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Water Scarcity Policy: Challenges, Achievements

Water is essential to life and in turn, it has come to hold significance across various religions and cultures. Both Judaism and Islam place religious importance on water as a symbol of life and renewal. From the use of water in purification before prayer, the Mikvah, and the importance of the Zamzam Well during the Hajj, water has always been pivotal to culture, religion, and life within the Middle East. The importance placed upon water for survival in harsh arid and semi-arid lands has led both Israel and the United Arab Emirates (UAE) to be at the cutting edge of water security infrastructure development for thousands of years. Both Israel and the UAE have been pushed to develop creative ways to manage water to provide for growing populations, agricultural sectors, and commercial development. The necessity that has bred innovation in these sectors will become a major technological export in the coming decades. This technology can also be shared with the world to ensure regional security and avoid humanitarian disasters through joint research projects, memorandums of understanding, and infrastructure agreements.

According to the Global Water Institute, by 2030 over 700 million people worldwide could be displaced by intense water scarcity. Water insecurity is projected to become a global crisis with warnings that North America, Europe, and Asia could exhaust major water basins by the middle of the century. The burden of water scarcity on nations from arid and semi-arid countries within the Middle East and Africa could cause catastrophic natural disasters to take place along with major political upheaval. Water scarcity can destabilise already fragile nations with limited access to water and agricultural produce. This instability is dangerous for both the UAE and Israel who have taken steps to establish diplomatic and economic ties with neighbouring states. As water insecurity and demand continue to rise, it is imperative for the stability of the region that both the UAE and Israel can produce sustainable water technology that assists poorer states in the region.

Water technology investment in the UAE and Israel not only benefits regional water diplomacy but opens up global investment opportunities. The expertise of water infrastructure organisations is extremely valuable as robust water infrastructure is essential to most agricultural, commercial, and industrial production. The Middle East has experienced the devastating impacts of water stress before many parts of the world that will experience water insecurity in the coming decades such as Europe and the US. Water security infrastructure within the UAE and Israel has been developed through necessity and can withstand extreme climate crises. Whilst the UAE and Israel have their own unique water scarcity challenges both circumstances require continued support by the government in funding water security infrastructure for domestic and international applications.

Israel has a diverse geography from deserts to mountains in the north. Over half of Israel's total land mass is made up of the Negev Desert situated in the South of Israel. Archaeologists have found remnants of an

ancient terraced irrigation system at Ein Gedi showing irrigation techniques in the region have been essential for survival for centuries. Water security infrastructure engineering was essential in the creation of the state of Israel and essential for its continuity. The provision of water for both commercial and private uses has always been of concern to the state as a matter of national security. Over ten years before the establishment of Israel in 1937 the national water company of Israel, Mekorot, was created as an essential service. The construction of the National Water Carrier of Israel under Prime Minister David Ben-Gurion and Prime Minister Levi Eshkol helped solidify the existence of the new state by providing water for the whole nation. The carrier supplied water from the sea of Galilee to all of Israel by running parallel to the coast inland down to Tze'elim and Mivtahim in the south. These infrastructure developments allowed for the establishment and success of kibbutzim across the nation to help feed the growing population.

Despite semi-arid conditions and only 20 percent of the land being naturally arable, advances in agricultural water technology have allowed Israel to become a major agricultural exporter with over \$2 billion in revenue per year. Israel is the only desert nation with more arable land now than 50 years ago through desert reclamation techniques, wastewater recycling, and modern irrigation technology. Israel's incorporation of brackish water irrigation and the establishment of the National Water Carrier was key to reclaiming land that had seen environmental degradation after long periods. Due to these advances in technology, and a cultural push toward water conservation, Israel has become the most water-conscious nation on the planet with 90% of its water being recycled for agricultural and commercial purposes.

Similarly, the UAE has made major advancements in the area of water recycling and desalination investment due to the amount of naturally occurring freshwater sources being negligible. Irrigation within the UAE dates back centuries with archaeological findings of waterways from the iron age being found in Al Ain on the eastern border. The aflaj used water from underground aquifers for agricultural irrigation and drinking water within the region. It was developed hundreds of years before the Roman aqueduct. This shows how important ample water supply has been in the region for thousands of years. A history of water scarcity has led the UAE to develop robust water infrastructure for commercial, agricultural, industrial, and personal use.

The UAE Water Security Strategy 2036 was announced in 2017 by the Ministry of Energy and Infrastructure as an essential commercial and security plan for the future of the UAE. The Strategy aims to create sustainable access to water throughout the UAE during both times of normalcy and emergency scenarios. The goals of the strategy include reducing agricultural water demand by 21% and increasing the use of treated water to 95%. Currently, the majority of water usage in the UAE is in agriculture, meaning a reduction in this sector is imperative. The UAE uses conventional water such as surface water, groundwater, aquifers, and nonconventional water like desalination, treated wastewater, and cloud seeding in its water infrastructure program. Both the UAE and Israel have a shared vision of the role of water in regional security, humanitarian assistance, and peaceful cooperation.

There are a variety of major projects within the UAE's ongoing development of water infrastructure, specifically in the desalination of potable water. Currently, there are 35 desalination plants spread out along the entire coast of the UAE ensuring consistent water desalination if one or more of the plants are unable to be used. In 2018 Abu Dhabi completed building the largest desalinated water reserve in the world, the Liwa aquifer. Other major projects such as the Jebel Ali Power and Desalination Plant are a part of the ongoing water infrastructure development spanning the length of the nation. The Jebel Ali Desalination Plant uses multi-stage flash distillation and reverse osmosis to desalinate potable water for commercial, agricultural and personal uses.

Reverse osmosis involves the separation of ions and removal of unwanted particles and molecules from water with the use of external pressure. In comparison, most water desalination plants in the Kingdom of Saudi Arabia use classic distillation technology which relies upon boiling, steam, and condensation. These traditional processes can be time-consuming and demand large amounts of electricity to function compared to the more energy-efficient reverse osmosis water desalination techniques. Currently, the Jebel Ali Desalination Plant can process over 2.135 million cubic metres of potable water every day. The UAE desalination advancements in reverse osmosis water desalination can help states reduce energy consumption and lower carbon emissions. These technological developments are in line with the Dubai Clean Energy Strategy 2050 launched by his Highness Sheikh Mohammed bin Rashid Al Maktoum.

Israel's water infrastructure has been built through a variety of both public and private enterprises. This has led to major technological advancements in water production and irrigation. Mekorot, the national water company of Israel, provides over 80% of Israel's drinking water through a variety of facilities across the country including reservoirs, wells for underground aquifers, and pumping stations. Mekorot has established 5 desalination plants on the coast of the Mediterranean Sea and one on the gulf of Aqaba which is joined to the Red Sea. Mekorot also established the Shafdan wastewater treatment plant in Petah Tikva which treats 97 million gallons of wastewater per day. Mekorot's international business branch, 'Mekorot Development and Enterprise' has provided water solutions to a variety of different nations including Argentina, Portugal, Uganda, and Cyprus. They have also been active in various water infrastructure expos such as the American Water Summit 2019 where they presented new major water infrastructure projects, such as the Fifth Line to Jerusalem to international companies.

The private sector has also pushed technological advancement forward and approached international markets successfully. IDE Technologies, a private Israeli company, established one of the biggest water desalination plants in the world, just 15 km south of Tel Aviv. Sorek uses reverse osmosis technology to produce 624,000 cubic metres of water per day. IDE Technologies plans to build Sorek 2 with a capacity of 548,000 cubic metres to add to the growing water infrastructure in Israel. The IDE has also completed desalination projects across nations that are experiencing water scarcity threats such as the Carlsbad Desalination Plant in the US, the Tianjin Desalination Plant in China, and the Gujarat Reliance Project. Each of these desalination plants is the biggest of their type in each respective country.

A new generator developed by Israeli company Watergen can take air from the atmosphere and transform it into clean drinking water in any climate. This technology has high commercial and humanitarian potential with the development of a portable generator. Dozens of Watergen machines have been installed throughout Abu Dhabi for members of the public to access freely. Following the Abraham Accords, Watergen and UAE firm Al Dahra Holdings Company entered into a joint water research program to further develop water output and commercial applicability. A part of this joint venture includes the establishment of a Watergen manufacturing centre in the UAE and a research institute at Tel Aviv University. The Al Dahra Holdings Company and Watergen hope they can expand upon the applicability of the technology for homes, office spaces, agriculture, and factories along with water infrastructure development for rural communities.

The UAE has continued to develop technology in the area of cloud seeding which involves the use of dispersing chemicals, such as silver iodide, salt, and dry ice into the air to change weather patterns. The ongoing development and research into the environmental impacts of cloud seeding and weather modification as a tool for water insecurity alleviation is important for both the UAE and other nations in the region. With environmental

impacts being an area of concern relating to cloud seeding, further research within this area could lead to further breakthroughs and safer techniques. In 2021, the UAE introduced a new drone cloud seeding technique that uses electric charges to change air molecules at low altitudes. This technique led to significant rainfall in the summer of 2021 across parts of the UAE. This technology, if found to be safe and effective, could have major commercial applications internationally. Technological developments such as cloud seeding drones and desalination advancements are crucial steps toward realising the goals of the Abu Dhabi Economic Vision 2030.

Developments in agricultural technology are essential in developing sustainable water infrastructure due to the fact a large portion of the water used every year goes directly to agricultural purposes across the globe. Israeli companies such as Netafim have continued to push innovation in the area of agricultural water infrastructure. Netafim is a world-leading sustainable irrigation company that provides innovative precision irrigation, irrigation software, and greenhouse solutions. Netafim technology helps farmers increase crop yields with a reduction in their water consumption. Sustainable farming practices promoted by Netafim are of high value to nations with large agricultural sectors. Netafim is also a member of the UN CEO Water Mandate and UN Global Compact (UNGC) and has received a variety of awards for its sustainable approach to agricultural water management.

Similarly, Emirati companies have also pushed forward in creating sustainable and water-conscious agricultural practices through the use of hydroponic farming. Companies such as Badia Farms produce locally grown produce in the UAE with the use of hydroponic farming for herbs and microgreens. Vertical farming is essential to domestic food security infrastructure within the UAE due to a lack of arable land. Badia states that vertical farming uses 90% less water than traditional open field growing. Currently, there are over 35,000 farms across the UAE with many using vertical farming or hydroponic technology. It was announced at the Expo 2020 that there are plans for the biggest vertical farm in the world to be built in the United Arab Emirates.

Whilst the UAE produces a variety of vegetable crops through vertical farming they import between 85%-90% of food internationally from India, Brazil, China, Australia, and the US. Due to the size of the country and the lack of arable land, steady food importation without supply chain issues is essential. According to the World Resources Institute over 54% of India faces high to extremely high water stress with natural groundwater supplies dwindling and major rivers, such as the Ganges drying up. This will continue to grow with the increasing climate crisis leading to major food shortages and migration. The southwest United States is projected to experience unprecedented water supply issues with major waterways like the Colorado river which has been significantly drained. California is one of the biggest concerns for water security with the state experiencing a major decline in available water despite being the largest producer of agricultural goods in the US.

Other major import partners, such as Brazil are also facing threats of water insecurity issues without robust water security infrastructure to alleviate droughts with rainfall levels continuing to decline. Furthermore, both China and Australia are facing increasing levels of water stress around agricultural hubs. The UAE is unable to self-sustain the amount of produce required without using immense amounts of scarce natural resources. This strategic vulnerability is being addressed through a variety of federal water and agricultural security initiatives. This includes UAE Vision 2021, UAE Food Security Strategy 2051, National Energy Strategy 2050, the Centennial Plan 2071, Agenda 2030, and the Sustainable Development Goals. Each of these initiatives emphasises diversification of food sources and water security as a national priority. Cooperation between public and private entities across the energy and agricultural sector is essential to achieving many of the targets set in place by the UAE government.

The outcomes of these various projects across the UAE and Israel are key to ensuring stability within the region. United Nations Development Programme's 1994 Human Development Report outlines the need for food security, health security, and environmental security as a way to combat instability, political turmoil, and social upheaval. It outlines that one of the greatest challenges of our time surrounds physical and economic water scarcity which impacts food, health, and environmental security. Furthermore, according to the Organization for Economic Co-operation and Development, an estimated \$1.3 trillion needs to be invested collectively by governments on an annual basis. This investment is required to improve water infrastructure to avoid major upcoming humanitarian crises. As the environment changes and water scarcity trends continue upward countries must invest quickly in organisations that have already completed research and development to avoid delay.

An understated precondition of the Syrian Civil War was the devastating drought which lasted from 2006 till 2011. According to records from The Climate School of Columbia University, this was Syria's most severe drought in upwards of 900 years. Over 1.5 million people were displaced leading people from rural farming areas to urban centres. This led to a humanitarian crisis with an increase in food prices, health deterioration, widespread crop failure, and increased unemployment rates. The mismanagement of scarce water and agricultural resources by the Assad government in part led to the ongoing conflict. The Syrian Civil War has spilled over into various countries in the region such as Iraq, Israel, Lebanon, Turkey, and Jordan along with a rise in global terrorism stemming from the conflict.

UNICEF released an article in 2021 that emphasised the ongoing strain placed upon the Lebanese water supply system and how it is close to collapse. It is projected that over 70% of people will lose access to water nationwide. This combined with rolling power outages, shortages in funding, a loss of key supplies such as chlorine, and increasing fuel prices could lead to a national crisis and political instability. A lack of critical resources for survival has previously led to increased extremism thus making this failure of infrastructure across the border from Israel, especially worrying. The provision of technology, such as Watergen generators could help assist regional and remote communities in Lebanon with water scarcity alleviation and agriculture as a short-term humanitarian effort. Furthermore, adopting principles of new greenhouse technology and drip irrigation developed by companies such as Netafilm could help alleviate hunger over the long term. Assisting in humanitarian efforts in the region would save the lives of many whilst also increasing Israel's soft power influence. Using water and agricultural security as a tool to ensure stability is essential in fostering collaboration, increasing economic ties, and decreasing the risk of conflict.

The new 'Water-For-Energy' deal between Jordan and Israel shows how water can be used to create new economic opportunities and regional stability. The UAE will provide Jordan with a solar power plant to generate 600 megawatts of power for Israel. In return, Israel will send 200 million cubic metres of water sourced from desalination plants to Jordan. Jordan is the second most water-scarce country in the world making this deal imperative to help the lives of millions and ensure security in the region. The sharing of technology throughout the region could play a major role in the normalisation of relations between Israel and other nations across the Middle East and North Africa.

It is within the best interests of both the UAE and Israel to create memorandums of understanding and joint research projects with its neighbours on issues of water stability. These actions will foster further regional interdependence and help normalise relations. Countries such as Bahrain, Sudan, and Morocco have recently entered into normalisation agreements with Israel showing continued de-escalation against Israel within the region. Whilst countries such as the Kingdom of Saudi Arabia have been historically hostile toward Israel, their

relationship has become less strained due to the Abraham Accords and mutual geopolitical goals regarding Iran and Turkey. The Kingdom of Saudi Arabia announced in September 2020 that flights from Israel to the UAE would be allowed to use Saudi airspace following the establishment of the Abraham Accords. Steps toward a normalisation of relations between Israel and The Kingdom of Saudi Arabia are essential for stability in the region.

In summary, water and agricultural security technology can become a tool for both the UAE, Israel, and its allies in the push toward peace and economic cooperation within the region. The vision of a stable and cooperative Middle East could lead to the region becoming an international powerhouse across many sectors such as energy, education, manufacturing, services, technology, and infrastructure. Water security is an important part of realising these goals for the region. Water scarcity in countries outside of the region, especially in areas of Europe, Asia, and The Middle East could provide a vast array of economic opportunities for both public and private water security companies. As mentioned previously, the Organization for Economic Co-operation and Development states that countries must spend trillions on water infrastructure development urgently. Many countries will adopt the advice and technology provided to them by organisations with pre-existing research and development along with proven international success. The commercial applicability of water technology could also further extend to interstellar travel and space settlement within the coming decades. Vertical farming and greenhouse technology adapted for other atmospheres could be a reality within our lifetimes. The opportunities within this sector are limitless and full of potential.