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Lebanon, Water Scarcity

### **Lebanon: Can One of the Biggest Necessities be Harder for Humans to Find?**

It is no secret that water is the one thing humans cannot live without on this planet. But what if the greatest necessity was not as easy to find as going to a grocery store or turning on a faucet? Many of the world's countries have this problem. It is known as water scarcity. Almost two-thirds of the world's population experiences one month a year in a water shortage (Water Scarcity). Lebanon is a country that is expanding both in population and urbanization, dealing with many water and weather problems, and taking in many refugees. All of these factors combined have created a water crisis within the country.

Lebanon is a smaller country with an area of 4,036 square miles and is one of the smallest countries in Asia. It shares a border with Syria on the north and east and Israel to the south. The west sits right on the Mediterranean Sea. Within its area, Lebanon is home to about 5,432,000 people. About 88.6% of these people live in urban areas and the other 11.4% live in more rural areas. The form of government present in Lebanon is a unitary multiparty republic. This actively demonstrates that the centralized, or national government is the head of everything and has power over the local governments. Lebanon also uses a parliamentary system within its government. With this, the people vote for who makes up the executives in the unicameral legislature. Those executives then vote for who should be elected as the prime minister and the one to run the country (Lebanon).

Lebanon, with its population, has a diverse society. It includes numerous different types of religions and ethnicities. The leading race in this country is Lebanese Arab with a total of 71% of the population. The average life expectancy in Lebanon is about 78 years old. Religion plays a big part in Lebanon whether citizens are Shi'i Muslim or Sunni Muslim. Each religion is practiced by more than a quarter of the population. The third largest religion found in Lebanon is Maronite, a Roman Catholic eastern rite group. Many of the people who make up this religion speak Syriac, even though the official language spoken is Arabic. Other languages surprisingly spoken in Lebanon are English and French due to the small Armenian and Kurdish populations. Lebanon has a high literacy rate in the Arabic population. This is mainly because of their highly developed schooling system where 74.2% complete a secondary level of education (Lebanon).

Lebanon's economy is in a cycle where they have periods of prosperity and others where it is unpredictable. The main reason for this is because of the currency issue. The Lebanese pound has very little trust behind it, so many businesses refuse to accept it. The value of the Lebanese pound has lost about 98% of its value since 2019 (Chehayeb). The reason for this distrust is that the government printed more money during the COVID-19 pandemic. This caused

inflation to happen. Another reason for the distrust is when a port explosion happened in Beirut, Lebanon's capital. This caused many businesses to rely on US currency because it is so reliable. The government has recently allowed more and more businesses to start doing the same. This is to help put a stop to the inflation that Lebanon is experiencing. The drawback to this though is that it could put many people into poverty because they do not have access to US currency. Lebanon has trading deals with many other countries, including the US, China, France, and Iraq. Lebanon's main exports are vegetables, textiles, and nonprecious metals. The main imports include machinery, petroleum, and transporting equipment.

Lebanon's infrastructure took a large toll after the civil war lasting from 1975-1990. This was the first time the currency was not 100% backed up. The port explosion is another item that took a toll on the infrastructure in Lebanon. The explosion happened when tons of unsafely stored ammonium nitrate ignited. It damaged not only the port but surrounding hotels and hospitals. Because this port is located right on the Mediterranean Sea, it is the busiest port in the region and easily links to 56 other ports around the world (Baff). Location is key, so it would only make sense that the road system would be designed to go through and into this port. The three major roads in Lebanon radiate from Beirut and each extends through other major cities. There is a total of 8,000 km of roadways, and 95% of them are paved. The car-to-person ratio is very high, so traffic on these roads is increasing drastically.

Despite many of the positive characteristics of Lebanon, there is one major issue- water scarcity. As previously stated this is a common issue where many countries experience months of water shortages. The principal cause of water scarcity in Lebanon is because there are limited water resources. The available groundwater is extracted at unhealthy levels. Many of these aquifers are located along the coast of the Mediterranean Sea and run the risk of getting contaminated with salt water. There are a total of about 80,000 wells throughout the country with 20,000 being licensed and private (Kahalil). This water shortage issue has been going on for decades and is only projected to get worse. This causes many people to rely on other sources such as expensive bottled water and tanker water. With both of these options being expensive it takes a toll on the poor who live on about four dollars a day. Many who cannot afford clean water rely on polluted water which can cause major health issues. As stated in the article *Lebanon: sharp drop in water supply raises health concerns* the author states: "Lack of access to safe water heightens the risk of outbreaks of waterborne disease, including acute watery diarrhoea and diseases long eradicated in Lebanon, such as cholera" (Rida). These diseases are contracted when bacteria-infested water is consumed either through the water itself or through contaminated food. These diseases can be very deadly. They are the second highest cause of death in young kids under five years old (Rida).

I am proposing that the process of desalination is a good option for fixing this problem. I think that a desalination plant is an appropriate solution because it can turn seawater into safe drinking water on a large scale. With about 5.4 million people a fast way to get clean water is necessary. There are already about 18,200 desalination plants that operate worldwide (Argurio et.

al). Desalination is the process of removing salt from seawater and turning it into safe drinking water for human consumption. Desalination occurs naturally in the water cycle. When seawater evaporates it leaves behind salt and forms clouds that then precipitate in the form of rain or snow. This rain or snow is now salt-free and can be collected as fresh water that is safe for drinking. But how do you speed this process up and make it run on a large scale while staying within a reasonable budget? These desalination plants remove the salt through a process called reverse osmosis. Reverse osmosis requires less energy than typical distillation. First, the saltwater is collected, and then all solid materials such as garbage, and seaweed are removed. The water makes its way into a pump where it uses high pressure to pass water through a membrane while holding salt and metal back.

Now, what happens to all the salt that is removed from the water? This leftover salt and metal combine together to form a hyper-saline mixture known as brine (Argurio). How much brine is produced depends on the type of water used. After the desalination process, this brine mixture is usually dumped back into the ocean, which is not good for the environment, and the animals living in it. But, this brine can be turned into a chemical that turns out to be very useful. As stated in the article *Turning desalination waste into a useful resource* the author states: “The approach can be used to produce sodium hydroxide, among other products. Otherwise known as caustic soda, sodium hydroxide can be used to pretreat seawater going into the desalination plant. This changes the acidity of the water, which helps to prevent fouling of the membranes used to filter out the salty water — a major cause of interruptions and failures in typical reverse osmosis desalination plants” (Chandler). This means that the membranes have a less chance of breaking during the process of reverse osmosis, and can be used longer. This would mean less time for repairs and more time that the plant could be running. This brine could also be used to make hydrochloric acid, a chemical that can be used for cleaning (Chandler).

The biggest obstacle stopping this project from happening would be the cost. It costs an average of 80 million dollars to build a desalination plant. Desalination plants also require lots of energy to run. I think that this desalination plant should be run using solar panels. This would be costly at first, but once it starts running it would save a lot of money in the long run. The government would have to get outside funding to build this plant. The government would also have to be the one running this plant because no private business would want to fund this project. Another challenge in seeing this solution through would be getting the citizens to trust it. Citizens have had their own ways of getting water for many years and might not trust this new process. They probably will not realize how much of an impact clean water can have on their lives until they try it. This can positively impact their lives by not taking as much time to walk miles to retrieve water and take it back home. Another way this project can positively the lives of the citizens is by being clean. This would reduce the risk of the citizens becoming ill and possibly dying.

To make sure that the water scarcity problem does not come back, the government needs to make an active attempt to keep these desalination plants running. By putting these plants in

larger towns, it allows more people to utilize them. To get the funding for the maintenance of the desalination plants, the government should make a separate tax. This would allow all citizens to benefit from this newly clean water, rather than selective groups of people who would otherwise be the main source of income for this project. Maintaining these facilities allows the whole economy to benefit because they have a clean, constant water system. It will make this coastal country easier to grow and expand by having clean water sources to grow crops. The more crops that are grown, the lower the food insecurity problem becomes. These crops could also be sold as exports, therefore growing the economy. This can also save the government money in the long run by not having to support as many healthcare systems because the citizens will be drinking clean water.

The positive outcome of solving this problem is that the citizens of Lebanon do not have to worry if they are going to have safe, clean drinking water. Running water through a desalination plant also stops the need for having to extract so much water from wells that are connected to underground aquifers. This helps to preserve the limited freshwater resources and use more of the salt water that makes up about 70% of the earth. Another positive outcome that comes from solving this problem is that the new clean water can help farmers to grow crops and can also be available for animals to drink. Being able to grow more crops would make Lebanon a more sustainable country and help the more than 30% of citizens who are currently living in poverty.

Many factors can come together to create a problem that devastates an entire country. The water scarcity problem in Lebanon is driven by limited water resources, population growth, and weather issues. I plan to put a stop to this problem by building a desalination plant in Lebanon to filter saltwater and turn it into fresh water that humans can safely drink. This will benefit the people of Lebanon so they do not have to run the risk of drinking contaminated water and becoming ill. This can also help when growing crops to make sure that they get an adequate amount of water to grow food sufficiently, and help put a stop to food insecurity.

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