

Written Testimony of Amit Lang,  
Chief Executive Officer, EMS Mekorot Projects Ltd. Israel  
Before the U.S. Senate Committee on Energy and Natural Resources,  
Subcommittee on Water and Power

Hearing on The Use of Technology and Innovation to Increase Water Security  
and Enable Economic Development in the West

United States Senate

October 30, 2019

Chairman Murkowski, Ranking Member Manchin and the members of the Subcommittee.

I wish to thank for the opportunity to share the vast knowledge of Israel and Mekorot in the field of water supply.

I am honored to present the written testimony about Mekorot's activities and contribution to water infrastructure, water treatment, secured supply and management, which are continuously evolving alongside the most advanced technologies over the years.

Mekorot is a fully owned government company and defined by law as the Israeli national water company. The Mekorot Group engages in various fields such as: Water supply, Water resource management, Water quality, Water security, Desalination, Hydrology and drilling, Effluent reclamation, Wastewater treatment, Rain enhancement, R&D and more. Mekorot supplies approximately 70% of the total water consumption in Israel.

Mekorot was founded in 1937, before the establishment of the State. Since then, Mekorot made a profound national contribution to realizing the Zionist vision and transforming it into a sustainable reality. The infrastructure and huge water plants, founded by the company, have essentially facilitated life in Israel and provided solutions, at all times, to all sectors – households, agriculture and industrial plants.

### **Introduction**

Israel has 3 different climate zone types: Mediterranean in the north, Arid in the south and Semi-Arid in central Israel. From the early days of the State, Israel suffered from lack of water. The constant population growth alongside the reduction of natural water resources led the country to initiate research and implement astonishing solutions.

The water supply system in Israel was created during the early years, based on several different sources and combinations covering the entire country. At present, pursuant to the climate change

and global warming, Mekorot uniquely provides water from no less than four water sources: surface water (Sea of Galilee), groundwater (mostly from the Mountain and Coastal Aquifers), desalinated water, and reclaimed water. The ability to use the same system for all four sources together, while managing demand in real time, makes Mekorot a reliable company for continuous and secure supply of water. There is no precedent for this in the entire world.

### **Surface Water:**

In early days, our country realized that given our challenging geo political environment, Water is the most essential resource to evolve demographically and agriculturally. Therefore, Israel set up in primary stages of its independence, a national transmission network.

The establishment of the National Water Carrier, inaugurated in 1964, which is still considered to be the largest infrastructure project in Israel, was the result of groundbreaking thinking in which water is transferred from a relatively rich water source at the north of the country, from the Sea of Galilee to areas at the south of the country on the edge of the desert.

The National Carrier Project enabled the State of Israel's development and the establishment of many new communities, including agricultural communities in distant and isolated areas even next to border zones close to unfriendly neighbors.

Mekorot has always considered the development of the State, the blooming of the desert and painting Israel green to be a national imperative. In the spirit of this vision, the company has succeeded in developing knowledge and unique capabilities based on careful and accurate planning processes.

For the past twenty years, the major part of the underground piping infrastructure of the national water system has been protected by a cathodic protection system. Mekorot has advanced wireless control systems which provide up-to-date information about the status of the infrastructure, the cathodic protection level and even automatic regulation of the corrosivity level.

### **Cloud Seeding:**

In addition to efforts and investments in water management and distribution, the rain enhancement operation, commenced in 1961, increases the water resources. Studies conducted during the 1960s and 70s showed that precipitation in Northern Israel was enhanced by 13% due to the rain enhancement operation. This provides some flexibility to the water management system, especially during drought years. At the present time, the cloud seeding efficiency is being re-evaluated in a multiyear study in cooperation with the academy. Although the official evaluation is incomplete, recent studies show that cloud seeding does indeed have a physical effect on rain clouds, which

can cause an increase in precipitation. We continue to examine ways and means to improve the seeding operation, aiming to reduce costs and increase its efficiency.

### **Ground Water:**

Later on, Mekorot was a pioneer in implementing and installing pumping equipment in the Mountain Aquifer (which is much deeper and bigger than the Coastal Aquifer). As early as the 1960s and 1970s, Mekorot drilled boreholes to depths of up to 1,500 meters, depths usually associated with the search for oil. The company installed many tons of pumping equipment at depths of up to 500 meters and more, providing reliable water sources and additional water sources for mountain communities.

### **Desalination Plants**

However, this was not sufficient, we were asked to provide additional water sources. The first of such sources was the use of desalination plants. Mekorot was one of the pioneers in implementing reverse osmosis technology for water desalination. In 1975 Mekorot built the first RO desalination plant for brackish water for the city of Eilat. Eilat, the most southern city in Israel that was so isolated by the desert and consequently without connection to the national water carrier, became the most visited city in Israel as a popular destination to visit the Red Sea.

From 1997 the desalination plant in Eilat, includes a sea water desalination facility and brackish water desalination plants from drillings nearby. The integrative advantage created in Israel significantly increased the recovery rate to 90% compared to the accepted world standard and is reducing the amount of specific energy required per cubic meter.

In Addition to the desalination plants in Eilat (which produce a total of 61,400 m<sup>3</sup> per day), Mekorot currently oprates several dozen (31) brackish desalination plants (which prудuce up to 13,000 m<sup>3</sup> per day). Mekorot is also committed to absorbing huge amounts of water from the five coastal desalination plants throughout the year, while also preserving the production capacity from the aquifers and managing surpluses in the system.

### **Reclaiming effluents and agriculture**

Alongside desalination, Mekorot also developed the ability to reclaim effluents, which brought Israel to first place globally in reclaiming wastewater for agricultural use by reaching an almost 90% reclamation rate.

The “Shafdan” facility, which is operated by Mekorot for many years, is an example of advanced technology which aims at constant improvement. The facility generates a larger quantity of effluents than the drinking water supplied by a single mega desalination plant on the sea shore.

The effluents are treated and undergo a unique process, which includes infiltration into the aquifer, the SAT (Soil Aquifer Treatment), via a number infiltration ponds. This is intended to complete the effluent treatment and to achieve a higher and better quality than the tertiary quality.

After remaining in the aquifer for several months, the effluents are pumped out and, via a series of pipelines, reservoirs, and pumping stations, are supplied for unrestricted agricultural use in the Western Negev (arid zone).

This remarkable facility is now at a crossroad. On the one hand, the entry of innovative technology for primary and secondary treatment of waste water and, on the other hand, an increase in the quantity of waste water resulting from population growth and the connection of additional consumers in the center of the country.

This is a serious challenge. The existing infiltration ponds are reaching their limits and cannot be expanded, since they occupy prime real estate in the center of the country. Furthermore, the housing shortage requires a new way of addressing the challenge and working to relocate some of the infiltration ponds, to enable construction of thousands of housing units as part of the solution for the housing shortage.

Mekorot is preparing for this challenge. Over the past few years, many research projects and trials were conducted at the Shafdan R&D facility in collaboration with partners from Israel and abroad. Different technologies of effluents treatment for reclaiming them to drinking water quality were examined. The company gained knowledge and experience that will come to the front in the construction of a semi-industrial pilot which will examine advanced technologies, such as UF (Ultra Filtration) combined with RO (Reverse Osmosis), for improving effluents and bringing them to the highest quality, suitable for all usage needs. This pilot will serve as the basis for planning a large and advanced industrial facility which will produce around 50 million cubic meters per year and will serve as an alternative to the reservoirs which reached their full potential and will enable the release of land and housing solution for young couples in the central region of the country.

Of course, alongside the industrial facility, we must also increase the transmission and storage system to the existing supply system at the Western Negev.

Along side the investment in effluent, the State developed modern and advanced irrigation capabilities, concurrently conducting advanced research for the development of special fruit and vegetable varieties, resulting in increased production from the fields whilst also reducing water usage. The close cooperation between water management and agriculture created a technological advantage that enables export of Israeli knowledge to the wider world, increased exports, and creation of new jobs.

Furthermore, in the Harava, an arid zone, located south of the Dead Sea to Eilat (Red Sea), which has a saline aquifer, there are many fields of palm trees growing dates which are irrigated by brine from the local desalination facilities, (the brine is a byproduct of the desalination plant and its usage is a great economic environmental utility). Additionally, a huge algae growing plant for food additives located in the Harava, is irrigated by drilling saline water combined with brine from the local desalination plant. Other crops in that zone are irrigated by effluents. This great achievement is an example of how Israel develops an agricultural region in arid climate conditions. Moreover, Israel effectively decreased the demand for potable water and still provides an answer to continued growth of agricultural settlements in distant and isolated areas.

### **Management**

Management of various water sources and the distribution of water supply in accordance with the differing and varying demands throughout the country required to implement large-scale monitoring and metering systems throughout the country, which generate millions of data items every day from a variety of devices, all connected to command and control systems. As a result, every point in the Israeli water supply system is controlled, monitored, and managed. Data collected includes flow, pressure, temperature, turbidity, conductivity, chlorine concentration and many other parameters. This operational data makes it possible to control operation of the water system using threshold values. The supply of different water mixes, often in a short period of time, creates "noise" of water quality in the measuring instruments. The effect of this "noise" must be reduced to distinguish between changes in water mixes and pollution in the system. Here, also, integrative management and the use of advanced control systems are critical: Operational deviations are transferred from the sensors array, through local control systems to human-machine interfaces (HMI), or via computer systems used to supervise, control and collect data - SCADA systems. These systems monitor and control processes involved in the production, secured delivery and supply of water, and the optimal management of the operation and maintenance of facilities. Another issue is the energy usage management. Mekorot is the largest consumer of electricity in Israel. The company spends hundreds of millions of Dollars annually for the energy needed to provide a reliable water supply. The metering and monitoring systems enable Mekorot to constantly implement solutions that reduce energy consumption. This has led to considerable savings in recent years.

## **Epilogue**

The advantage of integrate different sources of water, is the driving force behind our ability, despite long and difficult years of drought, to supply water to all of Israel. In fact, there was not even a single moment in Israel where we were unable to meet demands or taps were dry.

The integrative and holistic management has another positive result, the low system Non-Revenue Water Percentage, is the lowest in the world - less than 3%.

In addition to the aforesaid, Israel has encouraged residents to save every drop of water through media advertisements, especially during drought years, which together with the regulation enacted in Israel for differential water prices, prompted the end consumers to save water.

In the coming years, we will focus on the digital transformation. Since the beginning of the present decade, entrepreneurs, and leading companies in the computerization and software field have identified the need and begun to offer solutions that utilize the accumulated information in water utilities servers.

Better solutions in fields such as water management, water quality and safety, energy efficiency, holistic management of water and wastewater production facilities, predicted maintenance and more, are available. Where there is data, a meaningful solution can be offered.

We have realized that our database, stored in the company's computers and servers or in the cloud, for all intents and purposes, is a "gold mine".

The great advantage of Mekorot is our in-depth knowledge of the world of water, our ability to integrate solutions while creating synergetic values and an immediate return of investment due to the fact that the equipment is installed on the basis of innovative models, that use artificial intelligence to identify trends and anomalies in the water system. The integration of core solutions with computing capabilities provides great value. There is no doubt that the world of water resource management is an inseparable part of the Fourth Industrial Revolution.

Of course, we must not ignore the cyber field. As the data world becomes more important and data flows through communications systems to local or cloud servers, water systems are, as critical infrastructure, even more vulnerable and at risk. Hence, the importance of assimilating advanced cyber protection systems for information systems and operating systems as one cohesive unit.

The Israeli Government recently decided to allow Mekorot to share the extensive knowledge accumulated by the company for the purpose of exporting digital knowledge services. In addition, Mekorot is preparing to carry out a challenging five-year plan to implement a new AMI system, an advanced SCADA system, the first national operational system of its kind in the world and, finally, an advanced, supportive cyber array at an investment of millions of Dollars. This ongoing change will bring new operational management capabilities and the management of Israeli water resources to new heights.

I thank the Committee again for inviting me to testify and would be happy to share Israel's experience and knowledge in the field of water and answer any questions you may have.