The evolution of the Water Sector in Israel

Integrative Water Resources Management in Israel

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Coordinator of International Projects
Mekorot- Israel National Water Company
Technology

Management

Management = Education
(Value of the Water)
Technology is a Way to improve results or processes,
it's not a Goal
Creation of the State of Israel (1948)

Foundation of the National Water Company – Mekorot (1937)
Annual Rainfall in Israel – Desert Border

RAINFALL
- less than 100
- 100 to 200
- 200 to 400
- 400 to 600
- 600 to 1,000
- more than 1,000

Map showing annual rainfall in Israel with color coding for different rainfall categories.
State of siege in Jerusalem-1948
Indications for the efficient use of the daily quota of water (Jerusalem-1948)

10 litres

Water for drinking, 2 liters

Soapy water

Water for cooking

Final cleaning of dishes

Washing fruits and vegetables

Clothes washing

Floor cleaning

Toilet

Water for personal hygiene

Water for washing fruits and vegetables

Water for final cleaning of dishes

Water for soapy water

Water for toilet

Water for clothes washing

Water for floor cleaning

Water for drinking

Water for washing fruits and vegetables

Water for final cleaning of dishes

Water for soapy water

Water for toilet

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Water for clothes washing

Water for floor cleaning
4 Pillars of the Israeli Water Sector

**The measurement of water law (1955)**
All water supplied/consumed, must be measured

**Water Law (1959)**
All forms of water resources belong to the Public and should be managed by the State

**(2005) Centralized Management: only 1 responsible Water Authority**

**(2005) The Israeli’s Water Sector is self-financed**
Domestic: 850 Mm³ (39.5%)
Industrial: 150 Mm³ (7.0%)
Agriculture: 1150 Mm³ (53.5%)
Consumption in millions of m³ per year

Population in thousands of people

Large Scale Desalination

Reuse of Efluentes


NWC

Shifting from surface to pressurized irrigation.
Increasing usage efficiency.
Introduction of automation technologies of fertilization and filtering.
Brackish Water usage.
Full Pressurized Irrigation.
Automation
Increasing the reuse of effluents.
Development of monitoring technologies.

Implemented Policies

Agricultura Irrigada.
Infraestructura.
Regulación.

New regulations for the reuse of effluents.
Desalinated water.
Regional Projects - National Projects

NWC: 5% of the GDP (1964)

- Effluent reuse (1989)
Shafdan: Plant for the treatment and reuse of the Dan Region’s sewage

Old Plant: 200 Hectares

New Plant: 25 Hectares
Soil Aquifer Treatment - SAT

- Monitoring Wells
- Production Wells
- Recharge Fields

Reclaimed Water
Clarifiers
Pumping Station
Reservoir

Production Wells
Monitoring Wells
Production Wells
Monitoring Wells

SOREQ 1
YAVNE 1
YAVNE 2
YAVNE 3
YAVNE 4

SOREQ 2

160 Mm³/year
Shafdan Plant – Upgrade

New primary clarifiers
New Anaerobic Digesters
Bio Generator System for the production of electrical energy from biogas

56,000 MWh produced, 68% of the 82,000 MWh required

Energy of the process: 0.60 KWh/m³
Annual Supply of Potable Water & Reuse of Effluents

- **Potable Water Supply**: 850 Mm$^3$
  - Domestic + Industry: 450 Mm$^3$ + 200 Mm$^3$
    - **Marginals Water**: 450 Mm$^3$
      - Unrestricted Use In Agriculture: 300 Mm$^3$
        - Tertiary Effluents: 300 Mm$^3$ (53%)
          - Non recycled: ~70 Mm$^3$ (12%)
      - Restricted Use In Agriculture: 200 Mm$^3$
        - Secondary Effluents: 200 Mm$^3$ (35%)
          - >85% Reuse

- **Raw Effluents**: 570 Mm$^3$ (~65%)
  - WWTP Biologic Treatment
Circular Economy

68%
## Water Usage in Agriculture

**1960: 80.0% → 2020: 53.5%**

<table>
<thead>
<tr>
<th></th>
<th>Agriculture (%)</th>
<th>Domestic (%)</th>
<th>Leakages</th>
<th>Net Effluents</th>
<th>Reuse</th>
<th>Reuse (% Agr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Israel 2020</td>
<td>53.5</td>
<td>46.5</td>
<td>(10%) 4.65</td>
<td>(66%) 31</td>
<td>(85%) 26.35</td>
<td>49.2</td>
</tr>
<tr>
<td>Israel 1960</td>
<td>80.0</td>
<td>20.0</td>
<td>(10%) 2.0</td>
<td>(66%) 13</td>
<td>(85%) 11.33</td>
<td>14.2</td>
</tr>
<tr>
<td>AMLAT/Africa/India</td>
<td>80.0</td>
<td>20.0</td>
<td>(40%) 8.0</td>
<td>(50%) 10</td>
<td>(50%) 5.00</td>
<td>6.2</td>
</tr>
</tbody>
</table>
Future Projection of Effluents reuse

1. Industrial
2. Indirect Potable
3. Marginal agriculture
Use in Agriculture

The quota for each farmer is defined according to:

- size of the land
- geographic region
- water resources availability
4 Pillars of the Israeli Water Sector

(2005) Centralized Management:
only 1 responsible
Water Authority
Water Authority Board

ONE table for decision making

Member
Public Representative

Member
Ministry of Finance

Member
Ministry of Environment

Chairman
Water Authority

Member
Ministry of Interior

Member
Ministry of Agriculture

Member
Ministry of Infrastructures, Energy & Water
The Israeli Water Sector (2005)

The Water Authority

Mekorot

Bulk water supply

Corporations

Inside the cities
(2005) The Israeli’s Water Sector is self-financed
The water price

- Is **uniform** over Israel (Domestic and Agriculture)
- **All the costs** are divided by the quantity of water supplied
- It includes the **development** of the future projects
Composition of the domestic water price (2020)

- Corporations: 45%
- Desalinated Water: 15%
- WWT: 20%
- Mekorot: 20%
Water Prices
($/m^3$, VAT included)

• **Agriculture:**

<table>
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<tr>
<th></th>
<th>Potable Water</th>
<th>Shafdan-Reclaimed Water</th>
<th>Effluentes for Unrestricted Irrigation</th>
<th>Low Quality Effluentes</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Within the quota</td>
<td>0.76</td>
<td>0.37</td>
<td>0.40</td>
</tr>
<tr>
<td>II</td>
<td>Up to 10% (8%) above quota</td>
<td>1.20</td>
<td>1.11</td>
<td>0.49</td>
</tr>
<tr>
<td>III</td>
<td>More than 10% (8%) above quota</td>
<td>2.01</td>
<td>1.91</td>
<td>0.60</td>
</tr>
</tbody>
</table>

*Since 01/06/17 the price of the potable water for agriculture is uniform*

• **Domestic Use:**
  - Basic Quantity, 3.5 m$^3$/person-month 2.18
  - Additional Consumption 3.98
Distribution of Agricultural Inputs in Israel

- Forages 33.8%
- Depreciation 14.5%
- Miscellaneous 10.1%
- Fuel, lubricants and electricity 10.0%
- Pesticides, fertilizers and manure 8.5%
- Seeds and seedlings 8.4%
- Water 8.4%
- Packaging materials and contracted transport 6.3%
Uniform prices (domestic and agriculture) incentives the introduction of:

1) new technologies

2) more expensive water resources

3) cheaper money
Evolution of agricultural production

1968 = 100

(Y. Kislev, 2010)
Water Sources in 2005 and 2020

- 2005:
  - 71% Natural Water
  - 15% Brackish Water Desalination
  - 8% Sea Water Desalination
  - 5% Brackish Water
  - 1% Treated Waste Water

- 2020:
  - 22% Natural Water
  - 20% Brackish Water Desalination
  - 5% Sea Water Desalination
  - 3% Brackish Water
  - 20% Treated Waste Water
Master Plan of Israel

Annual volume in Mm$^3$

Year

Natural Recharge

Sea water desalination

Brakish water desalination

Efluentes

Source: Water Authority
Climate Change -
Increase in the Interannual Variation

More extreme values:
More years with floods and droughts

Increased uncertainty
Climate Change -
Increase in the Interannual Variation

Increased uncertainty

Technology must reduce uncertainty
Summary

- Learn (study) all the water resources
- Define the objectives of the sector
- Planning (short, medium and long term)
- Reducing the uncertainty
- Implement clear policies
- Implement gradually
- Educate
- Train
- Execute
Summary

Public Policy-Centralized Management

Trust

Water Culture (Scarcity)

Education
Questions/Reflections

1) Country/Region Project?

2) Role of the Water Sector and its Objectives

3) There are all the tools to achieve the objectives? There are barriers?

4) It is necessary to make some changes?
## Facts and Figures about **Mekorot**

<table>
<thead>
<tr>
<th>304,000 water samples analyzed per year</th>
<th>3,000 production and supply installations</th>
<th>10 command and control centers</th>
<th>43 desalination plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>12,000 km of water pipelines</td>
<td>over 1,000 active wells drilled</td>
<td>70% of the total water consumption in Israel</td>
<td>13 wastewater purification facilities and reclamation plants</td>
</tr>
<tr>
<td>Integrating 600 million m³ of desalinated seawater per year</td>
<td>85% of potable water in Israel</td>
<td>6 certified laboratories in Israel</td>
<td>1.6 billion m³ of water supplied per year (423 billion gallons)</td>
</tr>
</tbody>
</table>
Mekorot’s Consultancy Services Abroad

Master Plans for Water Sector- State Level (G2G)

Desalination: consulting and planning services (OC).

General design for all aspects of water engineering (desalination, sewage treatment, hydrology, drilling and supply systems).

General supervision and management control.

Energy efficiency.

Water loss and NRW management.

Command and control.

Cyber and infrastructure protection.
Water Innovation & Technologies Examples
Cyber Security for IoT Devices & Sensor Data Health in Water Operations

- Providing threat detection *At The Source*
- Reflecting the **healthiness of the data** and security level
- Using Machine Learning and AI to detect abnormal behavior of sensors data
- Presenting the system’s condition as “IXDen Grade”
CQM WATER has developed and patented an automated self-cleaning On-Site Chlorine Generation technology, capable of disinfecting large range of water matrices.
Spectral Sensing Technology
Water Quality Inspection
USING AI TO DRIVE SIGNIFICANT ENERGY SAVINGS IN WATER SYSTEMS

Results - Hafetz Haim (HH) Analysis

- HH water amount was maintained at safe and high levels
- AI Engine shifted water supply to low cost hours from peak

How it works

Using Deep Learning to determine capacity volume and relevant resources over time.

An Artificial Intelligence based solution that dynamically right-sizes your energy consumption.

Putting redundant capacity to sleep, saving energy and slashes electric bill.

Big Data Analytics to ensure no KPI impact.
An international R&D center for wastewater treatment and recycled water
More than the SAT can Handle: A New Era

The problem
The SAT fields are at capacity, but the plant needs to increase its maximum load.

The solution
An engineered treatment for excess effluents that cannot be infiltrated at the SAT.
Thanks