Review of ICETECH as a proposal for distribution of clean, drinkable water through the creation of artificial icebergs

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Abstract

The shortage of drinking water remains as one of the most prevalent problematical in the world, whether it is caused by insufficient sources, lack of investment in treatments or difficulties in distribution. ICETECH, a Russia-based initiative, is proposing a way to create artificial icebergs out of naturally abundant sources of fresh water to be delivered to vulnerable parts of the world as a way to combat such unbalances and move us towards a more equal future.

Index Terms – Water, shortage, natural source, freezing, melting, distribution, iceberg, transportation.

I. Introduction

One of the most – if not the most – worrying problematical that the humanity is currently dealing with is the disturbingly high number of people that do not have access to clean, drinkable water, probably the most important resource in terms of quality of life, or survival in the most dire situations.

According to statistics from the World Health Organization[1], 844 million people still lack access to a basic drinking water service, with 159 million still collecting water from surface level sources and 263 million needing over 30 minutes of a trip to reach an improved source. Sanitation is in an even worse situation, with 2.3 billion still lacking basic services. What makes it worrisome is that after decades of efforts to fix the situation, these numbers are still very high.

One of the main causes of this problematical is the lack of proper infrastructure to connect suitable water sources and facilities with the most vulnerable populations in regions of the world with scarce usable natural sources, like sub-Saharan Africa and southern Asia.

To combat these issues, ICETECH, a Russia-based project, is proposing a way to safely deliver clean, drinkable water to these parts of the world, by safely using their available natural sources and technology to transport artificial icebergs by sea[2]. In this document we will cover their proposal, taking a deep dive into what makes it innovative and how beneficial it can be to help close the gap and bring a solution to cover a basic necessity that an astounding amount of people still cannot cover.

II. Product Description

Russia is the most extensive territory in the world, while being one of the countries that reaches furthest into the northern Arctic Circle. This makes it so certain regions reach incredibly low temperatures throughout the year, along with receiving high annual precipitations[2]. One of these regions is Magadan Oblast, located on the east coast of Russia and the geographic focus point of ICETECH.

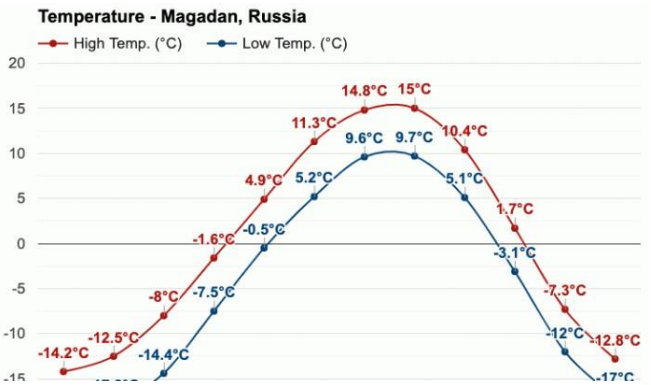


Figure 1. Average temperature of Magadan, Russia, by month. Data retrieved from https://www.weather-atlas.com/en/russia/magadan-climate

Due to its mostly snowy conditions throughout the year and isolation from big urban or industrial centers, the precipitation and hydrograph of this region become a very efficient source of water with drinking potential. ICETECH set their sights on mouth of the Gizhiga river, which has an average monthly consumption of over 400 million cubic meters per month (during the winter)[3]. By developing a way to safely transport a small portion of this volume to other regions of the world that need it most, ICETECH could become pioneers in clean water distribution.

The solution they have developed comes in the form of what they call "artificial icebergs". By controlling the natural freezing process of large volumes of water, they can create artificially shaped blocks of ice that could later be transported by sea across the eastern coasts of China, Indonesia, and even reach places like the Arabian Peninsula. Furthermore, since the freezing process occurs naturally, the energy costs of this part of the process becomes nearly zero.

However, block made entirely of ice are inefficient for this initiative since they lose volume easier by melting. ICETECH's solution is using a "skeleton" made of polymer. This membrane will allow a similar volume of water to freeze but slows its melting rate due to its thermal properties. Moreover, the material they plan to use does not create any byproducts from the interaction, so it is completely safe to use with drinking water.

This combination of processes and materials makes it so the potential final product can range from 1.5 million to 80 million m^3, with the great majority of the production taking place continually during the winter months (November to March).

III. Facilities and Transportation

Another important part to consider is that this project will require the building and maintenance of facilities on both ends of the supply chain: one for production and another for reception of the blocks. ICETECH has already defined the plans for both facilities, along with how they will manage the transportation of the icebergs[3].

III.a. Production complex

The first step of the process will be covered by complexes established on the shore of potential production sites (initially, the mouth of the Gizhiga river).

The production complex is centered on a laminar flow generator that receives fresh water from the nearby source and is handled through a crane system. By doing so, the flow of water can be controlled so no air pockets are formed during the freezing process, and the cranes allow for the potentially massive volumes of blocks that could be created.

The complex also includes a camp, preferably located near the shore that would cover all the requirements of the project, including housing for the shifts, generating the electricity and farming the fuel required for the precise functioning of the system.

III.b. Reception complex

In the receiving ports, a second type of facility will be established, one that is suited to crush the incoming ice blocks into smaller units, retrieving the remains of the membranes for recycling and storing the resulting water.

The disassembling process is the most important part, since smaller blocks of ice represent more surface area to transfer heat, accelerating the melting process, which is planned to be completely natural, since the receiving ports will be in warmer areas. To do this, a network of conveyor belts and cranes transport the smaller ice blocks inland, where they are dropped into shredders that reduce their size even more, and this product is then stored into storage tanks to melt.

This model is not only efficient, but allows for controlled distribution of the product, while also having expansion potential if the needs of a determined port exceed the initial plan, with the addition of more tanks and cranes.

III.c. Transportation

Delivering the final product is not an easy task. Not only will it be an incredibly heavy cargo, but it should also be done in a fast manner to prevent losing too much volume. For this, ICETECH has defined two possible ways: heavy duty tugboats to transport up to 250 tons, and large icebreaker boats for loads between 250 and 2500 tons.

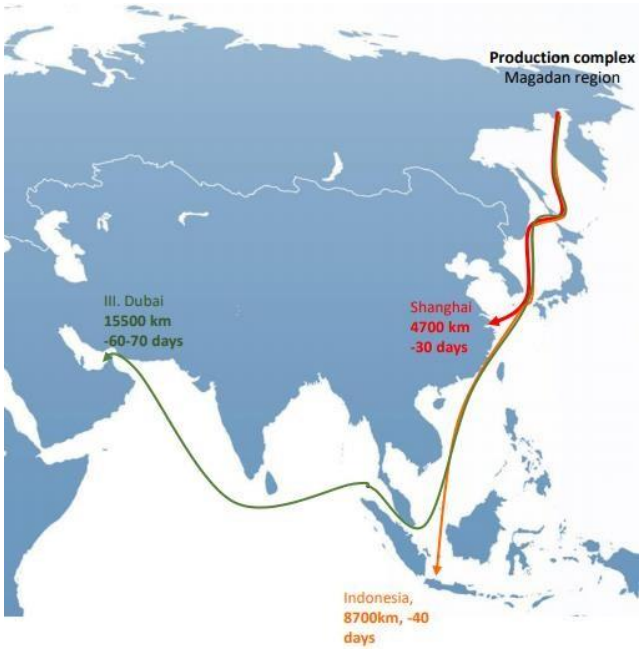
This division can also help making simultaneous deliveries to multiple locations in different parts of the world, while keeping the volume loss percentages in their expected 5% to 12%, depending on how far the receiving port is located.

IV. Potential Reach

From an economic point of view, ICETECH has certain advantages that come from their planned process and their location. First and foremost, their productions costs are minimal thanks to using natural freezing and melting processes.

Another positive aspect is represented by their potential clients. The first one to mention is China since it is the closest country following the eastern coastline of Russia. Water scarcity is a major issue in China which comes from the uneven distribution of suitable sources and population centers, along with the high levels of pollution[4]. ICETECH could become a major source for the northern regions of the Asian superpower, where most of the agricultural production is located, while also supplying them with clean water that is ready for consumption without treatments.

Figure 2. Potential routes for distribution to the main tentative clients: China (Red), Indonesia (Orange) and the UAE (Green). Note the projected shipping times for each location.



Then Indonesia, a much warmer country since it is closer to the Equator, which is currently the fourth most populated country in the world where nearly 10% of its inhabitants do not have access to clean water[5], that is because most of the islands lack sufficient sources for their growing populations. Indonesia is not only a step up in transportation requirements for covering greater distances and preventing melting, but it could represent a growing market if the population keeps increasing.

Lastly, the furthest potential client is the United Arab Emirates. The country located in the Arabian Peninsula has one of the most severe water shortages coupled with one of the highest water consumptions per capita rate[6]. Given its geographic location, the fresh water sources are incredibly scarce, along with the rapid growth of its urban centers (like Abu Dhabi and Dubai) and increase in tourism in the last decade, increasing the available water sources is a high priority. ICETECH faces the challenge of reaching this region without losing too much volume, but this country might become the main client of the project.

V. Conclusion

ICETECH is aiming high, both in economic and philanthropic terms, by proposing a sustainable system that takes advantage of natural climate conditions to redistribute such a valuable resource from regions where it is overly abundant to where it is needed most.

Beyond that, if the project proves to be as efficient as they claim, they could also plan for the implementation of similar facilities in other parts of the world, like Alaska and the northern coast of Canada that could extend their reach to other vulnerable populations in regions like Central and South America and the Sub-Saharan Africa.

Efforts like ICETECH's need not only to be supported financially, but also generate sentiment among the global population and highlight the opportunity that exists in projects like this, so we can

put the effort into creating a world where such basic needs, like clean drinkable water, are easily covered for all.

VI. References

1. WHO (2017) "Progress on Drinking Water, Sanitation and Hygiene: 2017 update and SDG baselines". Switzerland.
2. Encyclopedia Britannica. "Russia. Climate". Retrieved on 13, July 2020.
3. Information available at www.icetech.pro
4. Ma, T., Sun, S., Fu, G. et al (2020). "Pollution exacerbates China's water scarcity and its regional inequality". Nature Communications 11, 650.
5. Water.org (2020). "Indonesia".
6. Barton, Alexandra. "Water in Crisis – Middle East". The Water Project.