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Extreme weather-related events like Hurricane Ian, tropical cyclones, and droughts are continuing to have devastating impacts on infrastructure and communities globally. We especially hope that those in the Southeastern United States that are impacted by Hurricane Ian are quick to recover and wish the best to those assisting in the effort to help.

This report examines one component of recent extreme weather-events in particular (this summer's drought) and the impact of high temperatures on energy production. We also look at this summer's headlines and review the increasing frequency with which we are seeing extreme weather occur (including its economic impact).

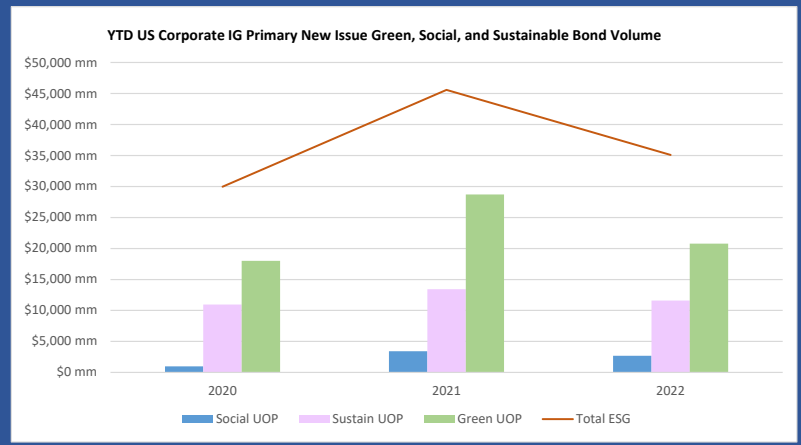
**No Longer Just Venezuela**

Many nations around the world found themselves this summer in a similar situation to that of Venezuela which in the past has had to turn to extended power rationing in response to its reservoirs being too shallow to run hydroelectric facilities. Despite being rich in hydrocarbons, the nation's overreliance on hydropower and poor policy decisions have led to power rationing that has greatly impacted its economy and people. This summer's extreme drought is affecting the energy security of developed and developing nations in the same way.

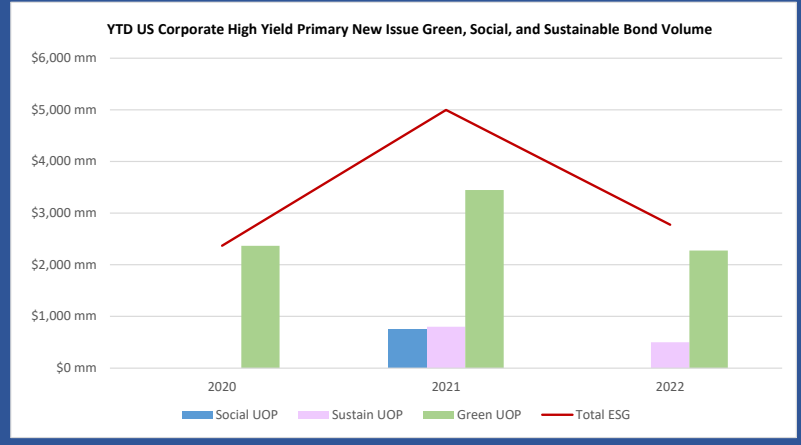
In Germany, the Rhine remained too shallow for barges to carry their regular loads of coal, forcing many barges to only haul 30% of their standard capacity. As a result, two coal fired power plants had to lower their output. Norway, which relies primarily on hydroelectric, also had to reduce output to save water as it found its reservoirs were only 60% full.

France, in August, made some big headlines as it experienced its worst drought on record and had to temporarily cut back its nuclear capacity to avoid discharging warm water back into rivers. Drought has become such an issue that France has even adjusted its regulations on winemaking to allow vineyards to irrigate their vines and approved six new grape varieties – all of which were selected because of their ability survive in drier/warmer conditions.

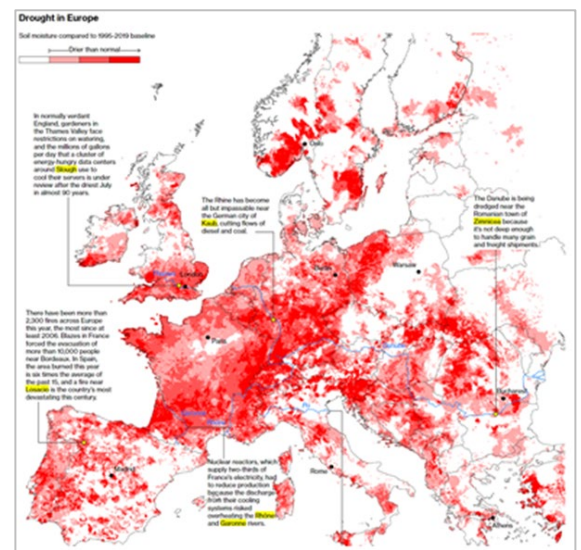
China was also impacted. Droughts and high energy demand resulted in several closed factories across its Sichuan region. FoxConn, a supplier to Apple, had to suspend some of its operations for a couple of days because of the power



Investment Grade: \$4.96bn in green, social, and sustainability debt priced in September. Pralogis, Citi, Valley National Bank, Wisconsin Electric Power, and Niagara Mohawk were among September's largest US IG issuers.



High Yield: No new high yield offerings to report



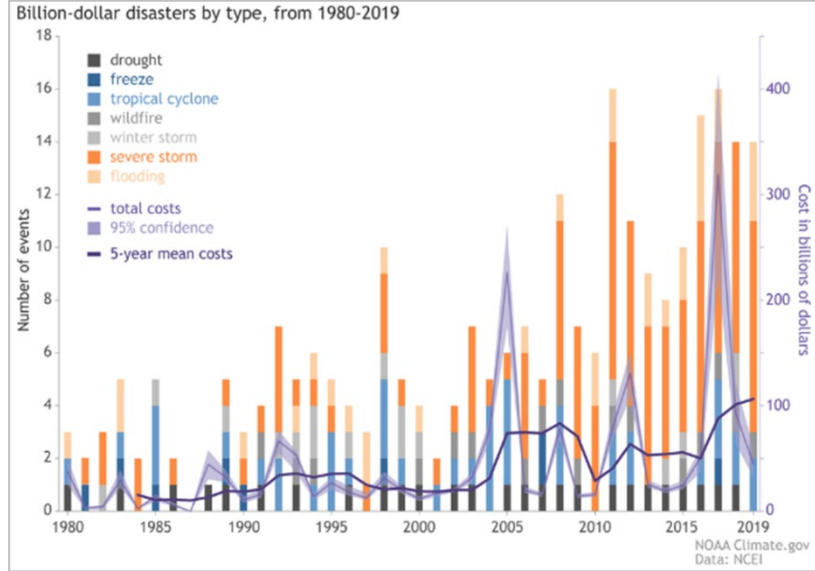
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crunch. In Africa, the heat was so intense that animals are having to be relocated as overpopulation and diminishing water/food become commonplace.

**More Frequent and More Costly**

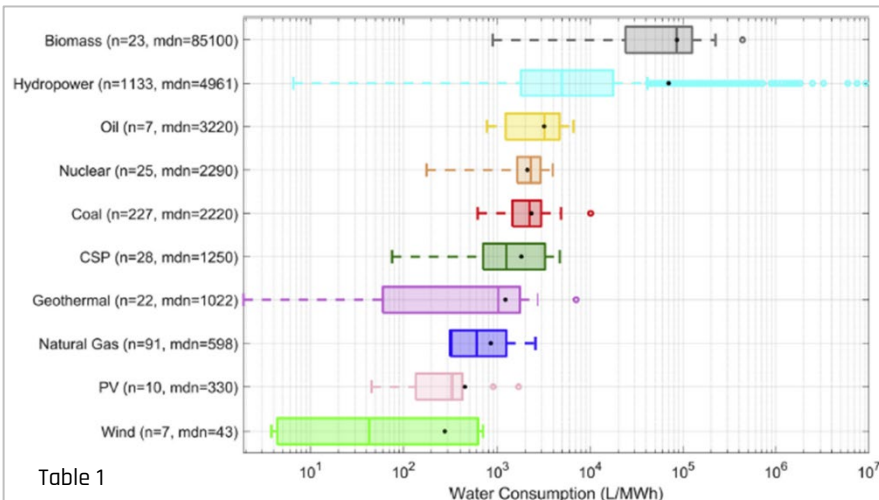
Since 2000, global drought frequency and duration has increased by a third. This frequency, combined with a reliance on certain technologies like hydropower, is helping to continue to drive energy prices ever higher. In the UK, energy prices have surged upwards of 80% (a coffee shop owner there reported a \$10,000 monthly electric bill!). In addition to rising energy rates, drought is also driving up water costs. Starting earlier this year, the Tier 4 rate for LA County water increased by 30%.

Here in the United States, droughts on average cost \$9.5 billion per incident and are the 2<sup>nd</sup> costliest extreme weather-related event (behind tropical cyclones). In 2011 a prolonged drought hit TX and cost its farmers and ranchers more than \$5 billion, a 28% loss compared to the average revenues of the previous four years. It also increased tree mortality as the drought provided more fuel for wildfires that burned 3.8 million acres (an area about the size of Connecticut) and destroyed 2,763 homes.



Over the next 20 years, drought and water risks like those seen in TX and other geographies are estimated to wipe away \$5.6 trillion in GDP. Among the nations that are most exposed to water related GDP loss are the United States, China, and Australia. As for specific sectors, according to a recent study, the manufacturing & distribution sector (as well as consumer and retail) are among those sectors which are the most impacted by water risks, followed by banks, agriculture, and utilities. Those sectors (in total) represent about 30-40% of the S&P 500.

In light of these recent events, investors are also becoming more concerned. Earlier this year the Valuing Water Initiative was created. It includes 64 investors representing \$9.8 trillion under management. While they have established no hard and fast rules (like many have done for emissions), the group aims to bring attention to the issues and may see its participants considering additional steps like voting against directors who don't address the problems.



**The Energy Water Nexus—New Solutions Needed**

The persistence of extreme weather-related events, like drought (and its impact on power services and pricing) is likely to continue if improvements are not made. By 2030 global water consumption by the energy sector is expected to be ~70 billion cubic meters. This is an over 30% increase from what it was in 2016 – an amount equal to about 2.8 million Olympic size swimming pools.

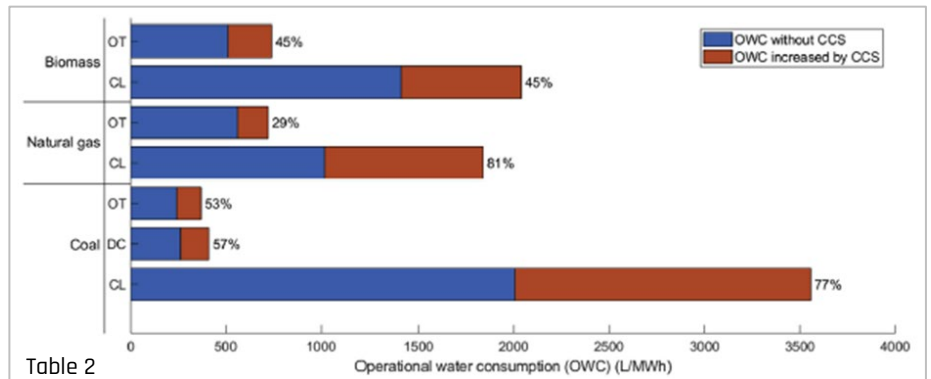
Here in the United States, nearly 100% of water

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withdrawn by utilities comes primarily from fresh surface water, with eastern states accounting for almost 84% of the withdrawn water. Even though water withdrawals by utilities are on average 18% less than what they were in 2000, factors like drought will continue to impact energy pricing and pose challenges for the build out of future energy capacity as utilities, agriculture, industries, and municipalities all compete for the same drops.

Energy investors especially will need to be very wary of the energy/water nexus and the volumetric water footprint (VWF) of energy projects and investments. As you can see in table 1 above, not all megawatt hours are equal in their impact on water resources. Biomass, hydropower, nuclear, and coal rank among the top consumers of water per megawatt hour produced.

If you have not had the opportunity to watch our recent [webinar on Russia and Ukraine](#), you absolutely should. One point that was mentioned was the energy security concerns and need for more generation. However, the challenge is that in light of prolonged drought and the issues experienced in Europe this summer, traditional options like adding more coal powered generators might not be best path.



For instance, the water-energy nexus has serious consequences for carbon capture and storage. As you can see in table 2 above, scrubbing carbon from power plant emissions will dramatically increase the operational water consumption of power plants. The water-energy nexus makes no decision easy and will require trade-offs.

**Bottom Line**

- Expect more costly weather-related events because of anthropogenic climate change (it is a threat and inflation multiplier).
- Water stress management is no-longer a concern isolated to developing nations - it is now driving price action across the globe.
- Energy & Power sectors will need to be conscious of water stress or face enhanced risks, possible action by investors/regulators, and increased cost of capital.

**Further Resources**

USGS: <https://www.usgs.gov/mission-areas/water-resources/science/thermoelectric-power-water-use>

Cost of Drought United States: <https://www.drought.gov/news/high-cost-drought>

Global Cost of Drought: <https://aquanomics.ghd.com/>

IEA: <https://www.iea.org/data-and-statistics/charts/global-water-consumption-in-the-energy-sector-by-fuel-type-in-the-sustainable-development-scenario-2016-2030>

Water Use and Energy: Global Meta Analysis: <https://www.sciencedirect.com/science/article/pii/S1364032119305994>

Water, Land and Energy Use: <https://nca2014.globalchange.gov/report/sectors/energy-water-and-land#great-plains-water>

CTVC: <https://www.ctvc.co/nuclear-option-diablo-plant-extends/>

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## Further Resources Continued...

LADWP: <https://www.ladwpnews.com/ladwp-water-rate-changes-now-in-effect/#:~:text=LADWP's%20highest%20water%20users%2C%20who,748%20gallons%2C%20a%20%243.602%20increase.>

WSJ: <https://time.com/6210322/zimbabwe-wildlife-relocation-climate-change/>

NY Times: <https://www.nytimes.com/2022/08/18/world/europe/drought-heat-energy.html>

FT: <https://www.ft.com/content/d332a79d-6664-460c-acc2-7cabb1c731cc>

WSJ: [https://www.wsj.com/articles/climate-change-forces-french-vineyards-to-alter-the-way-they-make-wine-11664116266?mod=Searchresults\\_pos6&page=1](https://www.wsj.com/articles/climate-change-forces-french-vineyards-to-alter-the-way-they-make-wine-11664116266?mod=Searchresults_pos6&page=1)

WSJ: [https://www.wsj.com/articles/global-drought-saps-hydropower-complicating-clean-energy-push-11662758968?mod=Searchresults\\_pos9&page=1](https://www.wsj.com/articles/global-drought-saps-hydropower-complicating-clean-energy-push-11662758968?mod=Searchresults_pos9&page=1)

WSJ: [https://www.wsj.com/articles/chinas-scorching-heat-and-hydropower-missteps-test-nations-power-grid-11661514473?mod=article\\_inline](https://www.wsj.com/articles/chinas-scorching-heat-and-hydropower-missteps-test-nations-power-grid-11661514473?mod=article_inline)

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