



Israel: water pricing and command and control for water demand management in cities and agriculture

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Challenges and drivers for green growth in the Israeli water sector

Green growth and water

We live in an era where it has been recognised that economic growth and development can be sustained only when we ensure that natural and environmental assets continue to provide resources and ecosystem services. Economic development and growth require investments and innovation, which in turn, open new economic opportunities. Technological innovation and the use of inputs (natural resources, human capital, capital etc.) enable production and contribute to economic growth. However, input scarcity may slow down economic growth unless technological progress can compensate for input scarcity. Such technologies may produce a substitute for the scarce input or enable a more efficient use of that input. For example, water scarcity constraint can be alleviated using technologies that produce desalinated water (sea water reverse osmosis technology), treat/recycle water (sewage treatment technologies) and use water efficiently (drip irrigation). When technological change occurs in such environments, it undoubtedly becomes a key to ensuring co-existence of economic growth and environmental improvements. This paper presents the Israeli case of promoting green growth: while dealing with water scarcity and environmentally-water-related threats, Israel also applies advanced administrative and economic tools and incentives that intend to rehabilitate natural resources and push forward innovative technologies.

Drivers of innovation in water and wastewater

Water scarcity and environmentally-water-related threats enforced Israeli policymakers to introduce advanced regulations, standards, administrative tools and economic incentives to the water sector in order to manage the sector efficiently. That, in turn, promoted the need for research and development of water and wastewater technologies – some of which financed by public funds and some by the private sector.

The unique experience of Israel can be attributed to several factors. Israel is a semi-arid area with an uneven distribution of its water resources and had already decided in its early days of its establishment to develop regions that were also remote from water sources. Blooming the desert was perhaps one of the initial driving forces for the Israeli economy and for which the water sector has responded with the building of the National Water Carrier from north to south. Border security settlements, food security and agricultural development put further pressure on water resources. The response was further development of physical infrastructure



and efficient drip irrigation technologies. Increasing population growth and a large inflow of immigration have created an additional burden on the already overexploited and environmental degraded resources, thus requiring reallocation of renewable water from the agricultural sector to the urban sector for drinking purposes. The need to supply water from alternative sources to the agricultural sector has pushed forward innovation in sewage treatment technologies that produced recycled water suitable for irrigation. Over the years, regulation and standards related to the quality of treated sewage have also contributed to advancing sewage treatment technologies.

Water scarcity also created markets for water saving technologies for domestic uses and for municipal uses. Economic incentives designed for reducing water demand in the urban and agricultural sectors based on increasing block tariffs resulted in the development of innovative water management devices such as water meters that are read remotely and more accurately (including measuring small drops so leakages would be fixed), pressure optimisers devices, computerised irrigation systems, etc. In recent years, increasing standards of living, consecutive years of droughts and peace agreement obligations have put further stress on water resources, pushing the economy to adapt to water production using sea-water reverse osmosis desalination technologies that were developed in Israel over the last few decades.

Contaminated drinking wells and aquifers are also a major factor in developing innovative purification/filters/membranes technologies. Economic incentives for rehabilitation of such water sources are today in place, pushing technology implementation but also innovation as investors are searching to minimise the operation cost of such activities. Finally, highly educated human capital supported by excellent universities and research centres have enabled the industry to use well-trained human power for developing innovative water and waste water technologies.

New challenges: restructuring national and municipal water organisations, rethinking production scales, realising financial sources

In recent years, the rationale motivating the water sector in Israel underwent major changes, embedding economic incentives and environmental and health considerations, striving to become more efficient and responsible for future generations and therefore enhancing innovation of water and wastewater technologies. The changes result from deficiencies in past management of the water sector. The changes indicate a very dynamic and advanced sector that deals with substantial risks and large climatic uncertainty by implementing new technologies of water production and water treatment and advanced supply and demand management tools.

Going big, meant restructuring the way the old Water Commission worked and turning it to a National Water and Sewage Authority with an inter-ministerial Water Authority Commission.



It necessitated dramatic political-structural-economic changes in the way Israel serves its urban customers which resulted in the establishment of 56 Municipal Water Corporations. It meant involving the private sector in PPP, including intervention of international companies and large foreign investments in state of the art desalination plants. It meant major changes in the way Israel realises the potential of waste water. Finally, it meant that water scarcity must be reflected in water prices. Prices increased substantially to reflect cost recovery leading the water sector to become eventually an independent, closed economy sector.

Policy towards water security

Dynamic policy: evolving issues

Policy towards water security has been very dynamic since the establishment of the state. It is irrelevant to report on one specific ‘golden’ policy that can be applied in a generic way elsewhere. Water policy is always relevant to location, time, culture, politics, social needs, etc.

Water policy has to be adjusted according to the stage of development of each State. Various needs and changing pressures raised different types of concern. Evolving issues, such as vast immigration in the 90's, water agreements with the HK of Jordan and the PA, water pollution, climatic impact, etc forced Israel to rethink its policy continuously. Water was and still is a major engine for economic growth for Israel. In order to secure water sources – natural, produced and treated – Israel has diverted vast financial resources over the years. In recent years, the financial burden has been shifted to consumers that pay higher water tariffs that reflect cost recovery. But tariffs also reflect cost of environmental and natural assets that have been deteriorated in recent years and require large investments for rehabilitation (polluted wells, aquifers and streams). Natural resources that provide ecosystem services such as lakes, streams, wetlands are also in increasing demand as GDP per capita has grown and leisure time increased. Sufficient level of water must be kept for nature in order to maintain and enhance various ecosystem services (biodiversity, recreation, drainage, flood control, aesthetic, property value, etc).

It is possible to indicate several issues that pushed forward the water economy in Israel. At first, survival and security were at the forefront of the agenda whereas today environmental considerations are an integral part of development. Chronologically, issues that have affected policies are as follows:

- **Water and food security** – development of water sources for agriculture, settling borders and developing remote areas. Today, after years of droughts, degraded water quality in aquifers, water is needed for existence and for keeping agreement with neighbours.
- **From an infant economy to advanced industry** – as a new emerging country with infant industry and much need for food security at the time, water was highly subsidised in order to allow for economic growth. Reliable supply along with sufficient quantities



where the two major issues. Only in recent decades, as anthropogenic activities have affected water resources, water pollution has become a major issue and provision of clean water is demanded. With increasing demand for water and diminishing availability of natural resources on one side and with growing economic strength, ability to pay and innovative technologies on the other side, subsidies have declined and prices reflect cost recovery.

- **Social and ideological values** – Israel enabled non-urban way of living for various strategic, social and ideological reasons. Customers living in areas remote from water sources did not pay marginal cost and tariffs were highly subsidised. Obviously, such an approach is not consistent with economic theory where subsidies cause inefficiencies. Another important issue was equity. All end users pay same price regardless of distance from water source. Again, water allocation is not based on the economic principle where water goes to the highest economic use.
- **Health** – today with higher pressure on water resources due to large, dense populations that reside along the coastal line and their activities cause pollution that effects water resources – the public may be subject to health risks. The standards of drinking water quality and the standards of waste water treatment (water is been reused for irrigation or diverted to stream) must be high and carefully monitored for health reasons. Health consideration effected water policy is Israel (e.g. standards, wells' protection zones, etc).
- **Environment** – two major issues are: open space and water treatment. The need to keep open space helps in advocating to maintain land use for agriculture. That in turn, kept the need for water allocation for farmers. The issues of water treatment can be divided to two main issues: (i) rehabilitation and treatment of polluted wells and aquifers; (ii) treatment of waste water – for reuse for irrigation and as a means to prevent pollution in streams where previously untreated waste water was discharged. Preventing stream pollution promotes enhancement of ecological assets and their services.
- **Tourism** – tourism is a source of economic growth. Provision of water supply must reliable and safe.

Supply and demand policies

While Israel during its years of establishment gave importance to water security, agriculture, and settlement along borders, it is clear that water policy was oriented towards the needs of the agricultural sector and those of remote areas beyond urban needs. Engineering and resource exploitation were major means to meet these needs. Through the years, Israel has developed its water management based on principles of supply and demand management.

The following summarises briefly the principles of the supply and demand management:



Supply management:

- Engineering and hydrological based – increase storage capacity, connect remote areas, develop water resources, divert saline water from fresh water sources
- Technologically based – water treatment: desalination of seawater and brackish water, waste water treatment to be reused for irrigation
- Environmentally based – allocate fresh water to the environment in order to maintain ecological assets and services, divert waste water to streams only after treatment, divert saline water, manage resource exploitation
- Efficiency and economically (cost) based – minimise water loss by repairing leakages, managing water pressure, etc.

Demand management:

- Education, awareness, water saving campaigns – encourage behavioural change
- Increasing block tariffs – incentives to consume less
- Fines – pay fines for consumption above allotted quotas (farmers and industry), pay over-use fee during drought period (residential, imposed for limited time)
- Aquifer production levies – pay for water production to reflect water scarcity rent

Financial policy

The water sector in Israel operates as a closed economy. It relies on water tariffs for its financial needs. Water tariffs reflect cost recovery and scarcity of resources. Government backs the sector with long-term commitments for purchasing water from desalinated plants in case water production in plants would not be required in heavy rainy seasons. Government also granted and backed the establishment of Municipal Water Corporations. It is likely that government budget would still be needed for unique projects where decision makers would prefer not to increase water tariffs in order to subsidise unique projects that may be unjustifiable economically but still legitimate at a national strategic level (e.g. expansion of water availability in remote areas such as Arava).

National policy for promoting the water industry, green jobs and export

Since 2005, the government has been promoting a national water technology programme. The goal was to take advantage of the concentration of water technologies in Israel, continue developing and exporting them. This represents true Green Growth in action. Not only do the technologies developed allow for more efficient management of the water (supply and demand) but they also produce many waste water treatment technologies and processes



benefiting the environment directly. Also, material, methodologies and technologies for treating polluted wells are being developed, increasing efforts to keep natural water resources clean and available for use. Green jobs have been created in the water industry and green export has developed to about \$2 billion in 2010. Connection with other non-water technologies such as the ICT sector has been promoted. Also, many non-technologically based solutions such as economic and statistical models have been developed (pressure management, statistical models for leakage detection, etc).

The program provides: grants for start-ups, infrastructure for water technology incubators, connection between academia and industry, academic site for experiments, beta site in the water sector, education, training, conferences, and international fairs.

Economic and administrative instruments for green growth

Several economic and administrative instruments are being used in Israel in order to achieve efficient management of water resources and of consumption. Among them are:

- Environmental taxes – aquifer levies for water production, sewage treatment fees (not part of the water tariff)
- Water quotas and increasing block tariff – for agricultural and domestic users (industry has quotas and flat tariff)
- Exchange of water rights (scarcity signal) – farmers could exchange fresh water rights for irrigation with recycled water and pay lower prices for actual use
- "Feed in tariff" – payment mechanism for artificial recharge in aquifer (storm water catchment, treated water)
- Government grants for well rehabilitation and water reclamation plants
- Government grants for eco-innovation – national water technology programme

Evaluation: economic, social and environmental benefits

To summarise briefly, among Israel's notable achievements are: the establishment (2005) of one of the world largest reverse osmosis sea-water desalination plant with a capacity of 120 million cubic meter per year (mcm/yr) along with additional plants (2007) with a capacity of 30 mcm/yr – both of which increased production capacity to a total of additional 45mcm/yr. The Government aims to augment sea-water desalination capacity to 750 mcm/yr by 2020.

Additional achievements are: structural changes related to the creation of the Governmental Water and Sewage Authority (GWSA), creation of 56 Municipal Water Corporations, treatment of sewage and recycling of treated effluents for agricultural purposes, thereby



freeing up potable water for other uses, raising the quality standards of drinking water and of treated sewage, changes in the structure and the rates of water pricing in all sectors to reflect marginal cost in order to improve efficiency in use, an innovative residential water saving campaign which transfers the implementation risk to the private sector, and implementation of public-private projects through international bids for new infrastructures and technologies.

Finally, green growth has also enabled job creation and the involvement of the private sector:

- Job creation – water saving awareness campaign, distribution of water saving devices for the tap, upgrading WTP's, eco-innovation industry, traditional water industry jobs
- PPP including foreign investment – desalination plants

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