a corporation is established). The capital-rich corporations have a higher recognized cost per cubic meter in this item. The other two items are “normative”: The first is loss rates, including both water loss and charge collection loss. High losses are recognized for “weak” corporations; i.e., those operating in low socio-economic localities (this group mainly includes municipalities located at the periphery and those populated with minorities). This means that the recognized cost on this item per cubic meter sold is higher in the weak corporations than in the stronger ones. Another cost factor with a normative component is wastewater treatment, for which the cost per cubic meter is calculated by formulae dictated by regulations and based on the size of the facility and the quality of the effluent; these differ between the corporations.

The Water Authority expects that the corporations will all converge in a few years to the same normative loss values. Consequently the recognized costs in the corporations should converge to similar levels, and the support of weak corporations by the strong ones will be eliminated (Figure 3.4). Yet this expectation is only a hope, not to say an illusion. The differences between the corporations are large, and the reported gaps between municipalities with low and high socio-economic levels were growing along time (Figure 3.4). Some corporations will succeed in streamlining operations, while others may not. The result may be that some corporations will be profitable, while others will suffer growing financial losses. The Water Authority will face difficulties in the future in using norms as the basis for recognized costs, rather than using actual performances. A structural incentive problem is added to this issue: Under the adopted tariffs structure, it doesn't make much sense for a corporation to increase its efficiency; those that show low costs and high profits will see their payments to Mekorót increased. The management of every corporation will attempt to convince the Water Authority that its costs are especially high. The government for its part will not be able to allow the corporations to accumulate profits, and even less to let them accumulate losses and go under, particularly given the governmental extensive support of the corporatization process; in other words, a regulatory capture may emerge. Yet, the Water Authority has not yet explained what its policy will be in the face of such eventualities.

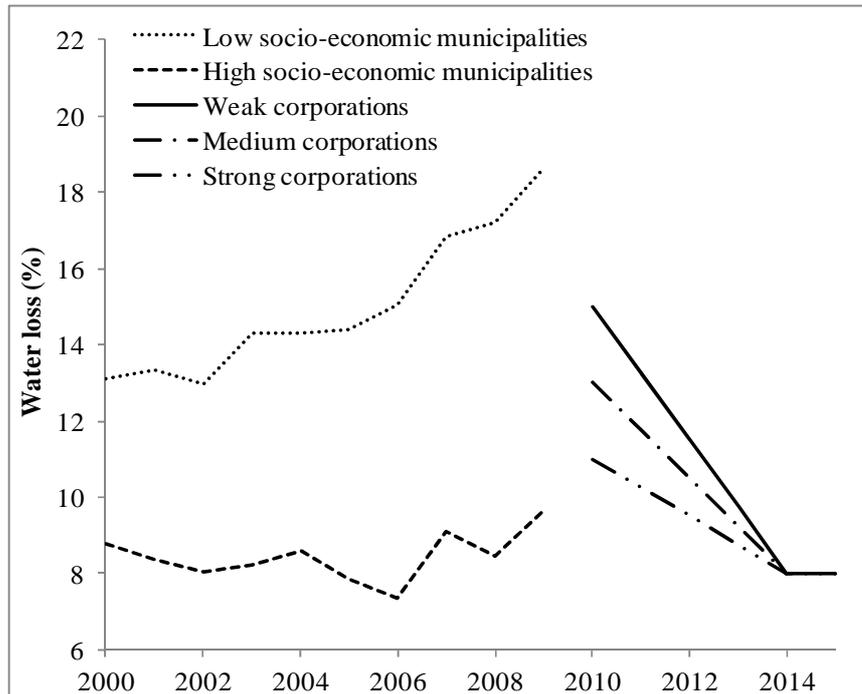


Figure 3.4. - Historical evolvement of water losses in municipalities with low and high socio-economic levels and future water-loss schedules for weak, medium and strong corporations as recognized by the Water Authority for setting the price of Mekorót water; Source: Central Bureau of Statistics (November, 2011) and Water Authority (January 2010).

3.3 Distributional Effects and Social Equity

The EPI (i.e., the corporatization and the setting of cost-recovering Mekorót prices) has distributional impacts on income, authority and political power on the national scale, as well as between and within municipalities.

a) Income Distribution

Most of the governmental income is derived from the high-income sector, which pays the lion share of taxes. Hence, by abolishing the financial support to Mekorót from the government's budget, and instead setting higher water prices so as to cover Mekorót's costs only through its water sales, the EPI imposes larger burden on the low income sector. This policy increases inequity since, as water is an essential commodity, the share of expense on water consumption in low-income households' total expenses is larger than that of the high income ones (CBS, 2009). On the other hand, the reduction in budgetary expenses on water supply enables allocating more governmental resources to other public services that may mostly support weak populations.

The Mekorót-water pricing scheme implies cross subsidization between corporations in weak and strong municipalities. By this means, in general strong communities support the weak ones. However, at least according to the Water Authority's expectations, these income transfers will be gradually reduced, as the



differences in approved costs between corporations will be eliminated. Similarly, prices of water supplied by Mekomót for agriculture are subsidized by urban water consumers; today, nearly €0.18/m³ of the water price for domestic use is allocated to this purpose. This subsidization would gradually vanish as agricultural water prices are planned to rise.

When water and sewage services moved to corporations, the municipalities do not have any more to finance these outlays, but they also lost the associated revenue. The municipalities, however, were motivated to join the corporatization process by state supportive grants. In addition, at the time of establishment, 30%-40% of the assets that a corporation "inherited" from its municipality are recorded as "owner's loan", which is to be repaid to the municipality from the corporation's revenues. Moreover, municipalities may expect to earn dividends in the future, when the income of the corporations is stabilized. Yet, as explained earlier, municipal tax collection may also suffer due to the loss water charge as an enforcement tools. The reduction in municipal budget affects services, and thereby income and welfare. In the corporations themselves, wage differences emerge: veteran workers that previously served in the municipal water departments earn more than new employees.

Increased investments in water related infrastructures and their maintenance increases the demand for labour by contractors, and thereby generally contributes to the reduction in unemployment rate. This effect, however, maybe balanced by a potential reduction in the provision of other municipal services.

Increased water prices reduce businesses' profits; however, since water does not constitute a major production factor in most manufacturing activities, this impact can be expected to be small. On the other hand, the expected increase in water-supply reliability reduces costs associated with abrupt supply breaks to industrial manufacturers.

b) Authority and Political Power

The corporatization process has reduced the authority and influence of the municipal mayors in the water services domain. By making the Water Authority the setter of water tariffs, the new law abolished the parliament's direct control on water prices, and thereby reduced the impact of parties representing low-income sectors on this matter. Moreover, the power of the official governmental entity that is responsible for water management by law – the Ministry of National Infrastructures – has been reduced. The power has been concentrated at the Water Authority's Council, which is composed of representatives appointed by the ministers of National Infrastructures, Agriculture and Rural Development, Treasury, Internal Affairs and Environmental Protection; these ministries have therefore some impact on the Council's decisions. By law, the Council holds official hearings before finalizing decisions, thereby allowing potentially influenced parties to represent their positions.

3.4 Institutions

At the upper level of institutions affecting the EPI stands the "water law," which



assigns the property rights over all water sources to the public, and nominates the government to manage and control water. An additional law enacted in 2001 has launched the corporatization process within the municipal sector. The other element of the EPI -- cost-recovering prices -- is associated with the reform that has established the Water Authority in 2006. In order to understand the significance of this reform, let us look at the simplified structure of the water sector shown in Table 1.

The vertical division is to nationwide supply and the urban sector. The former includes the water resources, Mekorót, regional water-supply cooperatives, effluent recycling facilities, and associated entities. The urban sector includes the water corporations and departments in the local councils providing water and sewage services, including wastewater treatment plants. The urban sector does not have its own resources; suppliers that withdraw water independently do so from resources belonging to the nationwide supply. The horizontal division is into two spheres: resources and economics. The economic sphere contains Mekorót and other entities in the nationwide supply, as well as the urban sector corporations. By law, the Water Authority is responsible both for regulating resources and for economic regulation. The combining of these two spheres under the aegis of a single regulating agency is unique to Israel; in other countries on which we have information, regulation is separated by sphere. The pricing mechanism set by the Water Authority constitutes a secondary level of legislative; it defines the rules of the game, and therefore can be considered as an institution level second to that of the water law. The prices themselves lay in the third institutional level.

Table 3.1: The water sector and its components

Nationwide supply	Urban supply	
+		Resources
+	+	Economy

Two types of institutions have influenced the shape of the EPI and its success. The first are the municipalities, who so far successfully blocked off the formation of many regional corporations, and, according to a recent governmental decision (Globs, 6.11.2011), will even increase their hold and impact on the corporations. The second are political parties representing low-income sectors, who prevented the original intention of the law to set different prices in different urban corporations, in each case to cover locally specific cost, in order to enhance water-supply efficiency.

3.5 Policy Implementability

The institutional component of the EPI (i.e., the corporatization process) has targeted the allocation of responsibilities, authorities and incomes within the municipal sector. The objectives of this policy were only partly achieved: not all the municipalities



made the transition, and many of those who did, particularly the large ones, established a single-municipality corporation rather than a regional entity. Thus, 27 out of the 52 existing corporations serve only one municipality, and altogether they serve 48% of the total population in municipalities that have corporatized. Moreover, the corporations themselves are now most likely going to lose much of their independency, such that the institutional arrangement becomes closer to the original idea raised in 1962 of establishing closed-water economies within the municipalities.

The EPI's pricing component has also been negotiated and changed along the way. The design of the pricing mechanism has encountered two fundamental problems associated with pricing principles. The first is the question of fairness versus efficiency. Setting a price equal to the marginal cost, which is the cost of desalination, signals the consumers about the costs that they are causing to the economy, and thereby brings about efficient consumption. Yet, because there are reservoirs from which the pumping cost is lower than desalination (e.g., the Sea of Galilee and wells), if the consumer pays for all water at a price equal to the marginal cost, her total payment will be higher than the total supply costs. On the other hand, if the price of water equals the average of supply cost, total consumer payments will equal the total costs. Here the question arises: Is it fair to set prices higher than the average cost? That is, is it fair to charge more than the total cost? This problem has been solved by setting block rate prices, both at the city gate (wholesale prices) and at the end user (retail), while the level of prices are set so as to cover Mecorot's costs, as well as the intra-municipal water delivery and sewage service costs.

Another matter is the question of equity in sharing the water cost burden; for instance, the cost of supply to Tel Aviv is lower than that to Jerusalem. Although it's original intention to set end-user prices which vary between municipalities, ultimately the Water Authority have discriminated only the wholesale prices paid to Mekorót, while maintaining parity in fees to urban consumers. In setting identical prices despite varying costs, the Water Authority sacrifices economic efficacy on the altar of parity and equality in sharing the burden. Parity has actually become one of the objectives that justify state intervention in regulating the water supply.

3.6 Transaction Costs

The EPI has two major aspects of transaction costs. The first is related to management and control: The establishment of the Water Authority was particularly aiming at concentrating the data collection, decision making and control of the water economy in one institution, and thereby reducing the transaction costs associated with coordination among multiple ministries and institutions. The second aspect is associated with asymmetric information: The information on water management in the urban sector was vague and incomplete as long as the intra-municipality water delivery was managed by the municipalities' water departments. The EPI, by establishing the corporations and setting strict reporting and monitoring standards, has reduced asymmetric information. Yet asymmetric information still exist; for example, the corporations now have the incentive to present exaggerated costs



figures, particularly those associated with investments, in order to signal the Water Authority to reduce the prices they pay for water they receive from Mekorót.

3.7 Uncertainty

Uncertainty is an integral part of the assessment of the EPI under consideration. The EPI's elements themselves are uncertain to the relevant active agents since they are continuously negotiated between various interest groups. This causes instability that slows the adoption of policies due to the steady buildup of expectations for their change, and that makes it difficult to render judgment regarding the extent to which the policies have achieved their objectives. In addition, criteria for success of the EPI were not explicitly defined. For example, testing whether the objectives of the corporatization policy has been achieved maybe based on measuring the reduction in water losses, in comparison to the normative trends according to which the Water Authority computes costs (Figure 3.4); yet, as shown, losses actually increased, possibly due to the effect of counteractive incentives, or other related policies. Other criteria for success, such as the quality of water delivery services (which is examined in many municipalities by routine satisfactory surveys) were only recently identified.

4 Conclusions

4.1 Lessons learned

The effects of institutional and economic changes are recognized in the long run; it may now be too early to identify and assess the full range of aspects associated with the EPI. We do believe, however, that two lessons can already be learned.

The first lesson learned is associated with the way a reform in EPIs is implemented, and can be summarized by the phrase “grasp all, lose all.”

Suppose that a local council could freely set the prices for the services it provides as a monopoly in its municipality. According to the well-known Ramsey-Boiteux pricing principle, a welfare maximizing not-for-profit monopoly should assign relatively higher price mark-ups to relatively inelastic price-demand commodities. This argument supports high urban water prices, since water distribution is characterized as a natural monopoly service, and the demand for urban water is relatively inelastic. However, due to social and equity (and therefore political) considerations, the municipal water supplier is not free to set water prices; the latter are regulated at the national level. Therefore, higher incomes to a water providing monopoly—the municipality—can be derived only through cost reductions. As municipal mayors may be short-sighted politicians, they may favour reducing costs by postponing the expensive investments in replacement of non-visible water-supply infrastructures; thus allowing increased water losses. This strategy is particularly prevalent in municipal systems acting in a non-transparent financial and budgetary environment. A preventive measure may be to separate financially the water and sewage services from the other municipal functions. This separation requires only



reorganization within the municipal financial and management administration, and it doesn't necessitate the establishment of separated entities such as new urban corporations. However, in some municipalities in Israel, particularly in those populated by minorities, water and monetary losses are particularly high, due to failure of enforcement resulting in water theft and incomplete collection of taxes and fees. These failures are attributed to cultural and political customs that limit the power of local authorities, and even that of the central government. In such municipalities, corporatization can augment the separation between local politics and water services, and thereby improve the performance of the services.

However, the government did not distinguish between municipalities and has been trying to establish water and sewage corporations in all of them. The plan was to exploit economies of scale and establish several regional corporations each servicing 20-30 municipalities. But hastily, the government permitted, and sometimes forced, the creation of many single locality corporations. It will now be difficult to merge them into regional entities. Moreover, the mayors of the affected municipalities, who feared losing power, succeeded in forcing upon the government changes that may eventually make the corporation again subject to local political control. They will lose their independence. Thus, EPI reformation should take account of unattainable objectives; in this case, "sanitizing" the political factors from involvement.

The second lesson learned is associated with the challenge of designing a pricing mechanism that simultaneously achieves several potentially contradicting targets: costs recovery, creation of incentives for efficiency, and equality.

Replacing government support with uniform end-user cost-recovery prices may increase the burden on low-income families whose share in taxes to meet the state's budget is minimal. This observation is one reason for the criticism of the prices set for the water and sewage corporations. This criticism is particularly strong when costs increase and prices have to be hiked. Indeed, trying to avoid criticism, the Water Authority recently refrained from increasing prices. It succeeded in getting the government to cover part of Mekorót's costs. Apparently, according to the social norms as they are reflected by this policy, equality overwhelms efficiency. This time, since it was done, not by direct subsidy, but rather by the government freeing Mekorót of rents it was supposed to pay, the principle of cost-recovery tariffs was maintained, at least from a public relationships perspective. This avenue for mitigating political opposition will not be open for ever and as costs rise (increased share of desalinated seawater is expected to increase costs) the public will have to accept higher rates.

Another problem that the new tariff structure raises is the use of Mekorót's wholesale prices to cross subsidize weak municipalities and the prices of water supplied to agriculture. This pricing regime does not encourage the management of corporations to improve the efficiency of the services.

Yet, all of these obstacles can be viewed as a reflection of dynamic struggles between public institutions on the allocation of power and authority, and between societal norms on the preferred dominance of contradicting economic effects such as



equity and efficiency. The EPI has shed light on these dilemmas, and brought them to a public discussion, while feeding the disputes with more reliable and consistent data; this is by itself a contribution, as says the phrase: a problem well defined is a problem half solved.

4.2 Enabling / Disabling Factors

A major enabling factor of the EPI has been the legislative framework that dictated nationwide centralized water management and regulation. The government has both the authority and the financial tools to drive desired policy. In practice, however, the dominance of the government exposes it to political pressures. Implementation depends on a wide range of forces acting in the political arena, exercised by parties in parliament, ministries, city-mayors, bureaucrats and water users in all sectors.

Political pressure has its positive aspects; it is one way of public participation. Indeed, recognizing this aspect, the law requires the Council of the Water Authority to conduct open hearings before finalizing tariffs and regulations. This procedure can be considered an enabling factor, since policies were understood and sometimes modified. But the procedure is also costly: hearings take time and as policies were reconsidered and changed, some groups blamed the Water Authority for zigzagging and thus reducing its credibility.

Another way of influence is through the parliament. The history of tariff setting in the urban corporation serves as a demonstrating example: The Law (of water and sewage corporations) states that “Every price shall reflect, as far as possible, the cost of the service for which it was set.” In simple language, the tariffs are locality specific; each corporation will have a unique tariff to cover its specific costs. Opposition was mounted when the expected differential tariffs were known and the director of the Water Authority was called several times to Parliament committees and asked to explain his policy. He claimed that he is only implementing the law. Yet, he was pressed and was even told that the law can be amended. After debates and deliberations, a way was found to square the circle, integrating identical tariffs with full cost-recovery as required by the law. Yet this did not suffice and the tariffs were changed again, this time the lowest-paying bracket was expanded. And it’s likely that the story won’t end there.

Being under such a political pressure, the aspects of the policy that do capture the public attention are crucial for the implementation of the policy as a whole; hence, public relationships may become either enabling or disabling factors. For example, the identical end-user tariffs were set as the prevailing opinion (in the media, the Parliament) was that the state should not discriminate between communities; all are sheltered under its wings and it is expected to rule equitably. This philosophy gained support particularly in light of the fact that it was precisely in the poor locales where tariffs were likely to be high, as there, the Water Authority approved (for first application years) higher water loss norms and higher collection costs than in other locales. Yet, while the observable consumer tariffs — the subject of public debate — were identical, the corporations pay Mekorót differing prices,



consequently, some corporations support others' water costs. While probably the poor communities are among those supported, it is also probable that this cross subsidization did not raise vehement public criticism since it remained behind the scenes and is not conspicuous to the public eye.

In addition, while identical tariffs were set in the wake of public pressure, a political aspect may also justify them: If different tariffs were to be set, the leadership of the communities harmed thereby would mobilize their forces to oppose "discrimination". Just consider higher tariffs for Jerusalem than for Tel Aviv; the state would not be able to implement its desired policy. Whereas with identical tariffs, the political struggle is aimed at lowering tariffs for all, and it is relatively weak, not focused and concentrated, since any given mayor can free ride on the struggle carried on by others. And thus, up until now, the Water Authority has succeeded in upholding its mandate and the decision of the government on full cost-recovery, even if only on a nationwide scale, not in every locale separately.

Another enabling factor was the Mediterranean climate: The repeating appearance of water crises, caused by series of drought years during the last three decades, accompanied with both a steady increase in water consumption due to population increase and a shortsighted water management policy that has relied almost entirely on natural water sources, formed a public emergency atmosphere that has facilitated implementation of drastic changes. Hence, the reforms were presented as urgent and critical to the overall efforts to cope with the problem. The economic policy incentives under consideration were viewed as only a part of a comprehensive move, which have resulted in the extensive establishment of desalination and wastewater treatment plants, the exchange of freshwater with recycled water for agricultural irrigation, and the reduction in urban water use.

5 References

- Barak, B., 2010, 'How much are we willing to pay for a clean river?' (Hebrew) (http://www.zalul.org.il/upimgs/file3_467.pdf) accessed 13 November 2011.
- Bein, D. - The "Bein Committee", 2010. 'State Investigative Committee on Administration of Israel's Water Supply' (Hebrew) (http://elyon1.court.gov.il/heb/mayim/Hodaot/01_01.pdf) accessed 29 October 2011.
- Ben-Shlomo, V., 2010, 'The economic value of aesthetic aspects in urban gardens' (Hebrew) Ph.D. thesis, The Department of Geography, Tel-Aviv University.
- Bilik, H., 2009, 'The necessary distinction between non-revenue water and leakage', *máyim v'Hashkayá [Water and Irrigation]*, 506: 38-39. (Hebrew).
- CBS - Central Bureau of Statistics, 2011, 'The state of society in Israel; environment', Report # 4. (Hebrew). (http://www.cbs.gov.il/webpub/pub/text_page.html?publ=54&CYear=2009&CMonth=1#8.) accessed 22 November 2011.



Fleischer, A., Tsur, Y., 2009, 'The amenity value of agricultural landscape and rural-urban land allocation', *J. Agric. Econ.* 60, 132–153.

Israeli Government, 2010, 'Principles of water supply administration', decision no. 2348 of October 24 (Hebrew)
(<http://www.pmo.gov.il/PMO/Archive/Decisions/2010/10/des2348.htm>) accessed 13 November 2011.

Globs, 6.11.2011, 'Nisan-committee's recommendations approved: will the water corporations return to the municipal authorities?' (Hebrew)
(<http://www.globes.co.il/news/article.aspx?did=1000695209>) accessed 7 November 2011.

Grunau, R. - The "Grunau Committee", 2005, 'Report of the Consulting Committee on Regulating Water and Sewage Association Fees' (Hebrew)
([http://www.wwa.gov.il/Apps/WS/WSProtocol.nsf/ProtocolView/9159819D684A879442257074004BF927/\\$FILE/Protocol.pdf?openElement](http://www.wwa.gov.il/Apps/WS/WSProtocol.nsf/ProtocolView/9159819D684A879442257074004BF927/$FILE/Protocol.pdf?openElement)) accessed 10 November 2011.

Kan, I., Haim, D., Rapaport-Rom, M. and Shechter, M., 2009, 'Environmental amenities and optimal agricultural land use: The case of Israel', *Ecol. Econ.* 68(6):1893-1898.

Kislev, Y., 2011, 'Water pricing in Israel in theory and practice'
(http://departments.agri.huji.ac.il/economics/teachers/kislev_yoav/Kislev-Acc-6-11-10.pdf) accessed 15 November 2011.

Kislev, Y., 2011, 'Governmental budget in the water economy during the last decade' (Hebrew) (http://departments.agri.huji.ac.il/economics/teachers/kislev_yoav/Tak-Abs-29-6-11.pdf) accessed 10 November 2011.

Magen, D. - the "Magen Committee", 2002, 'Parliamentary investigative committee on Israel's water economy' (Hebrew),
(http://www.knesset.gov.il/committees/heb/docs/vaadat_chakira_mayim.htm#1) accessed 28 October 2011.

MoEP - Ministry of Environmental Protection, 2011, 'Governmental decisions' (Hebrew) (<http://www.sviva.gov.il/bin/en.jsp?enPage=HomePage>) accessed

State Comptroller, 2009, 'Report on the critique of local governments for 2008' (Hebrew).

Water Authority, 2011, 'Legislation' (Hebrew)
(<http://www.water.gov.il/Hebrew/about-reshut-amaim/Pages/Legislation.aspx>) accessed 25 November 2011.

Weinberg, T, 2008, 'Urban mosquito nuisance in central Israel: An environmental and economical analysis' (Hebrew, with English abstract)
(lib.haifa.ac.il/theses/general/001466066.pdf.) accessed 23 October 2011.



6 Data Sources

Bar-Shira, Z., Cohen, N., and Kislev, Y., 2007, 'The demand for water in local jurisdictions', *haRiv'ón l'Kalkalá* [Economic Quarterly] 54 (2), 179-203.

CBS - Central Bureau of Statistics, various years, 'Statistical yearbook' (Hebrew) (http://www1.cbs.gov.il/reader/cw_usr_view_folder?ID=141) accessed 15 November 2011.

CBS - Central Bureau of Statistics, 2009, 'Monthly consumption expenditure in deciles of households, by net money income per household' (Hebrew) (http://www.cbs.gov.il/webpub/pub/text_page.html?publ=25&CYear=2009&CMonth=1#3) accessed 21 November 2011.

CBS - Central Bureau of Statistics, 2010, 'Satellite account of water in Israel, 2006' (Hebrew) (http://www.cbs.gov.il/publications11/water_account_06/pdf/e_print.pdf) accessed 20 November 2011.

Water Authority, March 2010, 'Corporatization status in Israel' (Hebrew) (<http://www.water.gov.il/Hebrew/Municipal-sector/Pages/Water-and-sewage-corporations.aspx>) accessed 21 November 2011.

Water Authority, January 2010, 'The reform in water and sewage tariffs' (Hebrew) (<http://www.water.gov.il/Hebrew/Rates/DocLib1/Reform-Jan2010.pdf>) accessed 24 November 2011.

Water Authority, 2011, 'Water and sewage corporations' (Hebrew) (<http://www.water.gov.il/Hebrew/Municipal-sector/Pages/Water-and-sewage-corporations.aspx>) accessed 21 November 2011.