



THE FUTURE OF WATER

UNLIMITED THINKING . EXPONENTIAL POTENTIAL

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WATER: BECAUSE THE **FUTURE MATTERS**

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THERE'S A reason why we call our planet the "Blue Planet," and why NASA astrologists in 1990 called it the "Pale Blue Dot" when they looked at the iconic satellite imagery taken from Voyager 1 as it turned one last time to take a photo of the Earth hanging seemingly motionless against the black void of space from a distance of over 6 Billion km, or 3.7 Billion miles. It's because we're a water planet.

Yet, despite this governments and the United Nations (UN) alike talk of future "Water Wars" as more countries, 129 in total by the year 2030, and more people, around 5 Billion by 2050, face a future dominated by water scarcity and water stress. And, as we've seen time and time

again throughout history when civilisations run out of water, whatever the reason, they cease to exist - think the Indus, Mayans, Mesopotamians, and the Ming and Tang Dynasties to name but a few.

5 BN

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**People facing water scarcity
challenges in the future**

Just dwell on that thought for a moment – without water there is no civilisation. Which then arguably makes solving both the current and the impending global water crisis and "crises" one of humanity's greatest challenges. And

considering the impact of climate change and rising sea levels – which both create their own set of unique water related challenges – it's not going to be an easy task. But, that said there are solutions here and on the horizon.

When we focus in on the water challenges facing our world today over 4.2 Billion people lack access to safely managed water sanitation services – which results in over 500,000 deaths a year, over 2.2 Billion people lack access to safely managed water, 2 Billion people live in countries experiencing high levels of water stress, and over two thirds of the world's transboundary rivers don't have a co-operative management framework which, in the worst cases causes tension and "Water Conflicts," which is yet another new phrase that's been coined to highlight the seriousness of the situation we face.

Water is one of our most important resources, if not arguably the most important,

"A lack of water and sanitation kills over 500,000 people every year around the world, and most of it is preventable."

which is why the UN for one are getting increasingly uncomfortable about the fact that as it becomes scarcer it's increasingly becoming "a good investment" for financial investment organisations looking to cash in on its future – note "its future," meaning water itself, rather than the solutions that solve our impending crisis. Which, when



No water no civilisation

2.2 BN

Number of people lacking access to safely managed water

you think about it makes sense in one way, but it definitely raises a whole host of red flags ...

Despite being one of our most important resources ironically many of us still treat water as a disposable and even "throw away" asset - even though in 2010 the UN General Assembly (UNGA) recognised access to water and sanitation as a human right.

Solving the water challenge though requires innovation and intervention on multiple fronts, many of which are major efforts in themselves, for example from solving climate change, which is responsible for triggering droughts and floods, to solving rising sea levels which results in seawater polluting

important fresh water sources and vital aquifers.

However, when people talk

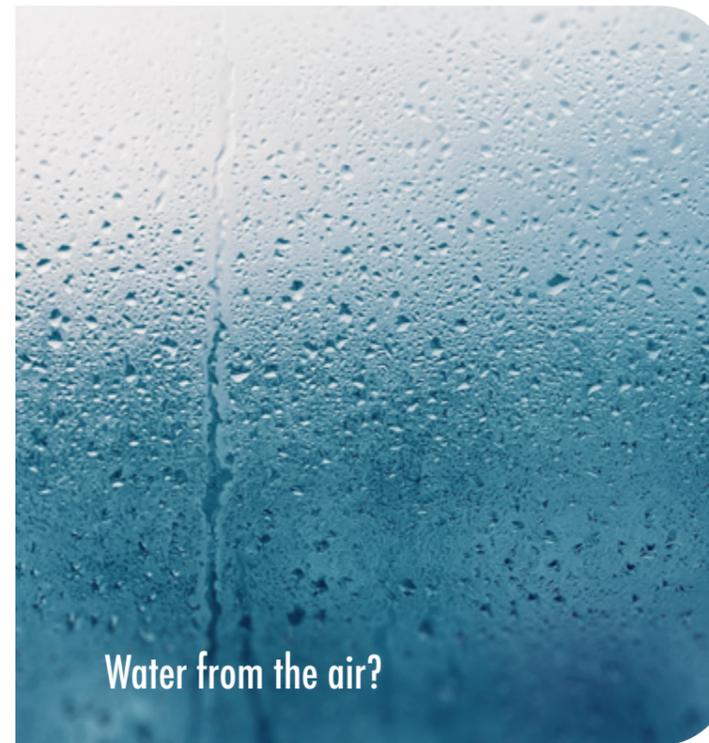
0.5% of all water

The amount of accessible freshwater reserves the world has access to

about solving the crisis the same problem crops up time and time again - water is in one place and the industries and people which need it are in another.

In short, when you really look at the problem and re-frame it we don't actually have a water crisis - we have a water distribution crisis. And that's an entirely different problem to solve because all of a sudden we have two options in front of us - find new ways to distribute and purify water, and or find new sources. So why not do both?

71% of the Earth's surface is



water with 97.5% of all water, or 320 million cubic miles worth, being saline and held mostly in the Earth's oceans. Only the remaining 2.5% is freshwater, and 80% of that is inaccessible - locked in glaciers, ice caps, and soil. So, when we really get to the nub of the matter, and despite all this water on our pale blue dot, only 0.5% of it is in liquid form and accessible to human civilisation, and even then I use the term "accessible" loosely.

All of which sounds dire - especially when set against all of our other environmental

and societal challenges. But, when we consider the fact that the Earth's hydrosphere contains a staggering 1.4×10^{18} tonnes of water, or 352 quintillion gallons, ironically this meagre amount - which still means that every person on Earth could have access to 2.2 million gallons of water - is more than enough to support our growing global needs. And that's before we discuss solutions.

Today we have four predominant solutions, not one, that can help us solve our water and sanitation crisis.

"Water has been deemed a human right by the UNGA but in the future we could face greater water challenges not fewer."

The first is for us all to simply use less water and use it more efficiently. Examples of this include the water saving devices many of us have in

our taps and showers today, as well as doing more simple things such as only boiling the water we need or turning the tap off when we brush our teeth. But there are big solutions in this bracket too.

70%

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The percentage of all freshwater used by agriculture

Today agriculture accounts for more than 70% of all global freshwater use, but thanks to new emerging food production methods such as vertical farms and clean meat we not only have a path to eliminate 99% of that figure but, when combined with other solutions which I'll discuss below, we have a path to eliminate 100% of agriculture's need to draw and consume potable water.

Breaking this down vertical farms themselves consume

99% less water than traditional farms – even if those farms are using precision agriculture systems – while growing 8 times the crop yields, and clean meat, which is meat without the animal then lets us use 99% less water, again, to produce animal meats and produce that range from meaty fillet steaks and chicken nuggets to dairy and soy produce. And as for getting to that 100% figure, well check out solution number four below in a minute where I discuss Hydropanels.

Secondly, we can use our traditional water sources more wisely and sustainably which includes solutions such as better water stewardship and more water recycling – both of which California has invested \$750 Million towards in order to try and alleviate an extreme drought which has blighted over 85% of the state and affected everything from agriculture and recreational water use to hydro electricity generation.

Meanwhile other solutions

in this category include cleaning up water sources and preventing saline water ingress into freshwater reserves such as aquifers and rivers – something that's an especially thorny problem as sea levels rise at more than 8mm a year now – via huge infrastructure investments like the ones we're seeing in Miami and New York. And then there are new sanitation technologies such as single step graphene, hydrogels, and Reverse Osmosis water filtration systems that are low cost, low power, easy to deploy, and scalable.

The third solution in our arsenal is desalination. Long touted as the potential hero of our story today there are relatively few new desalination plants planned globally as investment in the sector remains weak and as the cost of desalinated water remains stubbornly high at triple the price of water obtained from potable sources – and then there's the issue of brine wastewater which is continually cast as

the technology's toxic Achilles heel.

However, while many in the industry hoped that new technologies would let them exponentially reduce the cost of producing fresh water there may now be a saviour emerging as new energy sources such as solar power reduce energy costs, and as new catalytic and filtration technologies let desalination operators separate out and "mine" two of the 21st Century's most precious commodities from seawater – namely Lithium and Uranium. Both of which are over 5,000 times more concentrated in seawater than in ore mined in the traditional way from the ground.

Despite all these solutions though there's a fourth which to all intents and purposes could be the game changer the world needs - Direct Air Capture or DAC for short. It's no secret that the atmosphere contains an estimated 37.5 million billion gallons of water, but up until recently

trying to extract it cost effectively, sustainably, and most importantly at scale has been not only challenging but almost impossible.

However, today new advanced manufacturing technologies, such as 3D printing, and new materials, such as Hydrogels and Metal Organic Frameworks or MOFs, are changing the narrative, and DAC solutions have finally reached the point of commercialisation with some able to produce over 500 liters a day from normal environments and others able to produce 1 liter of water a day even in the driest desert environments – both of which are with today's technologies let alone tomorrow's which will inevitably be better and more efficient.

DAC's greatest benefit through is that they can extract water from the air in situ - where it's needed in a decentralised manner. And it's a double win because we can do all this without the need for governments and

organisations to invest huge amounts of money in complex water infrastructure projects that inevitably have to be maintained, monitored, and operated often at great cost.

Bringing this to a close for now at least, as you can see we have solutions to our water crisis, that could literally save lives and prevent wars, and it's all thanks to the combination of emerging technologies and human ingenuity.

Now, we just have to develop them and deploy them.