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Water Saving in Israel's Urban Sector: A Feasibility Study for a Renewed Policy

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Abstract

Over the years Israel has experienced an increasing shortage of water due to growing demands, especially in the urban sector. There are two complementary approaches for coping with this situation. The first and more conventional way is augmenting supplies to meet rising demands. As part of this approach, and after serious depletion of the natural resources reached crisis proportions, Israel has launched on a major program of sea-water desalination and shifting of potable water from agriculture to the cities and replacing it with reclaimed wastewater. The other approach is demand management - to reduce demands, so they are in better harmony with the existing supply, thereby postponing some of the investments in expanding supplies.

This paper reports the findings of a study of existing and potential savings in water use by the urban sector, especially households, which are the largest water consumer in the urban sector. The study included a comprehensive feasibility study, concerning technical, legal, economical, social and administrative aspects. It was designed to provide the basis for policy decisions. This paper focuses on the social feasibility of water saving by urban households.

Keywords: Residential and Urban Water Consumption, Water Demand Management in the Urban Sector, Feasibility Study, Israel.

Objectives and Method

The research hereby reported had two main objectives: (a) to estimate the existing and potential savings in water use by the Israeli urban sector; and (b) to reach operational recommendations concerning water saving promotion in Israel: means that will enlarge savings - education, legislation, pricing etc., and will address different levels of action - state and local authorities, non-governmental organizations and residents.

The research covers a broad review of the relevant literature and experiences, reported in Israel and elsewhere, concerning water saving devices and methods. A core component of the research includes a comprehensive feasibility study for the possibility of achieving significant water savings in households:

(a) *Technical feasibility* – description and examination, based on available international publications, of technical devices, from dual-flush toilet cistern to irrigation schedulers. All devices were examined for their efficiency, cost, ease of instillation and maintenance.

(b) *Legal feasibility* – description of Israeli laws, regulation and standards concerning water saving, and examination of their possible use to promote water saving in the city.

(c) *Economic feasibility* - three parts: (1) review and evaluation of the possible use of water prices as a tool to promote water saving in households in the Israeli context; (2) initial examination of the household's profitability due to purchase and use of

water saving devices; and (3) initial examination of the economic benefits of water saving in the national level.

(d) *Administrative feasibility* – two parts: (1) review of the accumulated experience from Israel and other countries regarding the possibility of influencing water saving by educational means; and (2) a set of structured interviews with position holders who deal with water saving in the local authorities

(e) *Social feasibility* – the methodology and the findings regarding social feasibility will be detailed below.

In this paper we focus on the following subjects: overview of water use in Israel, urban and residential water consumption and the social feasibility of water saving by households. The paper ends with a series of conclusions and a number of recommendations.

In the paper we use the following terms: *Urban water consumption,* which comprises: residential water consumption (inside the house and in the garden) (55%); public buildings (education, health, sport), public gardens, businesses, hotels etc. (altogether 24%); light industry and agriculture within municipal boundaries (both 8%); as well as water losses (13%). *Residential water consumption,* which comprises: indoor water use (drinking, cooking, cleaning etc.) (95%) and outdoor uses (irrigation, car washing, etc.) (5%).

Water Consumption in Israel

In 2001, the total potable water consumption in Israel was 1,342 million m3. This amount was provided to three major sectors: industry 9%, urban 49% and agriculture 42% (additional water for irrigation has been provided since 1993 from non-potable sources; in 2001 this amount reached 460 million m^3).

The percentage of urban demand for water grew over the years - in the 60's and 70's it was only 15% of the total potable water amount used in the country. This percentage increased to 25% in the 80's, to 40% in the 90's and to almost 50% today. The increasing demand for water is a result of the growing urban population and rising standard of living. This latter factor is probably the main cause for a constant, albeit slow, growth in water consumption per capita, as seen in Table 1.

Table 1 shows that since 1960 there was an annual average rise of $1m^3$ in water consumption per capita. This rise was stopped in the early 90's. In 1998 the average annual urban water demand per capita in Israel was $111.2m^3$ (305 liters/day). The average annual residential water demand per capita was $62m^3$ (170 liters/day). This amount is 55% of the total water consumption in the urban sector, and includes indoor water and outdoor water uses. In the years 2000-2001 there was a significant decline in per capita consumption. This decline is due to the sequence of dry years (which continued in 2002 and was reversed

Table 1: Urban water consumption per capita in the urban sector, 1960-2001

Years	Population	Water demand (capita/year)
1960'	2,600,000 (1965)	75-80 m^3
1970'	3,500,000 (1975)	85-95 m^3
1980'	4,270,000 (1985)	95-110 m^3
1990'	5,610,000 (1995)	95-110 m^3
2000, 2001	6,510,000 (2001)	101, 104 m^3

in winter 2003), which raised substantially the population's awareness of the need to save water.

Analysis of Urban and Residential Water Consumption in Israel

Israel is an urban society; more than 90% of the Israeli population (about 6.7 million, 2004) live in 201 cities, towns and suburbs, that are referred to as local authorities (rural communities are organized in regional authorities). Data about water consumption in Israel's local authorities was examined in order to identify consumer groups (municipalities) where water saving can have a sizeable effect and should be promoted. The data was analyzed according to size of the local authority, its geographical location and climate (northern, central and southern Israel)[1] and by socio-economic status of the residents[2].

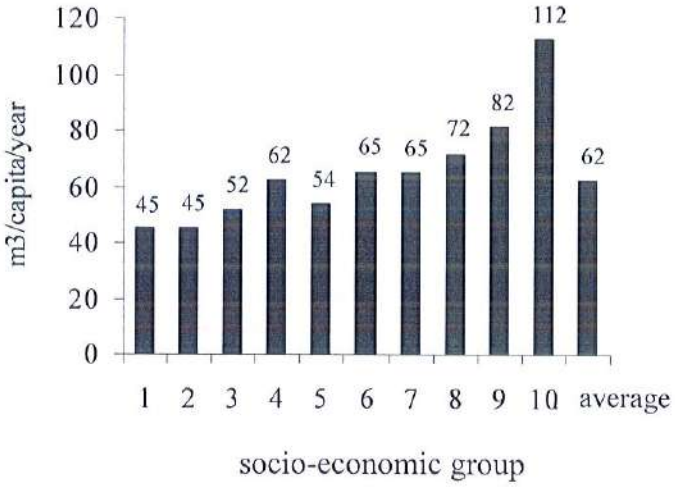

Figure 1: Residential water consumption by socio-economic group (1998)

The main finding is that the most dominant factor influencing residential water consumption (inside the house and in the garden) is the standard of living. Figure 1 shows that residential water consumption increases with the standard of living: the "strongest" local authorities (group 10) consume 112m^3 of water per capita per year, which is 2.5 times the water consumptions in the "weakest" local authorities (groups 1 and 2) (However, only 2% live in local authorities of group 10). This finding was strengthen by the analysis made according to size of local authority. Water consumption in small local authorities of up to 2,000 residents was found to be higher than consumption in larger municipalities; one third of the local authorities in this size group are "strong" authorities in which standard of living is relatively high.

An additional factor influencing residential water consumption is the geographical location. The consumption in southern Israel, where the precipitation is significantly low, is higher than in other parts of the country. The water consumption in central Israel is relatively high too; we assume that this is a result of the high standard of living that characterizes this area.

These findings bring us to recommend focusing on "strong" cities in socio-economic groups 7-9, in which 40% of the Israeli population live.

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[1] The climate and amount of precipitation in Israel vary according to geographical areas: the northern and central parts of the country are characterized by a Mediterranean climate, with an average annual precipitation amount of above 600 mm and 400-500 mm (respectively); southern Israel is characterized by a dry climate, with an average annual precipitation amount of maximum 200 mm.

[2] As defined by the "Israel Central Bureau of Statistics", the standard of living is measured by 14 variables, including education, employment and income. The standard of living is expressed in ten levels of socio-economic status: level 1 includes local authorities with residents that are relatively "weak", and level 10 include local authorities with residents that are relatively "strong".

Measuring the Social Feasibility of Water Saving by Urban Households

A social feasibility study is designed to assess the willingness and commitment of the public to act for the benefit of a defined purpose, tested by reviewing the public's attitudes and behaviors. In our case, we investigated the willingness of urban households to save water. The investigation was based on a telephone survey conducted among a representative sample of the Israeli urban population. The questionnaire composed for the survey examined the interviewees' awareness to the national water situation, the existence and use of water saving devices, water consumption habits etc.. It also examined the interviewees' interest in receiving information about ways to save water, to change water consumption habits and to buy and use water saving devices. The answers were analyzed according to size of the local authority and its geographical location in Israel, socio-economic status of the residents, gender, age, education and income.

The survey was conducted in summer 2002 and included 506 households from 150 local authorities. 16% of the interviewees were Arabs (Moslems and Christians) and 84% were Jewish; 15% of the Jewish interviewees were newcomers who immigrated to the country after 1990 (mostly from the former USSR), the rest (85%) were established residents. More than 50% of the interviewees reported they had at least 13 years of education, and only 8% had just a basic education of 0-8 years.

The survey shows that there is high awareness among the urban population in Israel of the importance of saving water. A vast majority of the respondents (some 85%), in all sectors (established residents and new immigrants, Jews and Arabs, different age groups, etc.), is aware of the national water condition, and agrees that water savings in households can contribute to improve the national water condition. Most of the population (about 70%) is interested in receiving information about ways to expand water saving inside the house and in the garden (65% of those would appreciate receiving pamphlets by mail).

A significant percentage of the interviewees reported that they save water at home. 80% (!) of the households currently use a dual-flush toilet cistern (usually 9/4.5 liters/flush), and 30% use water aerators on faucets. 65%-90% of the interviewees reported that they take actions to save water, like repairing leaks, closing the faucet while brushing teeth or shaving, and watering the garden during cool hours. Additional findings showed that 35% of those who did not own a dual-flush toilet cistern and 50% of those who did not own water aerators were willing to buy and install these appliances at home.

Another result of the social feasibility study is the advantage of addressing specific target groups and subjects. For example, we identified that new comers have relatively low awareness to the national water condition. Therefore, this group should be targeted with information about the scarcity of water in the region. Additional subjects that should be targeted are: water saving is an important action that will benefit the country and the environment; water saving will reduce the household's expense.

Conclusions and Recommendations

Following an extensive review of relevant literature and the feasibility study, we have reached a series of conclusions and recommendations:

(1) Water savings can and should be treated as a constant and reliable means for closing the demand-supply gap, under the condition of placing increased emphasis on its credibility.

(2) There is a wide range of means that are being used in Israel to promote water saving, among them: devices and technologies, education, public campaigns, pricing, primary legislation, municipal regulations and imposition of standards. The social, administrative, economic, legal and technical investigations show that it is possible to strengthen activities in all these dimensions, and thereby, increase savings.

(3) There is no need to use extreme means to achieve water saving. We do not recommend severe legislation and aggressive enforcement, water quotas, drying out gardens, or raising water prices (which we think will harm weak populations and will hardly serve the goal of water saving). We do recommend increased education and campaigns for relevant groups, distributing water saving handbooks to the public, activating the many existing "green" organizations, standardization of water-saving technologies, and removal of legal barriers that prevent people from taking water saving actions.

(4) The theoretical water savings in the urban sector can be as high as 40% of the total water consumption, if all possible means are fully implemented. This is the total hypothetical saving that could be achieved, relative to what would be consumed if individuals and authorities used water without taking any action for saving.

(5) The urban sector in Israel already saves 15%-20% of the expected water consumption. According to our calculations, about 140 million cubic meters per year were saved in 2001, relative to what would be consumed if the demand in the same year had followed the trend observed in per capita consumption during the period 1960-1990. Following our findings, we conclude that these savings are a result of the general awareness of the need to save water, to the use of water saving devices by households, and to actions already taken by the local authorities to reduce use and waste.

(6) It is possible to save about 10% of the urban water consumption forecasted for the year 2020. We believe that implementation of the above relatively simple and inexpensive recommendations will strengthen the existing trend of water saving in Israel, and will attain a long-term water-conscious behavior by all segments of the population. On this basis it is reasonable to reduce the forecasted per capita water consumption for the year 2020 from 130 cubic meters per year (the number that was used by the National Water Plan for the year 2020) to 115 cubic meters per year. This translates into a saving of about 130 million cubic meters per year in the year 2020, for a forecasted Israeli population of 8.6 million in that year.

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