THE MASS WATER CONSUMPTION BY TECHNOLOGY & AI

'Visualizing the Invisible'

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Introduction

The **mass water consumption by technology and Artificial Intelligence** is an issue that is spiraling out of control in recent years, with an **increase** in the use of technology in almost **every aspect of our day**. Without us even knowing or seeing anything, every technological aspect of our daily lives is wasting mass amounts of much needed water, from a simple google search, to streaming platforms, and video calls all the way to AI. The use of our phones daily for many hours, technology in schools and in the workplace has become regular, and the use of Artificial Intelligence, that consumes massive amounts of water to cool down data centers.

Source: Google Date Centers Photo Gallery. The data center in The Dalles or Cooling Towers in Oregon, is situated within the Columbia River Gorge, an area known for its waterfalls, creating a unique visual contrast between natural beauty and rows of servers.

As technology becomes even more used in our daily lives, the water consumed without us knowing only increases. This has created a **complicated problem**. Due to it being a recent one, many people even lack awareness of this issue and its existence. If advancements made in technology maintain the same rhythm that they have had over the recent years and the use of tools such as Artificial Intelligence, Streaming platforms, computers and phones increase, so will the water that is being used. As the Earth is 71% water, most people would think a water shortage crisis is almost impossible, but more than 97% of that water is undrinkable sea water, and less than 3% is clean and drinkable water. The problem is that technology requires clean water to cool down systems. Due to its limited supply, it is rapidly getting consumed by everyday use of technology which is resulting in leaving little-to-none for.

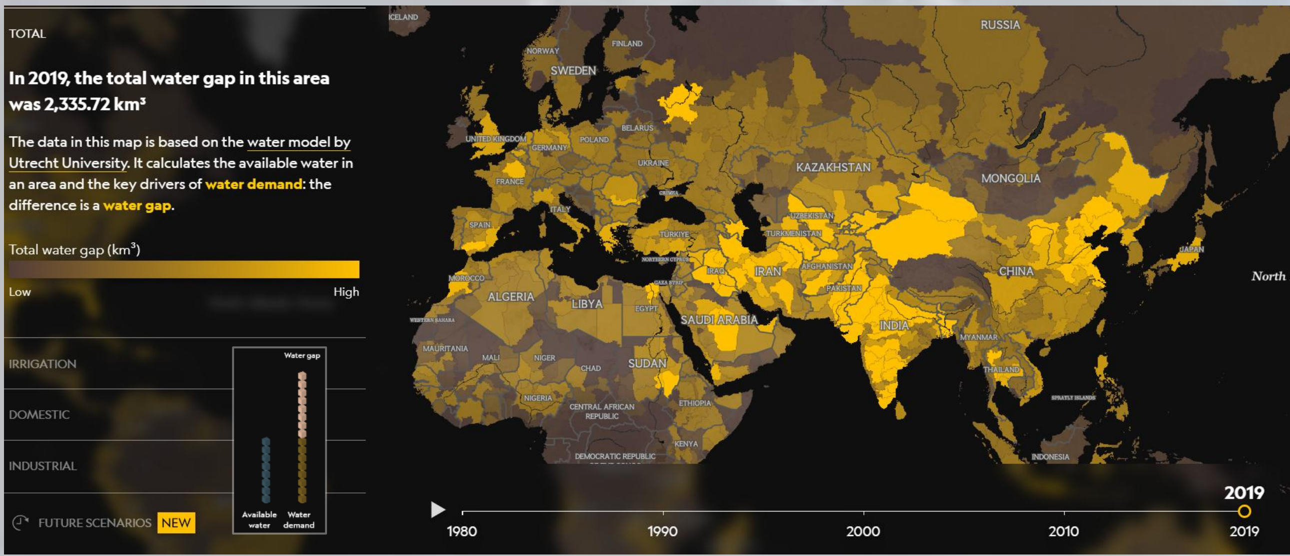
Only for the creation of a smart phone about 12.075L of water are needed; for a computer or a laptop, 190.000L of water is used and the creation of semiconductor chips costing 2.200L of pure water. Artificial intelligence, due to data centers using water to cool their systems, has increased the consumption of mass amounts of water yearly, resulting in nearly 200.000.000L of water being consumed every day just to maintain and cool AI data centers. That's more water consumed than in some cities, raising many concerns about sustainability and development of the situation. Since the average usage of technology per day has risen to almost 7 hours per day, we can only expect water usage to rise over the year, digging the hole of water waste even deeper and making it even harder for the world to recover.

Another thing that has advanced more in recent years, due to technology and AI consuming mass amounts of water, is **water stress**. Water stress is a phenomenon that refers to human needs for water in relation to the actual availability of water. Countries with water stress are those that have low water availability per person, which is less than 1,700 cubic meters of clean water per capita, according to the UN. In 2026, it is one of the biggest and most dangerous problems for humanity worldwide. According to recent measurements, 25 countries on our planet (located in the Mediterranean, North Africa and the Middle East), which host a quarter of the world's population, face extremely high water stress every year. One of them is Greece, which is known to have faced serious water shortage problems in recent years. The reason this water shortage is so great in some countries is people's habits compared to their needs. Especially in Greece, our activities consume much more water than we have available. In addition to climate change, overpopulation, and agriculture, which have been the main factors of water stress for years, in recent years, with the rapid development of technology and AI, this is expected to reach high numbers as well.

Due to the **water stress phenomenon**, another thing by the name **of water gap** has become a real issue for many communities around the world. That is because in many countries, people use much more water than the land can provide. The well-known **water cycle** (water evaporates, forms clouds in the atmosphere a then falls back down as rain) is no longer accurate. The reason behind this is human actions that intrude on the water cycle. For example, **humans now extract eight times more water than a century ago**.

The result is a **water gap** in an increasing number of places. Humans are using more water than the water cycle can provide, and so we deplete shallow aquifers, and may need to tap into deep ones that will not be renewed in our lifetime. In the process we **threaten** not only our own health, peace, and well-being, but also the health of ecosystems and wildlife.

While studying all these phenomenons, the so-called "Water footprint" numbers are rising dramatically. **Water footprint** is the total volume of freshwater used to produce goods and services we use, both directly and indirectly. It covers direct use like drinking, cooking and bathing, and indirect or invisible use such as water used to manufacture products, generate energy, and produce technology. The water footprint of technology belongs mainly to the indirect water footprint, because the water is being consumed behind the scenes for mining raw materials, manufacturing devices, operating technology, and cooling data centers and power plants



Source: Mind the Water Gap (Utrecht University & National Geographic). Zoom in on the interactive world map to see how great the demand for water is (during different years) and how large the gap is between demand and renewable supply in a water province (an area within a country that belongs to a single watershed), or increasingly smaller sub-basins.

Community Involvement and Awareness

As **water waste** becomes a much larger and global issue, which threatens the world with great problems for the future, we think that people must take immediate action to tackle that problem. One of the most important aspects of solving this problem **is informing and spreading awareness to young people**. In this way, future generations will have a greater understanding of this issue in hopes of a better handling of the water shortage problem.

In our school, we have taken multiple actions to make our classmates aware of this issue. First of all, we created a **small questionnaire** which we shared with young people from 7th grade up to the 12th. The questionnaire's context was about young people's habits which involve water usage. From all the questions we collected some very interesting statistics such as the fact that over 50% of teenagers don't know that technology uses such large amounts of water and that around 60% of young people are usure whether they would change any of their personal habits to save water. In addition to that, we designed some posters that we put up in school classrooms to spread awareness and draw interest to our classmates about this **sustainability issue**. Lastly, we visited all classrooms from 7th up to 12th grade and talked about our project and the sustainability issue that we are addressing.

With all the above, we managed to make young people familiar with the issue of **water waste** and other things such as **water stress, water footprint, and water gap**.

'Visualizing the Invisible'

One effective way to make the invisible path of water visible, raise awareness, and help people understand how much water their everyday online actions consume, is through the **creation of an app** designed for possible development (instead of a series of presentations or interactive infographics).

This app allows users to **visualize the invisible**. By accessing it, each user follows a personalized journey through four main interactive areas. These areas guide the user step by step, uncovering how digital activities translate into real-world water consumption.

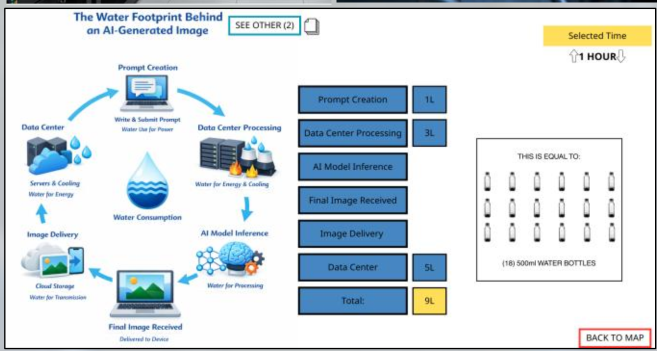
The app experience is structured around the following four stages:

I. **Select a tech task**: The first visual focuses on the user's choice of their specific online activities such as how much time they spend on the internet, between the 6 following activities:
- Video Streaming through Platforms
- Video Calls
- Doom Scrolling
- Data Storage
- AI Text Generation
- AI Image Generation

II. **Explore the task processing**: The second visual presents an interactive map that reveals the journey of the water consumed by the user's selected task. Based on the task, the map visualizes how this water travels through different locations and infrastructures. Users can interact with the map by clicking on arrows or buildings along the route, allowing them to start, pause, or continue following the water's journey as it unfolds.

III. **Explore the task processing**: The user enters a 3D virtual world that works like a playable field trip. Inside this environment, the player explores the hidden water footprint of a chosen digital activity. The user can move freely through a data center in 3D or switch to a "behind-the-scenes" mode. In this mode, the game visually shows how water flows through different systems and where it is being used to support digital processes.

IV. **Calculate the water footprint**: The final step will give the user the chance to see the visual of **the water path "up-close"**. A process that will focus on explaining in detail the path that the water they consumed during their time online follows based on what the user has selected, and to see a complete breakdown of how much water goes into each specific category and the total amount of Litters of water spent, with an image showing how much water is spent if it was used in water bottles.



Map details:

1. **Center:** The Consumption Hub At the heart of the map lies the school complex. This represents the end-users (students & teachers) using laptops and tablets. While it looks like simple screen time, the water consumption "hidden" behind these activities is significant:
Video Meetings (e.g., Online Classes): A group video call with more than 5 participants consumes approximately 2 – 13 gallons (8 – 49 liters) of water per hour. Video Streaming: Watching educational videos or entertainment consumes 3 – 21 gallons (11 – 79 liters) per hour. Social media: Even simple scrolling through feeds consumes 1 – 6 gallons (4 – 24 liters) per hour.
2. **Right Side:** The Data Center & Processing. On the right, the massive complex building, the server room with blue-lit racks, the network room, and the cooling plant room. This facility is responsible for "Water for servers & cooling". Every prompt generated or video stored requires electricity and cooling systems, which are the primary drivers of the water footprint mentioned above.
3. **Left Side:** Content Delivery & Network On the left, the facility with large satellite dishes represents the Content Delivery Network (CDN) and connectivity infrastructure. This sector accounts for the "Water for network infrastructure" and "Water for fast delivery of content" seen in your diagrams. It ensures that the data travels from the servers (right) to the school (center) and house (bottom) instantly.

Immersion cooling

Given the rapidly increasing water demand of digital infrastructure and AI-driven technologies, addressing the problem requires not only awareness but also concrete technological solutions. One of the most promising approaches currently being explored in sustainable computing is **immersion cooling**, an alternative cooling method for data centers that significantly reduces water and energy consumption.

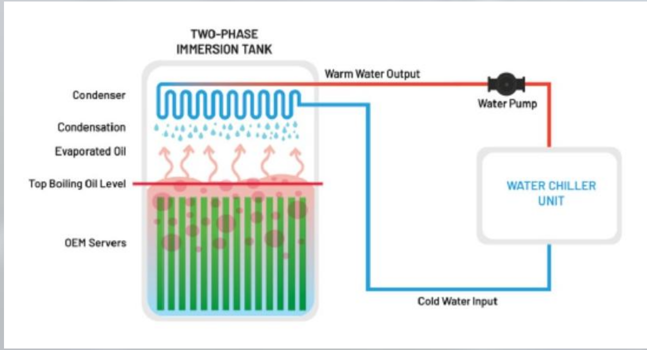
Immersion cooling is an innovative method of cooling IT hardware, servers or data centers, and mass amounts of clean and pure water. The way it works is by fully submerging computers or full servers in a thermally, but non-conductive liquid, like. The innovative way of cooling such hardware or servers with immersion cooling doesn't require fans, and the heat exchange between the warm coolant and cool water circuit usually happens by using a heat exchanger, such as a heater core or a radiator. Now some people may wonder what the differences are between immersion cooling and water cooling? Are they the same or not? We are here to answer that. In the case of water cooling, the liquid, which is clean water, is potentially harmful to electronics and thus the cooling must flow through a sealed loop isolated from the heat source. As a water block is used to indirectly transfer the heat from the heat source, in this case the electronic devices and the servers, to the working fluid, the water, because if the waters manages to come into direct contact with the electronic devices, it could cause massive damage, possibly destroying the servers and the electronic devices completely.

However, in the case of immersion cooling, the heat is transferred directly away from the heat source, using the working liquid, and that is possible due to the liquid, in the case of immersion cooling is electricity non-conductive, so it doesn't cause any damage or harm to the servers, hardware or electronic devices, allowing it to come into direct contact with the servers and remove the heat, faster, more efficiently and much more sustainably. Such type of fluids most commonly are materials such as mineral oil, Fluorocarbon based fluids, De-ionized water and Synthetic fluids

A wide variety of liquids are very suitable for the purpose of immersion cooling, with examples being transformer oils and other electrical cooling oils. **What different types of immersion cooling are there?**

In the case of immersion cooling there are **2 types** that can help **implement this sustainable solution**, with the first one being the "Single-phase Immersion Cooling":

- **Single-phase Immersion Cooling**: Single-phase Immersion Cooling is the method in which the single-phase coolant never changes state; it does not boil nor freeze, and it always remains in its liquid form. The coolant is pumped into a heat exchanger where the heat is then transferred to a cooler water circuit. This method uses open baths as there is little to no risk of the coolant evaporating.
- **Two-phase Immersion Cooling:** Two-phase Immersion Cooling, also known as Evaporative Cooling or Flow Boiling, is a method of immersion cooling which the working fluid can exist in either a liquid or gas state. This method focuses on taking advantage of a concept known as Latent Heat, where thermal energy is required to change the state of the cooling fluid. The working fluid is cooled when it reaches its boiling point and will remain at this saturation temperature, which is the temperature at which a liquid boils into its vapor or a vapor condenses into a liquid at a given pressure, it represents the boiling point where the vapor pressure is equal to the surrounding pressure, allowing both liquid and vapor to coexist in equilibrium, it increases with pressure. Energy is transferred from the heat source into the working cooling liquid, causing a portion of the fluid to boil off into a gas state. Once this happens, the gas then rises above the fluid pool where it is then condensed back to its saturation temperature. That causes the liquid to fall back into the fluid pool. This specific cooling method requires semi-open baths, meaning that the system is sealed during operation of the coolant evaporating. Though one issue with two-phase coolants is its somewhat high cost and that the effect of the vapor on the bath operators is still mostly unknown. In cases of two-phase and more rarely some single-phase immersion cooling fluids, evaporating can cause some issues. The liquid may need refilling or sealed inside the bath's enclosure.



Source: Two-Phase Immersion Cooling

Positive Impact

With the implementation of our **Water-Aware Digital Policy**, the above-mentioned measures will have a very positive impact on solving the issue of mass water consumption by technology and AI. First of all, by getting in touch with our peers, in ways such as sharing a **questionnaire** focusing on personal and school related questions based on their online habits and what they know about how much water technology and AI consume. We also focused on going from class to class to talk to our classmates directly and helped them get a better understanding of what the use of technology requires to function and the urgent need to find a sustainable solution. On the topic of awareness, the creation and use of our app will help people be more in touch with what technology requires to function and will get people more familiar with what their **water footprint** and their everyday activities consume without them even realizing or seeing anything. By using our app, more people will get the **chance to interact** and see how much water they consume.

Moreover, by immersion cooling we focus on finding a suitable and sustainable substitute for water to take over the job of cooling down data centers. By implementing such an idea, we focus on minimizing water waste and usage by technology and AI.

The proposed solutions are at the heart of **SmUCS** and **STEAM** values, as they directly address water conservation, a key global sustainability challenge. Reducing the water consumption associated with technology and AI helps **protect natural resources** and supports long-term environmental sustainability. Also, by involving **school communities** through our '*educational package*' with **questionnaires**, **quizzes**, **interactive infographics**, **presentations**, **water footprint apps** and **classroom activities**, emphasis is on working with people, not just technology. Finally, our **'Visualizing the Invisible' playful app** will help understand and explore the hidden **water footprint**, encouraging more **responsible digital habits**.

These ideas are at the center of solving this modern and complicated issue of mass water consumption by technology and AI that is expected to become a massive problem for our planet if action is not taken. With a successful implementation of all the above, we hope that by minimizing water consumption, referring to this issue, **our Earth** will become a more **sustainable place** with a brighter future.

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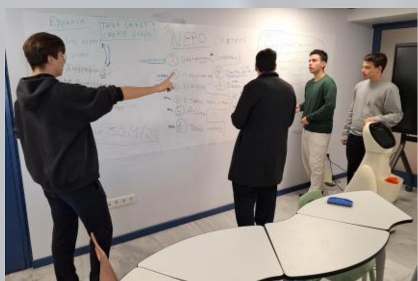
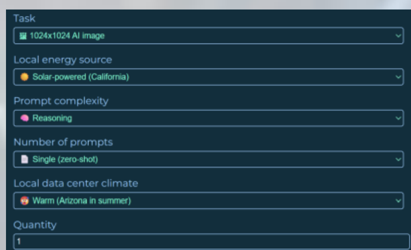
Poster, Snapshots and Water Footprint of the Project Development…



Project Footprint: 250-300 L

- Internet Navigation - Google Search
- AI Text Generation (~50 Promts)
- AI Image Creation (15)
- AI Video Creation (2 minutes)
- Video Streaming (Youtube 3 hours)
- Video Calls (0): 0 L
- Doom Scrolling (0): 0 L
- Storage (~50 Images, 3 Videos 0,4 GB)

Estimation from: what-uses-more.com



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