Water for Life

Media Backgrounder

December 8, 2020

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Water: the lifeblood of the planet

The Earth's water - 326 million cubic miles of it - has long fascinated explorers, authors, scientists and adventure-seekers.[1] Oceans, rivers, lakes, glaciers and other forms have been the subjects of mystery in literature and folklore, the backdrop for maiden voyages of engineering feats, the natural borders between nations, and the common denominator of military battles and round-the-world races.

Throughout this and above all, water is the most significant contributor to human life and the lifeblood of the planet. It is not only a nutrient vital to the functions inside the human body, it directly impacts the world outside it – from basic necessities like air, to the economies that feed global prosperity.

Today, however, global consumption risks devastating and depleting the Earth's water resources. With the global population expected to reach 9.7 billion by 2050, water conservation is becoming top of mind in efforts to turn the tide toward a new era of responsibility and sustainability.[2] Industry has a leading role to play in these efforts.

Water – a Finite Resource in Numbers

Water on Earth is vast, even present in places where it can't be seen. The amount of water that makes up the human body, depending on age and gender, can range from 55% in adult women to 78% in babies.[3] Water eliminates waste from the body, replenishes cells, and delivers oxygen throughout the body, among other functions. To put it very simply: the human body requires water to survive.

And where water can be seen, it also has a powerful impact on life. The ocean, for example, covers 70% of the Earth's surface and contains 97% of its water.[4] It produces 50% of its oxygen and stores 50 times more carbon dioxide than the atmosphere as it brings heat from the equator to the poles to regulate the climate and weather patterns.[5] Its ecosystem provides resources for food and medicine; sources from coral reefs, for example, are being used to develop new medicines for cancer, Alzheimer's disease and heart disease.[6] Waves, tides and currents are used to generate electricity, a use which increased by 13% in 2019.[7] An estimated 95% of the ocean is still unexplored.[8] This represents a potential treasure chest of untapped natural resources like energy, oil, gas, food and minerals.

[1] https://oceanservice.noaa.gov/facts/wherewater.html

[2] https://www.un.org/development/desa/en/news/population/world-population-prospects-2019.html

[3] https://www.usgs.gov/special-topic/water-science-school/science/water-you-water-and-human-body?qt-science_center_objects=0#qt-science_center_objects

[4] https://www.un.org/sustainabledevelopment/oceans/

[5] https://oceanservice.noaa.gov/facts/why-care-about-ocean.html

[6] https://oceanservice.noaa.gov/facts/coral_medicine.html

[7] https://www.iea.org/reports/ocean-power

[8] https://www.noaa.gov/oceans-coasts

From an economic perspective, water also feeds into industries such as tourism, recreation, and trade. More than 90 percent of the world's cargo travels by sea.[9] This represents more than 10 billion tons of raw materials, oil, merchandise, food and other goods being loaded and unloaded at ports worldwide.[10] Prior to the COVID-19 pandemic, in terms of "human" cargo, thousands of ferries transported more than two billion passengers along the Earth's bodies of water per year, almost the same number of passengers flying on commercial airlines.[11] Nearly 29 million voyagers took cruises each year, supporting more than one million jobs and generating $150 billion in output of goods and services.[12]   In the U.S. alone, the "ocean economy" has been driving more than 2 million jobs and $617 billion in sales.[13]

Consumption's Impact on Water Resources

But imagine a world where supermarket shelves are empty, coastal populations are displaced, and damaging storms become increasingly frequent. This is a world in which consumption has devastated the Earth's water resources.

For the purposes of this backgrounder, consumption is synonymous with the act or process of utilizing water itself, as well as manufactured goods and services. This is important to define, as water is consumed in different ways by domestic, industrial and agricultural sectors. And therein lies the complexity of its challenges: it is both consumed and a casualty of its consumption. Although water is seemingly everywhere, it is finite and not accessible to everyone – less than 1% of the 326 million cubic miles of it is readily available for human use.[14]

For those who have access to fresh water, the amount used varies from country to country – the average use per person in the U.S., for example, is 156 gallons of water per day, compared to 77 in France or three in Mali.[15] Daily activities like showering or flushing a toilet are some of the highest consuming activities in a household, while a leaky faucet alone can waste 3,000 gallons in a year.[16] Also, in the U.S., 30% of the water used by households daily is outdoors.[17] Even simple gestures like turning off a faucet while brushing teeth can save up to eight gallons of water each day.[18]

Yet domestic consumption is only part of the problem. The non-responsible use of water to provide consumers with the goods and services they use every day – from the food they eat to

[9] http://www.ics-shipping.org/shipping-facts/shipping-facts
[10] http://unctad.org/en/PublicationChapters/tdstat42_FS13_en.pdf
[11] http://www.interferry.com/communications/ferry-industry-facts/
[12] https://cruising.org/-/media/Research%20Updates/Research/Global_EIS_Infographic_2018%20CMEdit.pdf
[13] https://coast.noaa.gov/states/fast-facts/ocean-jobs.html
[14] https://www.epa.gov/watersense/how-we-use-water
[15] https://www.cdc.gov/globalhealth/infographics/food-water/water_use.htm
[16] https://www.epa.gov/watersense/fix-leak-week#:~:text=A%20leaky%20faucet%20that%20drips,take%20more%20than%20180%20showers
[17] https://www.epa.gov/watersense/start-saving
[18] https://www.epa.gov/watersense/statistics-and-facts

the cars they drive – jeopardizes the availability of water resources. For companies, their operations involve significant consumption of fresh water used for agriculture, livestock, maintenance of public and private infrastructures, and the manufacture of products and food. The amounts vary depending on the product or service.   Approximately 39,000 gallons of water are needed to manufacture a car.[19] A smartphone needs more than 3,000 gallons to produce it, one cup of coffee requires 37 gallons and – even more surprising perhaps – a plastic water bottle requires more water to produce it than it holds.[20]

Aside from this direct use of water to supply the world with goods and services, it is a polluted by-product of the actual use of these goods and services. Plastics, in particular, are severe threat to water, and this in turn affects human health, the climate, and industries such as tourism and fishing. Without making changes, by 2050, the amount of plastic in the ocean could surpass that of fish by weight.[21]

An estimated 4.8-12.7 million tons of plastic are dumped into the ocean each year; single use plastics, along with fishing gear waste, account for 70% of all trash in the oceans.[22] "The Great Pacific Garbage Patch" is a giant collection of debris in the waters between North America and Japan that is primarily made up of plastic. In addition to polluting ocean waters, this collection of plastic bottles, bags, caps and cups are detrimental to marine life, which mistakes them for food, consumes them, and dies from complications. Plastic debris causes the deaths of more than a million seabirds every year, as well as more than 100,000 marine mammals.[23] Humans consume fish that have inadvertently ingested plastic.

And the impact of plastic is illustrated by global warming and the accelerating rate of sea level rise. Sunlight affects plastic in water, causing it to emit greenhouse gases that contribute to rising temperatures.[24]   The planet is getting hotter: in the past century, nineteen of the 20 highest global surface temperatures occurred since 2001, with the exception of 1998.[25] Ice sheets and glaciers have melted, and seawater has warmed and expanded.[26] During the 20th century, the rate of sea level rise was approximately 0.06 in. (1.4 mm) per year, compared to 0.14 in. (3.6 mm) per year from 2006-2015. [27] As populations increase along low-lying coasts, the consequences of rising levels will impact coastlines, infrastructure, jobs, industries and well-being.

And to compound the problem of plastic consumption and disposal, an estimated 80% of marine pollution comes from land-based activities, where oil, sewage, fertilizer and other pollutants are

[19] https://www.automotiveworld.com/articles/water-water-everywhere-vehicle-manufacturing/
[20] https://www.watercalculator.org/footprint/the-hidden-water-in-everyday-products/
[21] https://www.ellenmacarthurfoundation.org/publications/the-new-plastics-economy-rethinking-the-future-of-plastics-catalysing-action
[22] https://www.europarl.europa.eu/news/en/headlines/society/20181005STO15110/plastic-in-the-ocean-the-facts-effects-and-new-eu-rules
[23] http://www.unesco.org/new/en/natural-sciences/ioc-oceans/focus-areas/rio-20-ocean/blueprint-for-the-future-we-want/marine-pollution/facts-and-figures-on-marine-pollution/
[24] https://www.wwf.org.au/news/blogs/plastic-waste-and-climate-change-whats-the-connection#gs.luvgb1
[25] https://climate.nasa.gov/vital-signs/global-temperature/
[26] https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level
[27] https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level

disposed of, or trickle into, water systems and find their way into the seas.[28] The effects of this pollution can cause, for example, high amounts of algae to grow, which reduces the levels of oxygen in the water that sustain fish and shellfish.[29] It can also negatively impact human health: One in three people do not have access to safe, uncontaminated drinking water that the body requires.[30] Among the consequences, 80% of all illnesses in the developing world are related to water and sanitation.[31]

The Challenge: How Can We Consume Smarter and Protect Our Most Precious Resource?

Organizations and governments worldwide have recognized the urgency of preserving the world's water resources in light of the looming population surge. A number of global initiatives have been established to inspire companies, governments and communities to come together to drive positive change.

In line with its Sustainable Development Goals – which one can argue all directly or indirectly involve water - the UN declared a Water Action Decade from 2018-2028 focused on the sustainable development and integrated management of water resources.[32] The World Economic Forum has established the Global Water Initiative to place water at the heart of economic growth planning by supporting new collaborations that will drive the UN's goal dedicated to water and sanitation.[33]

Government vigilance is evolving as well, with new laws and regulations that target goals to reduce pollution. In 2019, the European Parliament voted to ban single-use plastic items like cutlery, cotton bud sticks and straws by 2021.[34] Currently there is a global movement among a majority of UN member states that are favorable to establishing a global treaty aimed to reduce plastic waste. A joint U.S.-European satellite to monitor the ocean levels was launched in November 2020, which will provide data on sea levels, as well as information on the atmosphere and currents to enhance weather forecasts and support ship navigation.[35]

In parallel, innovators are having their say. The non-profit group The Ocean Cleanup aims to rid the ocean of 90% of plastic by developing ocean cleanup systems including a floating trash collection device.[36] Startups like EEL Energy, which is using 3D technology to develop an undulating membrane inspired by bio-mimicry - the motion made by fish swimming – to generate

[28] https://www.futureagenda.org/foresights/plastic-oceans/#:~:text=There%20are%20increasing%20high%20levels,three%20quarters%20of%20the%20Earth
[29] https://oceanservice.noaa.gov/facts/nutpollution.html
[30] https://www.who.int/news/item/18-06-2019-1-in-3-people-globally-do-not-have-access-to-safe-drinking-water-unicef-who
[31] https://thewaterproject.org/why-water/health
[32] https://www.un.org/sustainabledevelopment/water-action-decade/#:~:text=In%20December%202016%2C%20the%20United,on%20water%20during%20ten%20years.
[33] https://www.weforum.org/projects/global-water-initiative
[34] https://www.europarl.europa.eu/news/en/press-room/20190321IPR32111/parliament-seals-ban-on-throwaway-plastics-by-2021
[35] https://www.nasa.gov/press-release/nasa-us-and-european-partners-launch-mission-to-monitor-global-ocean
[36] https://theoceancleanup.com/about/

electricity from currents, are exploring new sources of energy that can help fight climate change.[37]

Although one of the first reflexes in water conservation has been to clean the oceans and improve sanitation, cleaning and recycling are not enough. And some countries that previously accepted to take on the world's plastic trash no longer do, resulting in a scramble to find alternatives. The world must be able to anticipate, push the boundaries of innovation, and change its consumption habits.

Water for Life

Dassault Systèmes, whose purpose is to harmonize product, nature and life, decided to make water, and the effects of consumption on it, the next focal point of its campaign "The Only Progress is Human."

Launched in February 2020, "The Only Progress is Human" aims to increase awareness of today's societal and environmental challenges, and inspire people to use the virtual world to gain deeper insights into these challenges and drive sustainable innovations for a better future. The initiative is engaging the public through a series of "10 Acts" that illustrate how virtual twin experiences can be used to create human-centric and real-world experiences that address each Act's challenge.

The first Act focused on emotion and the challenge, "How can virtual worlds change the way we experience emotions?" through a unique musical and visual experience called "Virtual Harmony" that featured the 3Dvarius, the first 3D-printed electric violin, which was designed using Dassault Systèmes' solutions.

Now, "Water for Life" combines the themes of water and consumption to represent the second and third Acts of the campaign. "Water for Life" aims to draw attention to the challenge of how to consume smarter and protect the world's most precious resource through the power of virtual universes to measure and optimize, create and innovate, and educate.

Virtual universes combine technology, science and art to provide a holistic approach to innovation and an inspiration for new offerings that can create harmony between product, nature and life. They usher in an entirely new way of inventing, learning, producing, and selling. They not only enhance the creative environment, they also allow anyone to reimagine a better future while understanding the social and ecological impacts of every design decision they make.

"Water for Life" will explore how virtual worlds are tremendous accelerators for measuring and optimizing the water footprint of businesses, supporting the development of sustainability-focused innovations, and educating future generations about this key resource.

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[37] https://3dexperiencelab.3ds.com/en/projects/city/eel-energy/

Measure and Optimize

Dassault Systèmes wishes to make its customers, partners and ecosystem aware of their impact on water, and work with them to reduce it.

The 3DEXPERIENCE platform already allows customers to imagine their new products and processes in a virtual 3D universe, thereby eliminating the need for physical prototypes, which consume large amounts of natural resources. Now, the company will give industrials the visibility to better understand their water footprint – the total fresh water they use to produce the goods and services consumed – by providing data on the water consumption associated with the product or process they are designing with the platform.

With that data, they will be able to understand the impacts of various design options, optimizing their water consumption. This integrated functionality will also provide data on other key environmental indicators, notably CO_2, land use, toxicity, and the wealth of other indicators that make up an environmental "lifecycle analysis" or total footprint calculation. This methodology assesses environmental impacts associated with all the stages of the lifecycle of a commercial product, process, or service. For instance, in the case of a manufactured product, environmental impacts are assessed from raw material extraction and processing (cradle), through the product's manufacture, distribution and use, to the recycling or final disposal of the materials composing it (grave). It helps to understand, for example, the total carbon emissions from a product, or the total water consumption of an industrial process.

The next step will be to not only provide the right data to customers to allow them to make more sustainable choices, but to actually guide them towards new solutions by embedding AI-generated recommendations for how to reduce the eco-footprint of a product or process.

Innovate and Create

Dassault Systèmes will foster innovation and creation related to water conservation through its 3DEXPERIENCE Lab open innovation lab and accelerator program.

The lab is engaging in an Open Innovation initiative to identify the most disruptive innovations from makers, passionate people and startups that are aiming to transform processes in industries that need to reduce their water consumption, and nurture them through collective intelligence. Already, a similar open innovation initiative from the lab dedicated to COVID-19 resulted in hundreds of projects and participants on urgent solutions ranging from a smart ventilator prototype to a head strap that holds a plastic face shield.

For more than four years, the lab has been working on accelerating sustainable solutions related to the ocean and seas and will continue to accelerate projects focused on water-related

challenges that support the UN's SDGs like "conserve and sustainably use the oceans, seas and marine resources" and many others. The 3DEXPERIENCE Lab provides a full technology, mentoring and networking support system to accelerate their digital product development. At the core of this development is access to the 3DEXPERIENCE platform. It will also reinforce this engagement with a partnership of incubators around the world who can propose engineering solutions and communities to boost initiatives locally in order to find the right solutions – not just one solution – that is tailor-made depending on the needs of a locality or population.

Educate

Protecting oceans is a long-term challenge. Dassault Systèmes will help future generations understand water-related challenges through new kinds of curricula and school programs that nurture the skills and vocations that are needed to feed the next generation of scientists and innovators to create a more sustainable world.

Dassault Systèmes' education department, 3DEXPERIENCE Edu, empowers five million students every year on Dassault Systèmes' solutions, and provides unique learning experiences for professionals to upskill throughout their life and boost their employability. Experience-based learning will transform the world of education, and the 3DEXPERIENCE platform reinforces the collaboration between education and industry. Students and educators are already using the platform on water-related projects. These include students building a trash tracking turtle-like robot to clean harbors or studying a fish nest that slows down the current. [38] [39]

In science and engineering, the most memorable way to learn is with an experiment. 3D virtual universes make it possible to experience anything, from the inside of a beating human heart to a chemical reaction as atoms combine to form molecules. This has a positive impact on the way that all complex subjects – including science, technology, engineering and math – are taught, so that the material becomes understandable and memorable in a deep, visceral way. This is why La Fondation Dassault Systèmes, the company's foundation, is dedicated to transforming the future of education and research with the learning and discovery capabilities of 3D technology and virtual universes.

Regarding water, the foundation has partnered on the "Mission Ocean" project, an innovative educational program using 3D and virtual worlds, inspired by ocean conservation and aimed at middle school and high school students. It will enable students to learn differently thanks to the possibilities offered by virtual worlds, learn about the challenges facing the oceans, and grasp their own power to act on the environment as well as to imagine themselves in the training and jobs of tomorrow. In addition to the foundation, which is providing 3D and virtual universes expertise and skills sponsorship, partners include: the French Ministry of Education (teachers for

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[38] https://edu.3ds.com/en/projects/green-turtle-project
[39] https://www.youtube.com/watch?v=8pE1k_R8KIg

the creation of the pedagogical content and the distribution in schools) and Ifremer (scientific advisor/data).

The pedagogical path for the teenagers' project will be rolled out in France in 2021. The materials will be distributed to French students first, and then translated and more broadly distributed to the greatest possible number of students in other countries, to amplify the impact of what we have accomplished.

Elsewhere, the foundation is supporting engineering schools to enhance student skills. Oceans are a way to create a project-based learning pedagogy that allows students to reinforce their skills while increasing their awareness of sustainable development. For example: the foundation in India is supporting students from the Walchand College of Engineering to create a new floating solid waste collection system for lakes and rivers. The foundation in the U.S. is supporting Olin College and Monterey Bay Aquarium Research Institute, which are creating a new generation of deep sea underwater robots with a real-time VR tools to explore some of the most remote places on our planet.

The foundation currently has two calls for projects for its presence in Europe, India and the US and is very open to receiving proposals from non-profit organizations that want to develop innovative projects in education and research around this theme.

In Conclusion

The impacts of the world's consumption on water and improving its management are emergencies for sustainable development. Further use of water resources requires new approaches to innovation that stem the damage that has already been done, and prevent further depletion. Instead of producing more, the world must produce differently and better, with new ways to consume.

Through "Water for Life," Dassault Systèmes not only wishes to increase awareness around this issue, but help any company willing to work on its water footprint reduce its direct impact on water resources, nurture the innovator ecosystem creating game-changing experiences, and engage students in a proactive, long-term endeavor.

Virtual worlds with Dassault Systèmes' 3DEXPERIENCE platform and applications have already helped innovators pioneer new medical treatments, improve service deliveries in cities, and design a sculpture that absorbs pollution. For water-related challenges, they open up new possibilities for discovery. If less water is used in all production - leading to the creation of more sustainable goods and services – coupled with a greater, general awareness of one's own water usage that can inspire change, the world stands to benefit from a better harmony between product, nature and life.