MANEUVERING TOWARDS A WATER SAFE FUTURE

A report on water in a changing climate and guidance on how to take action

storebrand

NORWEGIAN CHURCH AID
actalliance

Nordic finance institution Storebrand and international NGO Norwegian Church Aid have partnered up in order to encourage the private sector to initiate concrete action towards the Sustainable Development Goal on water, SDG 6 Clean Water and Sanitation. Our common interest is to learn how water and climate affects people, companies, societies and livelihoods. Together we aim to ensure that water keeps contributing to people living healthy and productive lives.

Storebrand is a leading player in the Nordic market for long-term savings and insurance. In Storebrand, sustainability is an integral part of core business. This means that environmental, social and governanc aspects are assessed before investment decisions are taken. Storebrand has been ranked by World Economic Forum as the second most sustainable company in the world and the most sustainable finance company in the world.

Norwegian Church Aid works with people and organisations around the world in their struggle to eradicate poverty and injustice. We help those whose needs are greatest, regardless of ethnicity, creed, political or religious affiliation. Every year, we give over 1 million people access to clean and safe drinking through our water, sanitation and hygiene programme.

Frontpage: *A borehole that gives 40.000 people water in the drought in Somalia. Especially to internally displaced people. Norwegian Church Aid cooperates with the government to distribute water to nearby areas in the Nugaal region.*

Photo: Håvard Bjelland, Norwegian Church Aid

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PREFACE

By Lisa Sivertsen,
Acting General Secretary Norwegian Church Aid

The world has enough clean water for all, yet 2,1 billion people are still forced to drink unsafe water every day. According to the UN's World Water Development Report, if we do not manage the world's most important resource more effectively, five billion people will be living in areas with insufficient access to safe water in 2050.

The water crisis is mainly due to unfair and uneven distribution both globally and locally, with climate change adding to the problems and making access to water increasingly unstable. More intensive flooding and longer droughts are causing problems with too much and too little water.

Norwegian Church Aid experiences the effects of the water crisis across the globe every day. In 2017, this was devastatingly clear with 40 million people hit by floods in Southeast Asia, and 20 million people dependent on aid after a prolonged drought in East and North Africa forced people from their homes.

Like every crisis, the water crisis hits the poor hardest. Poverty, conflict, corruption and climate change increase the vulnerability of countries, local communities and families. We live in uncertainty as to when the world's first major urban water crisis will be a fact. In this report, you can read about the people of Cape Town, who are living with strict regulations and limitations on water use, just managing to avoid the so-called "Day Zero" a situation where the city physically runs out of water. Alarmingly the situation in Cape Town is not unique but is also reflected in megacities like Sao Paulo, Rio de Janeiro and Karachi, as well as in different rural parts of the world. In the private sector water is often essential to production and many companies have already begun to report significant financial risks associated with water issues.

Fortunately the water crisis is neither unavoidable nor unsolvable. This report also focuses on solutions, on how people are coping with the water challenges they are facing. Rainwater harvesting in the rural areas of Brazil and reduction in water usage on the production lines of Cape Town are just two effective solutions that manage water in a better way. These solutions are extremely important, as the way we handle the coming water crisis, will greatly influence the livelihoods for millions of people and future value creation.

Water forms the basis of the partnership between Norwegian Church Aid and Storebrand. Together have chosen to compile and publish this report both to draw attention to the severity of the water crisis and to illustrate that new forms of partnership are essential if we are together to achieve the UN's Sustainable Development Goals by 2030.

This report aims to increase knowledge on the topic and to mobilise companies to ensure good water stewardship and concrete action towards SDG 6 Access to Clean Water and Sanitation. Despite our different perspectives as a humanitarian actor and an institutional investor, we stand on common ground: The world needs concrete actions if we are to have any chance of making real progress towards the Sustainable Development Goals. How we prepare for and adapt to changing environmental realities will be one of the defining challenges of our time.

Three year old Messa filling her cup with drinking water in a northern Iraqi refugee camp. 2,811,000 people received access to a safe water supply by Norwegian Church Aid in 2017. Photo: Håvard Bjelland, Norwegian Church Aid

6 CLEAN WATER AND SANITATION

SUSTAINABLE DEVELOPMENT GOAL 6

Ensure availability and sustainable management of water and sanitation for all.

6.1 SAFE DRINKING WATER

2.1 billion are drinking unsafe water every day.

200 million hours is spent every day collecting water.

6.2 SANITATION AND HYGIENE

892 million people do not have access to a toilet.

For every $1 invested in sanitation, $5.50 is returned in increased productivity.

6.3 WATER QUALITY

Only 20% of global wastewater is currently being treated.

842,000 people die every year from diseases caused by unsafe water, inadequate sanitation and hygiene.

6.4 WATER EFFICIENCY

70% of the world's freshwater supplies is used in agriculture.

Demand for water is estimated to grow by 50% for food supply and 35% by energy supply.

6.5 WATER RESOURCE MANAGEMENT

66% of the world's population could face water stress by 2025.

Up to 700 million people might be displaced because of climate change and water scarcity by 2030.

6.6 WATER EFFICENCY

1.8 billion people are currently affected by land degradation/desertification and drought.

1.2 billion people are currently at risk from floods.

UNDER PRESSURE

Water in a Changing Climate

Synne Movik
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Introduction

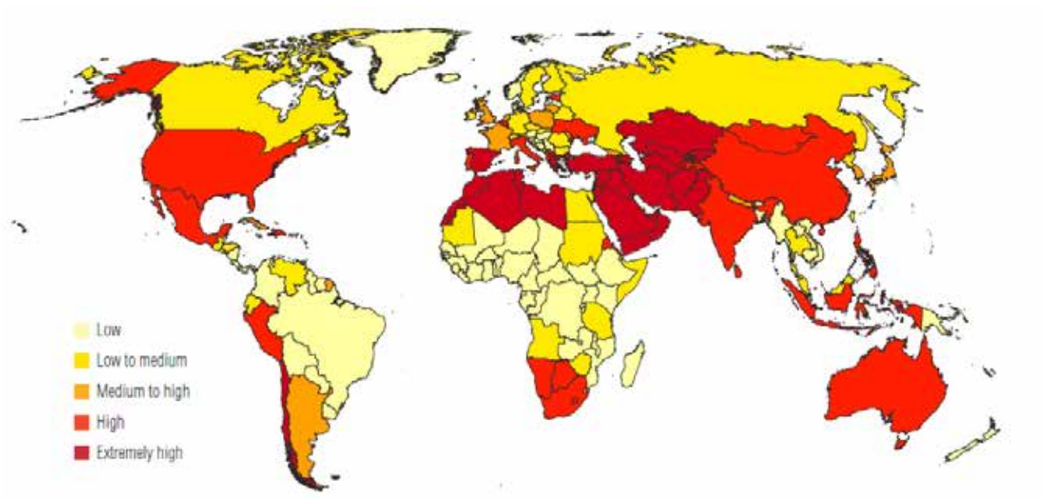
We depend on water for our very survival – water forms part of all aspects of society, the environment, and the economy. Climate change affects water resources in multiple ways and one could argue that water is at the very heart of climate change. Temperature changes affect rainfall patterns and intensity, extreme weather events, rising sea levels, floods and droughts, evapotranspiration and soil moisture – in short, all aspects of the hydrological cycle. It is thus important to understand the nature of how climate affects hydrology, and to understand what the main threats and challenges are. Which regions and peoples are likely to be most affected by changes in water availability and extreme events driven by climate change? What are the economic consequences of climate-driven water scarcity, floods and droughts; in what ways will it affect livelihoods, societies and economies? Given the challenges ahead, what actions can be taken to mitigate some of the most immediate and more long-term risks?

This part of the report provides a brief overview of some of these issues. The mandate has been to sketch out the ways in which climate change could affect water availability in different regions, what the likely economic impacts might be, as well as outline some recommendations based on existing literature, including suggestions concerning what the potential role of private sector actors could be. The report begins by outlining some of the main trends that have emerged with regard to climate change and water, as well as some projections for the future. It highlights the regional variations of potential impacts, and underscores the magnitude of uncertainties that are associated with such projections. Next, it goes on to tease out some of the likely impacts in economic terms of climate-induced water stresses and extremes, again highlighting the uncertainty associated with the models. The report also pays attention to the impact on, and role of, the private sector. What emerges from these sections is that the poorest people are likely to be the worst hit by water scarcity, floods and droughts, as they often are the most vulnerable and have the most to lose from such hazards. Therefore, when reflecting on recommendations, it is imperative that policies and actions take into account in what ways the most vulnerable will benefit from the suggested remedies.

Impacts of climate change on water resources

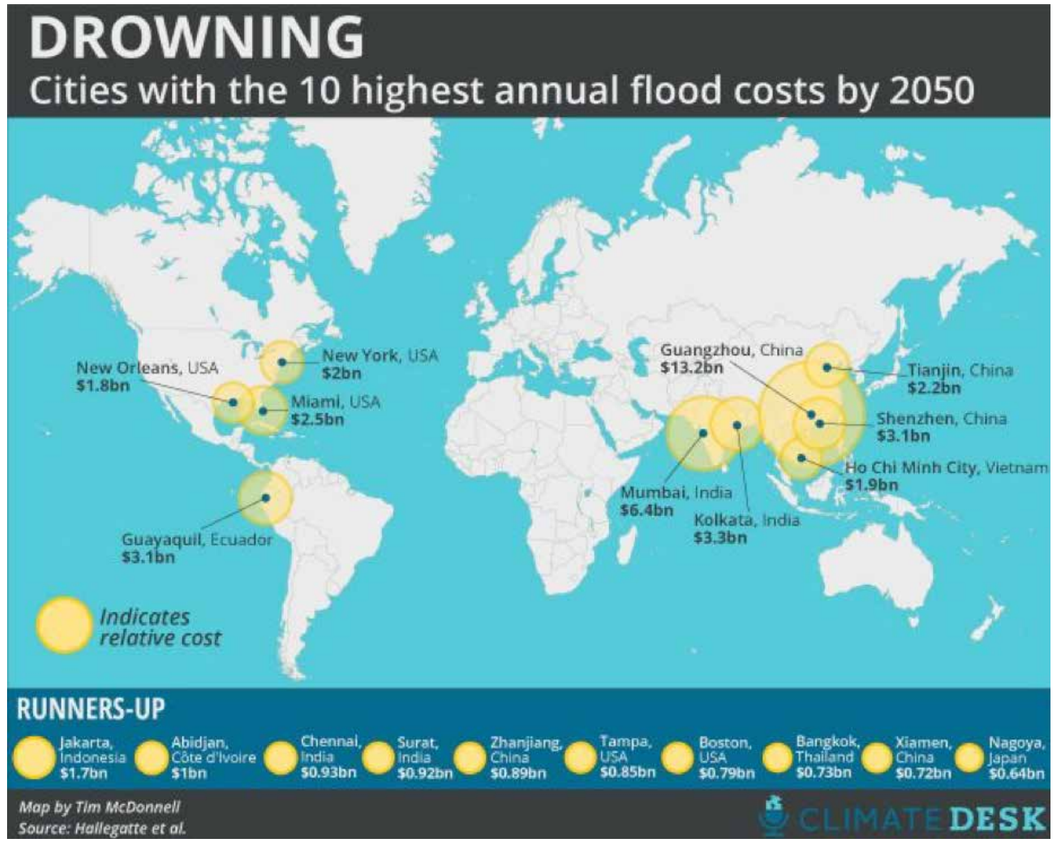
The general pattern that emerges regarding the impact of climate change on water resources is that areas already receiving abundant rainfall will likely get even more, whereas relatively dry areas are set to become even drier. Floods and droughts are likely to become more frequent and more intense, as are extreme weather events such as storms and cyclones. Snowcaps and glaciers are melting at an increasing rate, and runoff patterns from river basins are changing, though there are huge regional variations. There is also evidence that the sea level is rising at a faster rate[1]. The overall trend is that wet areas will get wetter, for instance regions that already receive ample rainfall such as South America, specifically the Amazon basin, will receive more rainfall, whereas dry areas will get drier (see below).

Map 1: Country-Level Water Stress in 2040 under the Business-As-Usual Scenario [2]



According to a World Bank report an estimated 1,6 billion people are living in parts of the world that are already experiencing water scarcity[3], whereas the most recent UN Water report[4] states that an estimated 3.6 billion people live in areas that are potentially water-scarce (see fact box). According to the UN report, the number of people living in potentially water-scarce areas could increase to some 4.8–5.7 billion by 2050. However, the drivers and impacts of water scarcity are contested, as 'scarcity' is not just physical scarcity, it can also be e.g. economic scarcity, meaning that water is available, but that people do not have the economic means to access it (see e.g. Huff and Mehta, 2015 for more on different meanings of scarcity[5]). Therefore, these estimates need to be treated with some caution. That said, there is no denying that water access is a challenge in many regions, and in particular it affects those most dependent on natural resources the hardest. If you are a farmer depending on rain fed crops for your livelihoods, getting through a prolonged drought can be a matter of life and death. Droughts are arguably the greatest single threat from climate change. Identified 'drought belts' – regions that are particularly drought-prone – include Mexico, western South America, southern Europe, China, Australia and South Africa (ibid.).

On the other hand, low-lying coastal regions, particularly regions with large urban metropolises such as Mumbai and Manila, are likely to become more at risk to extreme events of flooding and sea level rise. The regional impact of these changes is highly uneven, with the greatest number of people affected living in Asia and the Pacific. The number of people at risk from floods is projected to rise from 1.2 billion today to around 1.6 billion in 2050, representing almost a fifth of the world's population[6]. Mumbai experienced a devastating flood in 2005, which brought the city to a total standstill and cost many people their lives, often those living in slums and low-lying floodprone areas[7].



Map 2: Coastal cities at risk from flooding, and estimated costs. [8]

Water-scarce - Meaning water scarce for at least one month per year.

Water-tower - A water tower is an 'elevated structure supporting a water tank constructed at a height sufficient to pressurize a water supply system for the distribution of potable water, and to provide emergency storage for fire protection'[10]. The term is used for the Himalayan mountains as they are an important source of freshwater for the surrounding lowlands.

River runoff - River runoff refers to all water that comes into a river water system from sources such as rainfall, snowmelt and groundwater. Runoff includes water flowing over the land into the water system, water that sinks into the soil to join the water system, as well as water that flows from the river to a larger body of water, such as a sea or ocean[11].

Forty-two percent of world irrigation water withdrawals come from groundwater, and the rest from surface water (Döll et al. 2012). The two sources of water, however, are rarely distinguished in economic models, yet their fundamental characteristics are quite different as are the growth rates and potential hydrological constraints (OECD, 2015a). Groundwater is generally less vulnerable to climate variability than surface water.

The melting of snowcaps and glaciers is going to affect the world's 'water towers', such as the Himalayan region (see fact box) most acutely. The changes in river runoff regimes in these regions are projected to be quite substantial, and it will be the least developed countries, such as Nepal, that are going to be most affected since water for agriculture and energy is most crucial here. There will be large regional variations in river runoff trends – while glacier- and snow-dominated areas are likely to see a surge in the river runoff (see fact box), regions such as central Asia and central America will experience a diminishing river runoff, which is likely to affect agricultural productivity. River basin runoff in east Africa will likely decline significantly by 2050, potentially affecting agricultural productivity in particular, while the southern parts of the continent are not likely to experience such marked decline before the second half of the century. River basin runoff patterns in parts of North America and the northern parts of western Europe are not likely to vary very much.

With increasing pressures on available water resources, it will be a challenge to meet the Sustainable Development Goals (SDGs) adopted by the United Nations. SDG 6 relates to water, and includes targets for improving access to sanitation, reducing water pollution, improving water use efficiency, and making water use more sustainable. But water affects the chances of meeting other SDGs too, since it is such a cross-cutting issue – such as food security, access to energy, and sustainable cities to mention a few. Meeting the SDGs will require substantial reorientation of current practices, and an overhaul of legislation and regulation, as well as much better co-ordination between water-intensive sectors. Another challenge is to incorporate into the water SDG the idea of water for livelihoods and multiple uses of water. These multiple uses are often not captured by the formal statistics, and thus the often more complex picture of water supply, access and use is not adequately reflected in the official documentation. Work on multiple use systems is providing valuable insights on the nature of such practices and the potential to scaling up multiple use activities is large[9].

While there is a lot of uncertainty attached to the observations, models and projections, it appears that those who will be most affected by climate-induced water scarcity and extreme events such as floods and droughts, are those that are already among the most vulnerable. Seventy % of people living in Sub-Saharan Africa depend on rain fed agriculture for their livelihoods, and will therefore be severely affected by a long-term decline in rainfall and an increase in the intensity and frequency of droughts, making Sub-Saharan Africa one of the most vulnerable regions.

Economic aspects of climate-induced water scarcity and extreme events

Rising demand for water over the next decades could make water one of the most fiercely contested resources on the face of the planet[12]. According to a recent survey of 900 decision-makers at the World Economic Forum, the dominant perceptions are that water crises and failing to adapt to climate change are two of the greatest risks to economic growth and social stability globally[13]. What kind of economic impacts are climate-induced water scarcity and extreme events likely to have? The assumptions are that the trends of rising numbers of people settling in already densely populated conurbations, increasing affluence and associated high-consumption lifestyles coupled with increasing variability and uncertainty of water supplies will combine to create greater pressure on already strained water supplies. Areas where water is currently relatively abundant, such as Central Africa and East Asia, are also likely to experience these pressures.

Water shortages and declining water quality will obviously impact human livelihoods, health and ecosystems, and also impact industry and the business sector. The impact is already being felt, e.g. through stricter regulation of companies' water allocations, higher prices, growing opposition from communities and increased awareness and critical questioning by the public at large about corporate water-use practices[14].

The links between water scarcity and economic growth are complex and relatively poorly understood. There is generally a lack of empirical evidence demonstrating a causal link between lack of water and a decline in economic growth. Moreover, water supply and demand rarely respect national boundaries and so the analysis of water scarcity and economic growth is not naturally amenable to country-level analysis[15]. Still, countries such as China and India are arguably already experiencing that economic growth is limited by declining water supplies from depleted groundwater and rivers, due to limiting agricultural and industrial production. The threats to productivity and business from limited water supplies can be categorised into direct physical, reputational and/or regulatory limitations. Physical limitations might include industrial operations, the supply of raw materials and impacts on the broader supply chain[16]. Severe water shortage is likely to be a barrier to growth in the Middle East and the Sahel regions, and a rough estimate based on a modelling exercise puts the figure at 6 % of GDP. While it is a fraught exercise to try to assign numbers to how much water scarcity will affect people's livelihoods, their labour opportunities and the economy more broadly, it seems safe to say that the impacts will be highly skewed. The driest areas will probably sustain the heaviest losses, particularly regions such as the Middle East, the Sahel, and Central and East Asia. What drives the magnitude of the projected economic losses is the scale of the water deficit. Apart from the more direct impacts of water scarcity on loss of livelihoods and impacts on economic growth, there might be more subtle effects as well, such as a change in trading patterns that might further negatively affect hard-hit regions (e.g. through continuing to produce water-intensive

The people in Derashe, a rural district in southern Ethiopia, have limited access to safe water. Thousands of people are dependent on getting drinking water from the nearby river, which is also used by animals and for washing and laundry *Photo: Laurie MacGregor, Norwegian Church Aid*

Access to clean water in Khorri i Pakistan. *Photo: Håvard Bjelland, Norwegian Church Aid*

Water harvesting in Tigray, Ethiopia. Community overseeing their shallow well used for pumping water to irrigated farmland. The project is contributing to the national programme that has resulted in Tigray being greener than it has been in 145 years. *Photo: Benedicte Wiik, Norwegian Church Aid*

crop at ever higher financial and social costs which will distort prices). Again, it is the poorest who will likely be hit the hardest. Conventional economic theory posits that with every 1 % growth in GDP, there is likely to be a 2 to 3 % reduction in poverty. But there are large regional variations. For example, Sub-Saharan Africa (SSA) has tended to experience a slower decline in poverty. There are many reasons for this – some studies have suggested that this might be due to the region's heavy reliance on mining, which benefits investors far more than labourers[17].

Two sectors that are likely to be severely affected by water shortages are agriculture and energy. The total amount of water needed in a year to feed today's 7.1 billion people amounts to some 7.7 cubic kilometres. One fifth of this water is used for irrigation, which accounts for roughly 70 % of total annual global freshwater withdrawals[18]. In OECD countries, the figure is roughly 44 %. Although there is increasingly fierce competition for water, agriculture will likely remain one of the largest consumptive users for the foreseeable future. 15 Asian countries have roughly 70 % of the world's irrigated cropland areas. 16 % is located in America, 8 % in Europe, and only 5 % of the world's irrigated cropland is in Africa. Given that there are strong links between irrigated agriculture and poverty reduction, boosting investment in sustainable irrigation infrastructure and practices, coupled with agricultural water conservation measures could offer some promise. In the US, agricultural water allocations are being restricted in California due to drought.

One study estimated total agricultural output value losses of $600 million (taking into account spillover effects in other sectors) from the 2016 drought[19]. Water and energy production are inextricably interlinked. One obvious example is hydropower – there are debates concerning to what extent hydropower is a consumptive water user, due to evapotranspiration from reservoirs. However, water is needed for a range of other means of energy production as well, such as cooling thermal plants and biofuels. For biofuels, its estimated that, given the right combination of high oil prices and climate regulation, biofuels could increase their blue water footprint from 0.5 % of available blue water worldwide to 5.5 % of available water by 2030[20]. In addition to agriculture and energy, declining water availability will obviously have an impact on human health and ecosystems, but such impacts are extremely difficult to quantify.

Recommendations

Given the gravity of the situation and the high degree of uncertainty, what can be done? While it is useful to get an impression of global trends, what really matters is what will happen at the regional and local scale. When planning for future water supplies, there is a need to take into account the particular local context, needs and seasonal variations[21].

In terms of supply, a promising feature are the vast groundwater reserves on the African continent that were documented by the British Geological Survey in 2012. While not a quick fix, the fact that there are ample water resources within reach holds some promise for the region, but it needs to be developed with great care in order to ensure that the groundwater resources are used in a sustainable manner. Though groundwater is affected to a lesser extent by climate change (see fact box), it is not 'climate proof', and in particular changing rainfall patterns will affect aquifer recharge rates. In some areas of the continent, artificial groundwater recharge is being explored.

There is huge potential for recycling and re-use of water and wastewater, which is becoming a key element in many urban planning projects[22]. Coming up with creative solutions to recycling sewage water and grey water is an area where the private sector can offer ideas, in particular for big cities. The latest UN Water report highlights the potential of nature-based systems, underscoring the need to move away from concrete-and-steel solutions to promoting 'blue-green'

infrastructure and systems that utilize nature's own capacity to absorb, conserve, clean and protect water.

There is also the issue of storage. In many regions of the world, particularly in Sub-Saharan Africa, there is scope to develop sustainable water infrastructure and storage solutions, particularly in agriculture, that may tide people over periods of prolonged drought. One example of an organisation working towards this end is the Climate Resilient Infrastructure Development Facility (CRIDF). It works to provide long-term solutions to water issues that affect the lives of the poor in Southern Africa, collaborating with communities to better build and manage their own climate-resilient and multiple-function water infrastructure. A key element of the Facility's work is to bring together financial resources for projects in the region.

Apart from storage of 'blue' water, there is also a huge potential to conserve so-called 'green' water in improved agriculture practices, what has become known as 'conservation agriculture'. Given that agriculture is the world's largest consumer of water, and is likely to remain so in the foreseeable future, steps to improve conservation and better use of water in agricultural practices have a huge potential. This includes stepping up efforts to revitalise local water management structures and practices[24].

While one cannot control what comes from the clouds, it is possible to regulate how water is used. With regard to what one might call 'demand-side options, one issue is the careful use of increased block tariffs to facilitate cross-subsidisation between users. What characterises many water supply schemes in urban and peri-ruban areas is the highly skewed distribution in access to water, where the well-off can afford to pay, while those in marginal circumstances often are forced to pay a huge chunk of their monthly income to secure water for themselves and their failures. There is a need to makes sure that the high-volume users are curbed, and that affordability and access by the poor and less well-off are prioritized.

Regarding what the private sector can do, there is massive scope for reducing the private sector's water footprint, e.g. through reducing water use and waste in the production cycles. Increasing consciousness around 'water stewardship' in the private sector and industry is one important element. However, there is a need to be careful here – while initiatives such as the Corporate Water Stewardship initiative are welcome, it is important to underscore the fact that these reporting schemes and various interventions need to be made transparent and accountable. Empirical evidence has pointed to a tendency on the part of companies to report for political, rather than for operational purposes[25].

The private sector also has an important role to play in leveraging financing for necessary investments to improve water availability, management and use, for example through promoting the use of nature-based solutions in a variety of settings. Norway could contribute through direct investments in nature-based solutions in developing country context, and also through promoting 'green' financial instruments, such as green bonds. The private sector can also be further stimulated to promote nature-based solutions in areas that it operates. Furthermore, it could aid in promoting research and collaboration to facilitate learning across borders and setting up networks of best practice with respect to dealing with floods and droughts.

It also requires a shift in focus – water management has often been framed in terms of particular river basins or services systems, but as the latest UN Water report points out, there is a need to take into account how entire landscapes affect water availability and quality. For instance, there is a clear link between forests and water, which has been reflected in how forest degradation in the Amazon basin is linked to more severe and frequent droughts in adjacent regions. The São Paulo drought of 2014-15 has been linked to deforestation in the Amazon (ibid).

Climate services is another element of importance. People dependent on natural resources for their livelihoods, particularly farmers and fishers, are wholly dependent on the weather. Having access to reliable forecasts can help farmers plant at the right time, or help villagers and fisherpeople escape storms and floods. It is important that such systems be tailored to fit the needs, experiences and expectations of their users. Norway is contributing to this through research.

On a more general note, there is the issue of governance. Big, centralised systems are more vulnerable than decentralised, distributed ones. Furthermore, policies and investments that can help lead countries to a more water secure future include better water allocation practices, particularly promoting a fairer distribution of a crucial resource. Incentives to increase efficiency, and massive investments in infrastructure to secure water storage and supply, particularly for the poor, are other needed measures.

The majority of regulation and policy frameworks for water management were often developed with a grey-infrastructure approach in mind, and so efforts are needed to reform such frameworks in order to facilitate the promotion of more sustainable and nature-based solutions.

WETTER AND DRIER

Pakistan's changing climate

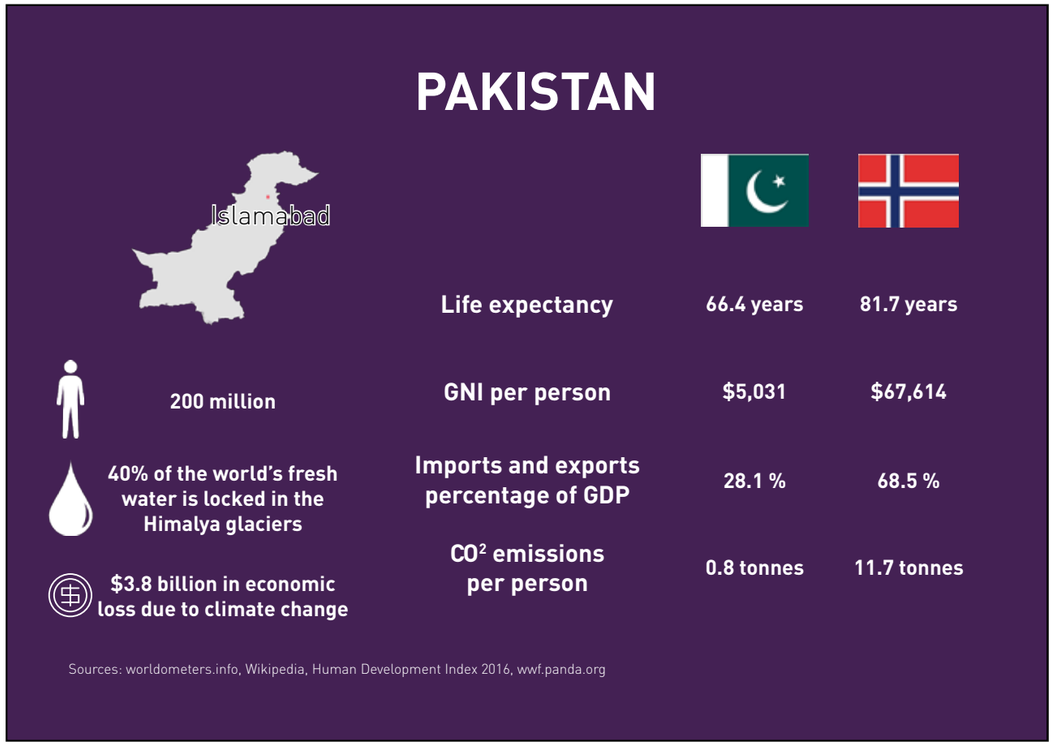
Introduction

Climate change already have severe implications on Pakistan in the form of natural disasters, socio-economic downturn, malnourishment, energy crisis and water scarcity. Pakistan is a geographically diverse country, covering nearly 800.000 square kilometers and with a population of 200 million and over 60 % living in rural areas, Pakistan comes out very poorly on global Human Development Index.

The situation is even more severe if seen with the lens of climate change. In the Global Climate Risk Index 2018[1], Pakistan is ranked 7th among the most climate change affected countries in the world, with a death toll of more than 500 lives per year and economic losses worth USD 3.8 billion — equivalent to 0.6 % of the GDP – due to climate change. During the last 20 years, Pakistan has suffered 141 extreme weather events — like cyclones, storms, floods and heat waves. The changing climatic conditions are adding to water scarcity due the increase in temperature and decrease in annual rainfall pattern in several parts of Pakistan. One of the major factor being non-availability of proper water storage and retention structure.[2]

In addition to above mentioned challenges, diverse topography of the country makes access to safe water extremely difficult for many communities and present a high risk of natural disasters across the country during seasonal monsoon rains and drought seasons. The extreme floods in 2010 and 2011 affected more than 20 million people, about the same number as the population of Scandinavia. Since 2010, there are floods almost every year, which results in displacement of millions of people in many parts of the country.

Sindh is the most underdeveloped province in Pakistan, and faces the biggest challenge of scarce and finite water resources due to scanty rainfall. Indiscriminate dumping of sewage and solid waste further pollutes the ground water sources. Over 50 % of the population has no access to sewage systems or wastewater treatment facilities and they mostly depend on on-site disposal affecting the groundwater quality.



In Sindh Province in Pakistan Norwegian Church Aid is building a water filtration system that will provide 16.000 people access to safe water. The system is built in partnership with the local authorities. They own the ground and will take over the responsibility for maintenance after the project is finished. Photo: Håvard Bjelland, Norwegian Church Aid

Water Scarcity

Pakistan ranks third amongst countries facing water shortages, according to a report from the International Monetary Fund (IMF)[3]. In addition, an estimated 97.900 people die every year in Pakistan due to poor water and sanitation conditions and 54.000 children under the age of five die from diarrhea. In 2013, the child mortality rate was 42 %, and water and sanitation related diseases were reportedly responsible for some 60 % of the total number of child mortality cases in Pakistan[4]. Pakistan's National Nutritional Survey from 2011 states that rural population, mainly women, have low access to health facilities, clean water and sanitation. The survey further states that only 32 % of the people have access to water from a tap or proper well. Higher dropout rate of girls are reported because of the absence of proper sanitation facilities for millions of girls in schools. In absence of proper toilets, millions of women and girls either wait for nightfall to defecate in the open, or do so in unsanitary non-flush toilets. This exposes them to the risk of sexual harassment, violence and undermines their safety and dignity[5].

The rural areas of Sindh are facing an acute water shortage. This is having an adverse effect on agriculture, which is the mainstay of the people. As a result, many people in Sindh remain economically poor as they are trapped in an ongoing cycle of poverty. For a country where more than 50 % of the population is directly dependent on agricultural activities, the impact of water scarcity is severe. Economic opportunities are lost due to the time-consuming processes of acquiring water where it is not readily available.

The people of Sindh are also facing water pollution and bad sanitation conditions. More than 80 % of the drinking water supplied for consumption is polluted and not safe for humans.

A report called by the Commission on the affairs of clean water mentions that 460 water samples were collected from different sources, and all samples were found not safe for human consumption.

Out of the population that depend on local rainfall for crop and livestock production, 75 % lacked the resources to cover basic survival and livelihood protection needs. In short, more than 1.000.000 people fell below emergency-level thresholds. Since 2013-2015, drought has increased water scarcity in Sindh province, causing large reductions in yields and abandonment of cultivation altogether in the most drought-affected zones.

Economic effects

The city of Karachi is known as a business hub, industrial development and is the the largest city of Pakistan with a population of more than 20 million people. Due to country wide water scarcity, specifically for electricity generation, Karachi is facing prolonged power breakdown which massively effects the operations of industrial units. The situation is intensified in summers when the demand of water and energy increases by manifolds. According to local sources, Karachi city alone requires more than 3.7 billion liters per day, but it is only able to meet half of this demand.

A leading newspaper "the Express Tribunes" published a report on April 22nd, 2018, presenting an alarming situation for the industries and different business groups in the situation of absence of water supply. Many of the textile industries, mainly dying units stopped work due to absence of water supply. It had a snowball effect and subsequently multiple units of cloth cutting and stitching industry came to a halt. The laborers, who earned based on per piece of cloth, ended up without income.

In addition, the water shortage in the largest leather industry is severe. This industry engages over 100.000 skilled and unskilled workforce and hence pays millions of rupees towards duties and taxes to federal and provincial governments. Pakistan Tanners Association has however raised alarm, fearing the total collapse of the export-oriented industry[6].

Tanneries are facing an acute water shortage at a peak operational time when processing of hides and skins has just started and the situation is threatening export orders worth millions of dollars.

Due to scarcity, the water used by the tanneries is supplied by trucks and this business is often managed by illegal mafias with strong political backings. Most of the industries in Karachi are totally dependent on such mafias for availability of water. The mafia's water is usually from untreated wells and contains high ratio of salts and minerals and this reduces the quality. Pakistan is a producer of one of the finest quality of livestock skins in the world, but processing it with hard water deteriorates the quality and it badly affects price in the world market. The tanning industry needs soft and treated water for producing high quality leather for exports, which enables exporters to fetch at least 15% to 20% better price internationally. Instead, the water transported through trucks contains high ratio of salts and minerals. Usage of contaminated water in tanneries damages the quality of leather. This in trun badly affects its price in the global markets.

On the other hand, many of the leading private sector companies including Procter & Gamble and Unilever are making effort to serve communities with provision of safe and clean drinking water. According to the annual reports of the company, these investments increased their product publicity and sale among the residents of Karachi.

The water scarcity has created an emergent crisis as major crops like rice, maize, cotton and sugarcane are affected. According to an article published in "The Tribune" dated 26th September 2017, Water scarcity and water-borne diseases are causing serious economic and health crises in Pakistan with accumulated annual national income losses of up to USD 254 million – roughly 0.6 to 1.44% of GDP.

Another article on "loaming water crisis" published in the Tribune on 3rd April, 2018, reflects that the crop yield for the upcoming harvest season is likely to be reduced drastically due to reduced water discharge from reservoirs, which currently stand at an extremely low level. The water shortage was initially projected to be at 31 %, but instead stands at 60 %.

Though there are various factors that account for such critically reduced water shortage levels, climate change is one of the major reasons. The reduced water supply for irrigation purposes will be effecting harvesting in Pakistan by manifold. It will not be limited to reduced crop supply in domestic market only, but will also effect the export capacity of Pakistan.

As a result, the industries should expect to be bound to pay a certain tariff on excessive water use during different processes like textile and leather, and could be made to abide by the rule of recycling water before discharge in the water bodies. To promote water conservation in the industrial sector, attention must be given to water intensive sectors such as textile processing, paper and pulp, leather and tanneries and sugar industries.

Flooding and big destruction after heavy rainfall in Pakistan, 2014. Photo: ACT/CWS-PA/Khalid Rasheed

Pakistan Recurrent Floods

The floods in Pakistan began in late July 2010, resulting from heavy monsoon rains, which affected the Indus River basin. Approximately one-fifth of Pakistan's total land area was affected by floods, with the Khyber Pakhtunkhwa province facing the brunt of the damage and casualties. According to Pakistani government data, the floods directly affected about 20 million people, mostly by destruction of property, livelihood and infrastructure, with a death toll of close to 2.000. UN Secretary-General Ban Ki-moon expressed that the flood was the worst disaster he had ever seen. The Pakistani economy was harmed by extensive damage to infrastructure and crops. Total economic impact may have been as much as USD 43 billion[7].

In 2011, a new event of flooding occurred followed the previous year's historic floods, which devastated the entire country. Unprecedented torrential monsoon rains caused severe flooding in 16 districts of Sindh province. The flood originated from monsoon rain, the highest amount of rainfall ever recorded in Sindh. The floods caused considerable damage; an estimated 434 civilians were killed and 5.3 million people affected. Sindh being a fertile region and often called the "breadbasket" of the country; the damage and toll of the floods on the local agrarian economy was extensive. At least 1.7 million acres of arable land was flooded[8].

In September 2014, the Kashmir region suffered disastrous floods across many of its districts caused by torrential rainfall. The Indian administrated Jammu and Kashmir, as well as Pakistan administered Azad Kashmir, Gilgit-Baltistan and Punjab were affected by these floods. By 24 September 2014, 277 people in India and about 280 people in Pakistan had died due to the floods.[9]

In 2015, floods occurred in river Indus which affected various districts in all provinces of Pakistan. The Khyber Pakhtunkhwa government said that around 300.000 people had been affected by flash floods in the northern district of Chitral[10]. According to National Disaster Management Authority (NDMA) spokesperson, around 700.000 people from Punjab and Sindh were affected due to monsoon rains in Pakistan (Daily Times, visited on 03rd of August). It is calculated that more than 1 million people have been affected by floods in 2015.

CAPE TOWN'S DAY ZERO

Introduction

There is still water in the taps in Cape Town. However, "Day Zero", the day when the taps in the city will run dry, was alarmingly close during the first months of 2018. Restrictions on water usage led to long queues at the municipal water stations, as people all over the city came to get their daily ration of 50 liters of fresh water.

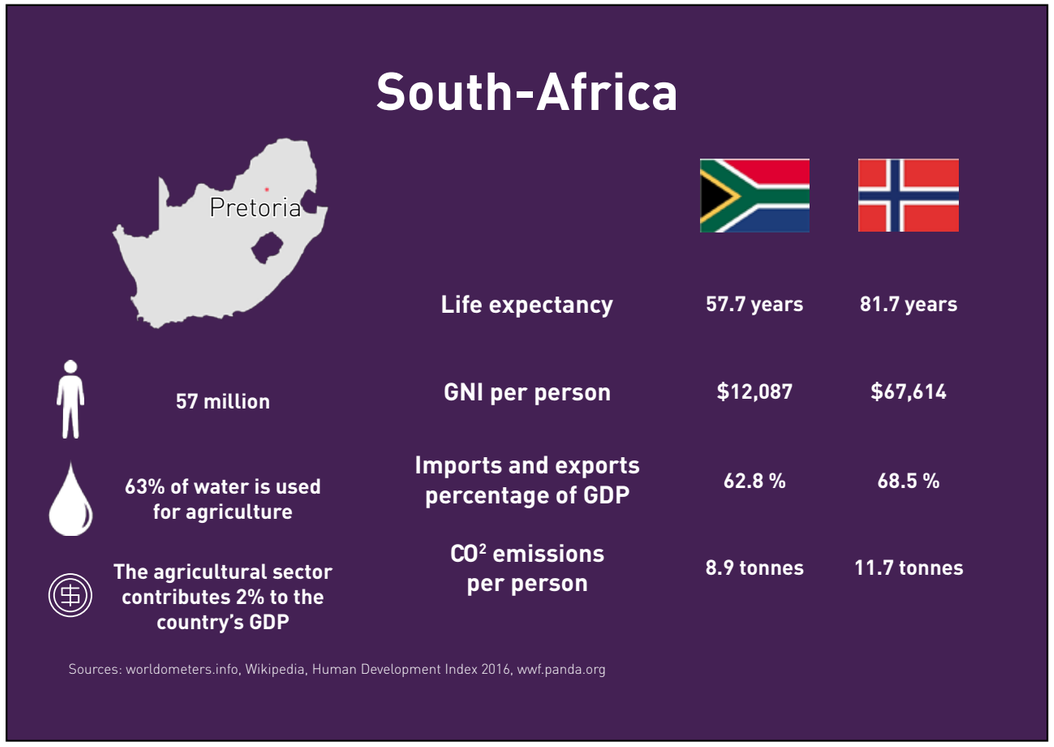
Climate change is affecting many facets of South African society, including the economy. Socio-economic progression is dependent on resources influenced by climate change, such as water, livestock, fiber and biodiversity. This is factors for the production potential of many sectors of the economy, which in turn affect human development aspirations of the country. For some regions in South Africa, the observed rate of warming has been more than 2°C - more than twice the global rate of temperature increase.[1] There is evidence that extreme weather events in South Africa are increasing, with heat waves found to be more likely, dry spell durations lengthening and rainfall intensity increasing.

Water scarcity

The drought in the Western Cape Province is now into its third year. The severe situation lead to restriction on water use. The limit was set at 50 liters of water per person per day. For comparison, the average Norwegian use 200 liters of water per day. In addition, the city of Cape Town significantly increased the cost of water. The fear was that Cape Town would become the first big city in the world to run out of water. As four million people counted down to the day the water reservoir would become empty, the restrictions was enough for day zero to be postponed. For now.

There are several reasons behind this, one of them being the persistent droughts in the area over the past three years. There has been much less rain than normal over this period, hence the water sources dries up. The rainfall in Cape Town has been steadily decreasing over the past ten years, and the recent draught has led to the driest period for 100 years. This is in line with what climate scientist is saying; climate change will lead to drier conditions around Cape Town.[2]

Capetonians queing for water february 2018. Day zero has been avoided for now, but the inhabitants are facing severe water restrictions and are risking fines if they exceed the daily limit of 50 liters per person. *Photo: Håkon Haugsbø, Norwegian Church Aid*



Economic effects

The agricultural sector is important for the South African economy, as it contributes 2 % to the country's GDP.[3] It is also a massive consumer of water, as 63 % of water used in the South Africa is consumed by this sector.[4] Consequently, the sector has suffered severely from the water scarcity during the last years. Wine production, one of the country's biggest export industry and for which the Cape Town area is world famous, is down by 20 %. Other agricultural products that is important for the economy, namely fruit and vegetable production, has gone down by 15 %. The reason being farmers planting less due to water shortages.[5] In addition, economic losses in these sectors occur through lower prices due to poorer quality, and this development is set to continue for several years throughout the value chain.[6] Another reason for the decline in production was the municipal restrictions on water usage for the agricultural sector.

The losses in these sectors can run into billions of Rand in decreased revenue per annum resulting in what can be as much as tens of thousands of job losses. So far, provisional estimates indicate job losses of around 33 000 since the drought began.[7]

Additionally, this will impact South Africa's food security and social welfare. Particularly within poor and vulnerable households with few resources in the rural part of the country, which often depend on jobs in the food producing sectors

How can private actors meet this challenge?

Restrictions in the Western Cape requires businesses to reduce their water consumption by 45 %. Therefore, many businesses have taken measures to meet this demand, and this has been done in numerous ways. Below are two case studies, showing how the industry in South Africa now are working to minimize their water consumption. In addition, the case studies shows how lucrative it has been for them to include water awareness in their business strategies.

REDUCING WATER USE IN THE BEVERAGE INDUSTRY

Written by Greencape

Challenge

Quality Beverages is a soft drink manufacturing and bottling company that produces popular brands such as Jive, Mountain Dew and Mirinda. During 2016, Quality Beverages set out to identify and implement water saving interventions with the aim of improving their environmental sustainability.

Solution

Quality beverages' first intervention was an educational campaign for staff on saving water, highlighting where water could be saved or reused. To motivate them, the staff were given water consumption targets, which helped the company meet its water consumption goal. The company also started to reuse the waste water from bottle rinsing processes by collecting, filtering and then reusing the water in other process stages.

Business benefits

Quality Beverages reduced their water use from 1.77 liters per liter of soft drink produced (during the latter half of 2016) to 1.30 liters per liter of soft drink produced in 2017. This equates to a 27 % reduction in water use, and a 61 % decrease in waste water production.

Monthly water savings	**3.000 kilolitres**
Cumulative savings up to end January 2018	**USD 82.000**
Total capital investment	**USD 13.000**

REDUCING WATER USE IN THE TEXTILE INDUSTRY

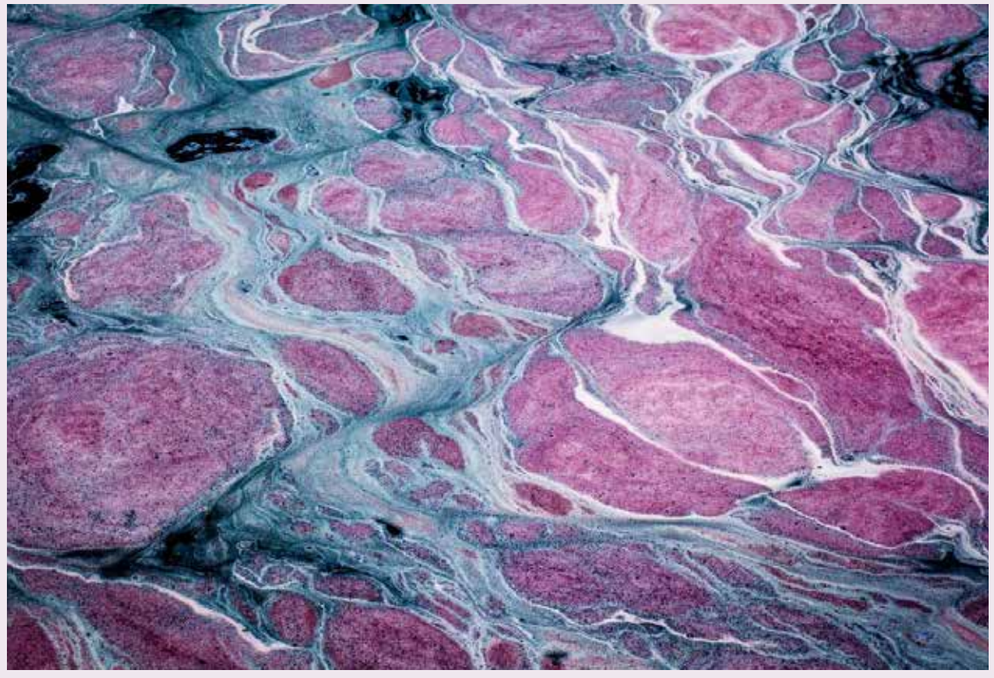
Written by Greencape

Challenge

ACA Threads is a Cape Town based sewing thread manufacturer and supplier with over 60 years of experience in the South African sewing thread industry. Their sewing thread is dyed in a package format, with the process requiring a significant amount of water. The company decided to improve the sustainability of their business by reducing their water consumption and associated costs.

Solution

Starting in 2012, ACA Threads invested in new Dye vat controllers that improved process automation. They also adopted modified dye recipes, started to use recycled cooling water and implemented a hot drop capability in their dyeing process.



Business benefits

These investments have resulted in a 70 % reduction in water consumption between 2012 and 2017. They are now using 50 liters of water per kg of dyed thread, versus 168 liters of water per kg in 2012.

Annual water savings	**50.000 kiloliters per year**
Annual savings	**USD 180.000**
Total capital investment	**USD 425.000**

ARE WE DRYING OUT?

Ethiopia in a changing climate

Introduction

Ethiopia is the second largest country in sub-Saharan Africa. It has over 80 different ethnic groups and a population of over 100 million people. The vast majority of the population live in rural areas (80%), but the rate of urbanization, at 3.8% per annum, is rapid. Although Ethiopia is one of the world's poorest countries, it has made substantial progress in social and human development over the past decade, and government policies have charted a course towards a future middle-income country status. However, whilst the share of the population below the poverty line has fallen from 38.7% in 2004/05 to 29.6% in 2010/11, because of high population growth, the absolute number of poor (approximately 25 million) has remained unchanged over the past 15 years, and only 61% of the population has access to safe water. Ethiopia is vulnerable to sustained droughts and famines, severely affecting the rural population which is primarily reliant on rain-fed agriculture as their source of livelihood.

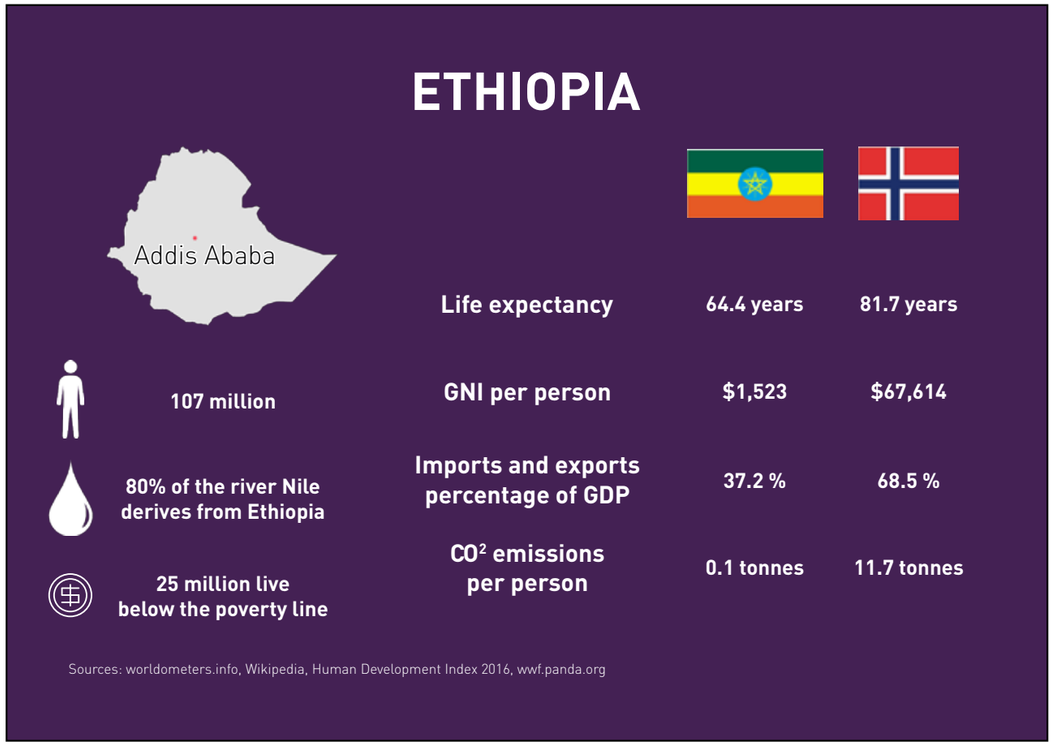
Water scarcity

Climate change is increasing the surface temperature of the planet, leading to sea level raise, changes the global distribution of rainfall, affect the direction of ocean currents, and increase the intensity and frequency of extreme weather events. Climate change is already causing loss of life, damaging property and affecting livelihoods in many parts of the world, and it is expected to continue to do so in the future.

Climate change will affect all nations, but the impact is higher on low-income countries, such as Ethiopia, which have limited capacity to cope with the effects of a changing climate.

Ethiopia has experienced at least five major national droughts since 1980, along with numerous local droughts. Cycles of drought create poverty traps for many households, constantly thwarting efforts to build up assets and increase income. Survey data show that between 1999 and 2004 more than half of all households in the country experienced at least one major drought shock. These shocks are a major cause of transient poverty. Agropastoral and pastoral households, which are reliant on livestock for their livelihoods, also suffer severe asset losses during droughts. As experience in Ethiopia has repeatedly shown, the consequences are likely to include adverse impacts for their terms of trade, with livestock prices falling sharply relative to cereal prices.[1]

Alemayehu Mulugeta (62) in Berehet, Ethiopia overseeing his dried up land. Photo: Kristin Morseth, Norwegian Church Aid



After the El Niño-driven weather that caused one of the worst droughts in many parts of Ethiopia in 2015/2016, lowland areas across the Horn of Africa are experiencing alarming droughts. In Ethiopia, the south and south-eastern areas are most affected, with the failure of the 2016 rain seasons. Currently, with the arrival of seasonal rains to most areas, water for domestic use and livestock will increase as well as the regeneration of pasture. However, the immediate impact of the rains is harmful. Weak and emaciated livestock often die due to the cold, change of weather and increase in diseases. The rains also increase the risk of water borne diseases, including acute watery diarrhea.

On a country aggregate level, the average daily rainfall is expected to decline over the next decades. Decreases in rainfall amount will be exacerbated by higher evaporation rates associated with the increasing temperatures. The annual average temperature between 2070-2099 is projected to be almost 27°C, in contrast to the previous average of 23°C.[2] The large temperature increase will have negative impact[3] since the plantphysiological growth optimum is often lower for many food and cash crops.

The case of Berehet

Berehet district is located at 350 km from the capital Addis Ababa. This rural district has total area of almost 90.000 hectares and a population of about 40.000. The livelihood of the district is rainfall dependent and is a mixed agriculture. In 2016, the main rain started in the third week of July and was not adequate and resulted in a total failure of harvest.

This resulted in shortage of food and drinking water for both humans and livestock due to decrease of discharge of springs and dry up of ponds. Three municipalities in the district were fully dependent on ponds for drinking water.

The number of people affected by the crisis, as reported by the district, was a total of almost 30.000 people, which was in severe shortage of food and water. Of these, 8.000 people were dependent on food aid from the government. In addition, high incidence of water-related diseases, like amoeba, diarrhea, and typhoid were reported in some of the areas, as many people had to use water from unprotected sources.

The National Disaster Risk Management Commission (NDRMC) reports that the current number of food beneficiaries has reached 7.6 million, an increase by 2 million people from the 5.6 million beneficiaries estimated at the beginning of the year. An additional 9.2 million people are in need of water, sanitation and hygiene interventions, including access to safe water and response to water borne diseases. Despite the efforts being undertaken through different actors to tackle the water scarcity, all the nation's water resources are under the threat of climate change.

Economic Effects

Hydrological challenges in Ethiopia, worsened by climate change, has been estimated to cost the country roughly one third of its growth potential. It is also estimated that climate change impacts over the coming decades will lead to a reduction of gross domestic product (GDP) growth by between 2-10 % per year.[4]

The agricultural sector is vital for Ethiopia's economy, as more than 72 % of the population is working in this sector and it stands for more than 35 % of the country's GDP.[5] Coffee being the major export article and the most important cash crop, as it alone was worth more than USD 860 million in the 2016-2017 production year.[6]

However, farmers are already seeing the negative effects as the temperatures are rising rapidly in many of the areas where coffee is produced. The seasons are getting more unpredictable, and the dry seasons are getting longer. It is calculated that this will only intensify, and that climate change will have a big impact on this sector. Agricultural productivity will likely generate as much as 30% less income,[7] and studies shows that suitable coffee producing areas in Ethiopia will be reduced with up to 60 %.[8]

It will be a challenge to produce efficient food for the population of Ethiopia and the whole Sahel region. To deal with the impact of climate change, growing populations and increasing temperature, climate smart agriculture can be one contributing solution. There is a need to improve access to inputs, improve irrigation, appropriate mechanizations, high quality agricultural extension, access to financial services, market access and secure land tenure. Furthermore, the farmers of Ethiopia need climate services, like seasonal and daily forecasting of weather. By improving this, the farmers can adjust their agricultural operations in order to cope in a changing climate.

A check dam constructed in Tigray region in Norwegian Church Aid's climate resilience program. Together with various water harvesting schemes the project has proved to increase productivity in agriculture which has again improved livelihoods. The program is part of the national programme that has contributed to Tigray being greener than it has been in 145 years. The Tigray region has won several rewards, the latest being a U.N.-backed award for the world's best policy to combat desertification and improve fertility of drylands. *Photo: Hilina Abebe, Norwegian Church Aid Ethiopia*

TURNING OFF THE TAP

Brazil's new reality

Introduction

Brazil is one of the world's biggest countries, with a population of above 200 million people. The country has a diverse climate, heavily influenced by the world's largest rainforest; the Amazon.

Brazil has 12 % of the world's freshwater reserves,[1] accounting for 53 % of the water resources in South America, much is found in the Amazon. The rainforest is 5.500.000 km^2, and the forest is producing more than 50 % of all the rainfall in the Amazon region[2]. In addition, it is having an impact on rain patterns far away from the forest itself. Hence, the Amazon is vital for the climate not only in Brazil, but for the whole planet.

At the same time, the north-eastern part of Brazil has been hit by severe drought several times, and scientists are warning that these kind of droughts will be the rule, rather than the exception in the future in this region of Brazil.[3] Water harvesting methods has been crucial for the rural population in this area.

In economic terms, Brazilians are now living through one of the most dramatic backlashes for decades. A deep crisis of political governance combined with an acute economic stagnation has led to severe cuts in social programs, abolition of civil rights, and the loss of economic leverage that has been lifting people from poverty in recent decades. From 2016 to 2017 1,5 million people returned to extreme poverty in Brazil[4], and experts is expecting even further worsening social indicators. In addition, Brazil as a country has a huge inequality among the population, exemplified by the fact that the country's richest 5 % have the same income as the remaining 95 %.[5]

Water scarcity

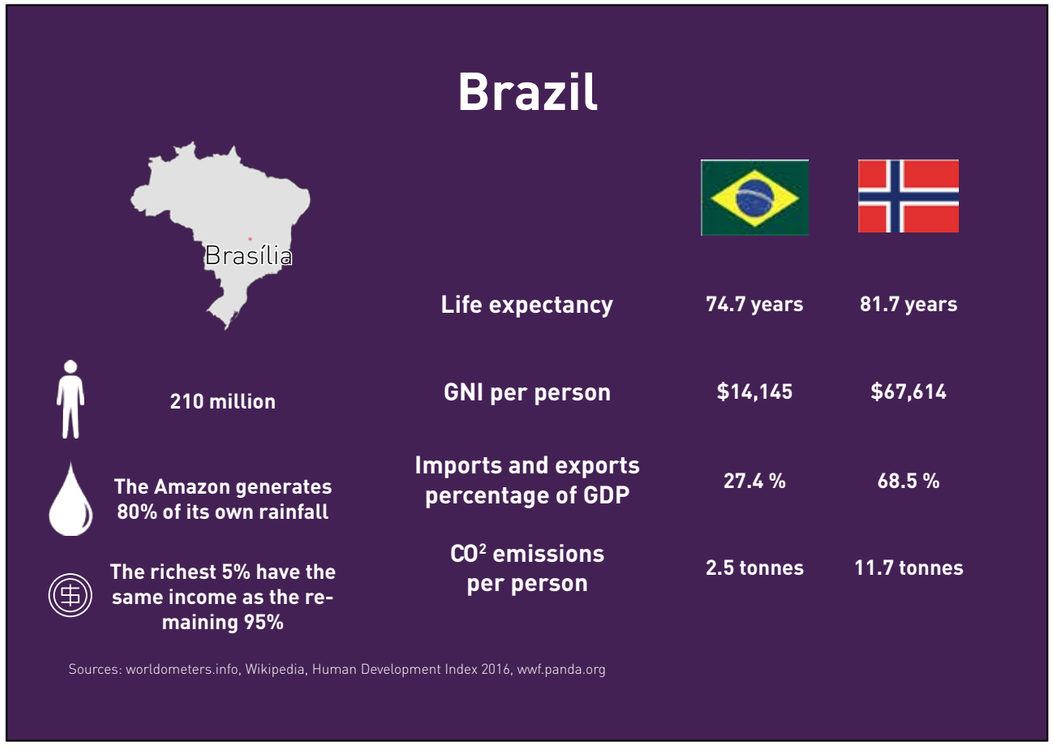
Many areas in Brazil are affected by a changing climate. Some are experiencing more rainfall than normal and hence a wetter reality than their way of life is based on. Many others are experiencing less rainfall, meaning in many cases that they receive less fresh water than needed. Sao Paulo, the biggest city in South America, is just one of the megacities in the world vulnerable for sufficient water. In 2015, the city almost ran out of water in the reservoirs. The inhabitants feared water shutoffs[6]. After two years of ongoing draught, the rain eventually came and the reservoirs were again filled[7] [8]. Nevertheless, water shortage is an anxiety that lives on among the people of Sao Paulo, and the fear is that it will eventually come, as climate change – as one of the factors – is rapidly increasing. Rio de Janeiro, the second largest city in Brazil is facing a similar situation. The megacity is dependent on four big dams. Among the causes of the decrease in the volume of water in the reservoirs are unreliable rainfall and the deforestation of 70 % of the areas of the watershed that supplies the region.[9] In time of crisis, water is being transported into the city by water trucks but the vast majority of inhabitants cannot buy the expensive water, neither can they relocate and they suffer as a result.

Barcarena, a municipality in Pará state, became an industrial hub in the 1980s, with the installation of the Albras and the Alunorte complex with the aim to produce aluminium. Barcarena became economically important for the region, as it also houses the largest port in the state of Pará and it became a supply centre of agricultural and forestry products to the state capital of Belém.

Production was based on family ownership of land; common use of the forest, rivers and streams; and hunting and fishing as daily activities, all of which were essential to the local population´s survival. In 1991 Barcarena had a population of 45.000 while today it has more than 120.000. The expansion of the city has happened without sufficient investments in infrastructure, housing and education. The water and sanitation situation in the city is among the worst in the country.

The security situation is challenging and there is a lot of violence. Moreover, after Barcarena became a big industrial hub, it has been affected by many environmental accidents as well as a general pollution of water and air. Over time, the local population have seen many large and small incidents from the industry in the area. In 2003 and 2009, for example, Alunorte had leakages of polluting red mud with major consequences for local people. This has not only affected the daily life of the local population, but also on the economic possibilities in the area.

The sanitary situation in Barcarena is very poor. Open pipes lead sewage straight into the road, potentially contaminating clean water reservoirs and spreading diseases. Photo: Daltro Paiva (IEB)



Hydro Alunorte in Barcarena, is the world's largest alumina refinery. Photo: Norsk Hydro

Economic Effects

Impacts of the lack of quality water are felt by the whole population of Barcarena, but they affect mainly those who have a direct relation with the water for social and economic reproduction, such as the fisher communities. A research carried out in 2005-2006[10] identified good and healthy conditions in the rivers. Today, this scenario has changed. It is reported that the fishermen/women now need to work in more distant areas, increasing production costs while reducing fishery resources, leading to drastic reductions in income and alimentation.

Another sector that has been severely affected by the constant environmental accidents is tourism, since local beaches and rivers are no longer seen as safe places for leisure. Considering that a significant part of the economically active population of Barcarena work in the service sector, there might be damaging effects for the economic development of the municipality when dealing with this scenario of recurring accidents.

Between 2000 and 2018, there have been 20 big accidents involving companies in the mining and metallurgical sector and the harbour activities. Although the companies claim they have made – or will make – investments for improved security regarding their productive activities, it is obvious that even the activity of these companies might be compromised if their current level of accidents persists.

Hydro has invested heavily in Barcarena. In 2011, they increased their engagement and became the main shareholder of Alunorte and Albras. This created expectations among the local population. Norway was seen as a leading nation in the work for global standards for corporate social responsibility.

In 2014 a multi-stakeholder forum in Barcarena consisting of civil society, local government and some of the companies, was founded. Hydro was active in this process and Norwegian Church Aid was involved through local partners. In spite of these efforts, the population's expectations to Hydro has not been fulfilled. In 2017 people living close to Alunorte, said there had been no changes since Hydro became the main owner.

At the moment Hydro is facing challenges. After extreme rainfall in February 2018, the Alunorte complex has again been accused of polluting the rivers with caustic red mud. They had to reduce their production with 50 %[11] and provide clean water supplies to affected communities. The company has denied that there was leakages of red mud and presented their own report with opposite conclusions than the one used by the Ministerio Publico.

The reduction in the production at the Alunorte complex alone will probably give an economic loss of about USD 146.000.000 in the first two quarters of 2018. It will also affect their mine in Paragominas and their production in Albras. In addition, it has affected their reputation in Norway as well as in Brazil.

Harvesting rain in Brazil

In the world's most densely populated dry region, the semi-arid part of North East of Brazil 24 million people is facing constant water shortages. In a changing climate and with irregularities in water access between rich and poor, countryside and the city, it was key to bring water under control for the farming communities.

Based on this reality, Diaconia, a Brazilian organization decided to consolidate measures that would be able to contribute to the sustainable development of the region. Technical and social technologies was implemented, and public policies promoted in order to make it possible for the population to live with the dry conditions. Water security was the key element.

An attempt was rainwater-harvesting systems created and developed with farmers. They are cisterns and catchment areas built with simple techniques and have storing capacity of either 16.000 liters or 52.000 liters. The dissemination of the cistern as a technology was due to its importance as a method of securing drinking water, and subsequently, water for small domestic animals and for small-scale food production.

The idea proved to be both efficient and viable and in 2003, the Federal Government adopted the «Cistern Program» as part of their national policy on access to water.

Today the rainwater harvesting installations is common practice and there are more than one million families with these facilities. The approach and technology is reducing the risk of disaster in a changing climate and uphold food security during droughts.

A big scale cistern building-program has given clean water to millions of people in Brazil. These cisterns can contain as much as 52.000 liters of water, and provide farmers with water for their agricultural activities even during long lasting drought. This climate adaptation program has won many prizes due to it successfulness.

AN INVESTOR'S VIEW ON WATER MANAGMENT

Karin Gjerde-Meyer
Sustainability Analyst at
Storebrand
Asset Management

Company rating and SDG 6

The impacts of global water challenges, driven by factors such as water scarcity and extreme weather events, are increasingly materializing for companies around the globe. Many companies already address carbon and climate risk, but now the time has come for the business community to take a serious look at how water-related risks are affecting organizations.

In 2016, the Sustainable Development Goals (SDGs) were launched. Then SDGs, which build on the Millennium Goals, are a collection of 17 goals set by the United Nations. They are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. They provide clear guidelines and targets for all countries to adopt in accordance with their own priorities and the environmental challenges of the world at large[1]. 193 Heads of State have signed the goals and a large number of companies have now embraced the SDGs. Storebrand recognizes the importance of these goals, and the power that lies in a common, roadmap towards a sustainable world.

Storebrand, as an asset manager, has a long history of incorporating Environmental, Social and Governance (ESG) factors in the assessment of what companies to invest our client's savings in. We believe that ESG factors provide valuable insight into the performance of companies, and that well performing ESG companies are also better positioned for long term profitability. We strongly believe that prospering in these areas not only benefits the planet and the people on it, but also companies. We are currently using the SDG framework as an additional lens to look at company performance and assess whether a company is hindering or helping achieve the SDGs, through risk/opportunity analyses.

Photo: Shutterstock

In our initial analysis, we divided the goals into levels: Risks and Opportunities in Core Business, Key Enablers and Fundamental Outcomes.

The first level Risks and Opportunities includes SDGs that we assess to be the most relevant for the companies that we invest in, and where companies have the most direct influence through their products and services. The second level called Key Enablers refer to goals that companies can influence through their operations. These goals include gender equality in goal 5 and anti-corruption in goal 16. Fundamental Outcomes are more state-oriented goals, and less relevant for companies operations and products. However, incorporating and working with the goals at the first two levels will have a positive trickle down effect on the third level as well.

Water is essential for all life, a resource that neither companies nor people can do without. SDG 6 addresses how access to safe water and sanitation and sound management of freshwater ecosystems are essential to human health and to environmental sustainability and economic prosperity[2]. Water also feeds into many of the other SDGs, such as Goal 7; Affordable and Clean Energy, Goal 2; Zero Hunger and Goal 3; Good Health and Well Being.

SDG 6 is a goal that is of high relevance to the companies we invest in, as access to water and water-related risks have a direct effect on companies' bottom line. Our first step to analyzing SDG 6 was to look at companies' exposure to water risk, as well as the strategies that companies apply to mitigate risk. **As an investor, our analyses depend on company transparency and we strongly encourage companies to start evaluating and reporting on water risk and water management.** There are many reasons why water needs to be manged well. Risks that are not managed properly, can lead to operational disruptions and production stops, fines and loss of profit.

We would like to share some insight from our work, and hope this will inspire companies to take water risk seriously and to take a look at their own operations and supply chains. We also provide tips and tools for assessing water risk and present some exciting water market opportunities.

storebrand

COMPANIES SHOULD

ASSESS DIFFERENT TYPES OF WATER RISK

Water risk is a complex area and can manifest itself in different ways. The nature of a company's operations, geographical location, dependency on water, value chains and raw material dependency are all factors that play a role in determining what sort of water-related risk your company faces. Adding to the complexity, most water-related risks are caused by conditions external to the company. When assessing water risk in companies, it is wise to research and understand both the physical, regulatory and reputational aspects [3, 4, 5]

Based on a survey conducted by The World Economic Forum where respondents were asked to assess the impact of various global risks, Water issues have ranked among the top 5 risks for the past 7 years.

Existing water use is already higher than the total renewable supply. The gap is being closed by tapping aquifers, which are at risk of irreversible over exploitation. There is a projected 40 % gap between global supply and demand for freshwater by 2030[15]

Physical water risk

Physical water risk can be caused by being exposed to too much water, too little water, or water that is polluted and not fit for use. Examples are drought and floods, high water competition, aging or inadequate water infrastructure, groundwater stress and climate change impacts [3].

Water risk analyses tend to focus on water scarcity, which is among the main problems facing the world. Water use has been growing at more than twice the rate of population growth in the last century, and an increasing number of regions are chronically short of water. A third of world's biggest groundwater systems are already in distress [6]. However, flood risk events have become more extreme and more costly, and deserve additional attention. Flood risk is present in all regions of the world, and is exacerbated by climate change. Both the probability of flood risk and the intensity of extreme precipitation are increasing [7]. The number of people at risk from floods is projected to rise from 1.2 billion today to around 1.6 billion in 2050 (nearly 20% of the world's population) [8].

This also affects companies and Volkswagen AG is an example of this. Their operations close to the River Rhine in Germany were forced to close due to flooding from heavy rainfall in 2016. The flooding also impacted the railway connection and several streets at the production site. The overall costs from this event are estimated to be around 100 million Euro [9].

Water pollution is also on the rise globally, as virtually all goods-producing activities generate pollutants as unwanted by-products. An estimated 80% of wastewater is released to the environment without any prior treatment [10], and each year, an estimated 5 million deaths worldwide are caused by contaminated water [11]. It is not just water quantity that is of vital importance to many organizations, but also water quality. Pollution threatens access to clean water needed for operations, and treating waste-water can often be a significant cost for companies. In 2017, Anglo American reported to CDP (formerly the Carbon Disclosure Project), that their mining operations in Canada impacted surface and ground water quality, and that as a result their three sites are spending approximately $100 million on water management per annum [9].

"Water makes life possible and is essential to our economy. But, in many parts of the world, freshwater resources are in jeopardy due to growing demand, pollution and climate change. These pressures create profound risks for businesses and communities"

– Monica Freyman CFA,
Director, Investor Engagement Water, Ceres.

Reputational water risk

Reputational water risk, or social water risk, stems from how the community, employees and other stakeholders to a company perceive the company's effect on local water resources. Concerned stakeholders have little sympathy for polluting companies, and mismanagement can lead to negative media coverage, decreased consumer loyalty and brand value, and can even threaten a company's social license to operate. One example is The Coca-Cola Company, decided not to move forward on the development of an $81 million bottling plant in southern India in April 2015, due to resistance from local farmers, who cited concerns about strains on local groundwater supplies. In 2017 Coca-Cola reported to CDP that local retailers, trade associations and politicians in India had called for a boycott of their products [9]. Even in water-rich regions, companies perceived as using water unfairly may be exposed to reputational risk or loss of community support [12].

Regulatory water risk

Regulatory water risk means poor or unsustainable regional water management by authorities, unexpected regulatory changes, fines, enforcement action and abrupt increases in water tariffs. Stricter regulatory requirements and increased prices may be the result of water pollution, water scarcity and conflict among various users. Many companies – including General Motors, Danone, BHP Billiton, Hewlett Packard (HP) and PepsiCo, have reported higher water prices as a risk to their organization, leading to higher operating costs and water supply disruption. Kellogg Company reported that several of their manufacturing facilities in Mexico have experienced water price increases of up to 300% in five years. In California in 2016, HP sites were under a mandatory 20 % reduction in water consumption due to local drought. In South Africa the government was responding to the drought by imposing water use restrictions, which has led to higher operating costs for Danone. JBS reported hat water scarcity in Brazil as one of the reasons for their permit being delayed, affecting operations, and production negatively [9].

Norsk Hydro runs the world's largest alumina refinery in Northern Brazil. After heavy rainfall that led to flooding at their Alunorte plant, they were accused of polluting local water supplies, upsetting both environmental activists and the local population. The company admitted in March 2018 that they had discharged untreated rain and surface water into the Pará river, but has rejected claims it caused contamination of the local environment. The company faces fines and regulatory restrictions, and the Alunorte plant is currently running at about 50 percent capacity under a judicial order. Hydro's CEO has referred to the problems in Brazil as the most serious event he has faced during his years at the company. As a result of this, Norsk Hydro is now spending a substantial amount of money on improving the plant to be prepared for future rainfall and flooding, and Pareto Securities estimates that Norsk Hydro is losing $1.3 million a day on the production stop.

WATER IS ESSENTIAL FOR INDUSTRIAL PRODUCTION

Water is essential for industrial production

Use of the world's fresh water is usually divided into three groups, agriculture, industry and domestic users. Agriculture is by far the biggest user of the world's freshwater resources, as it accounts for 70% of all fresh water consumption [11]. It is also one of the most inefficient users, and a major source of water pollution [13]. Industry is the second largest consumer, with 20%. Water is crucial for industrial production, be it for paper, textiles, electricity generation or mining. The last 10% of available fresh water is used for domestic use. There are, however, major regional differences in water use; in developing countries agriculture consumes about 80%, while in developed countries, about half of all fresh water is destined for industrial use [11].

The challenges associated with water risk vary between industries, and research reports can provide insights into the materiality of water for companies.

Morgan Stanley Research point to water being of primary importance for the Utilities, Materials and Industrials sectors. and of importance for all other sectors except Consumer Discretionary and Financials. [14]

Sustainalytics, a providor of ESG and coprorate governance data, has highlighted 8 industries outside of agriculture that are typically considered to have the largest water requirements; Food Products, Utilities, Automobiles, Precious Metals, Oil and Gas, Forestry, Semiconductors and Textiles[15]. In Forestry, water is used in pulp making, processing and paper manufacturing. Producing one ton of pulp requires an estimated 64,000 liters of water. In the Automobile industry water is used in surface treatment and coating, paint spray booths, washing/rinsing vehicles and air conditioning systems. It is estimated that producing a single vehicle may require up to 145,000 liters of water. For food and beverage companies, the primary exposure is indirect, as they use water-intensive agricultural products, including meat and cereals, as raw ingredients [15]. Producing one kilo of beef requires over 15,000 liters of water [16].

In the textile-industry, water is used in "wet processing" and dyeing of fabric. Producing one kilogram of cotton; equivalent to a pair of jeans, can require up to 20,000 liters of water [17]. The textile industry is not just a massive consumer of water, it is also one of the biggest polluters. It is estimated that 20% of industrial water pollution in the world comes from the treatment and dyeing of textiles, and about 8,000 synthetic chemicals are used to turn raw materials into textiles [18]. Wastewater from the industry is often dumped without treatment into rivers, which brings toxic content to the sea, where it spreads around the globe [19]. The Textile industry have responded to this challenge with several initiatives like the Better Cotton Initiative (BCI) [20], the Partnership for Cleaner Textiles (PaCT) [21] and Better Mill Initiative (BMI) [22].

Companies are also using this challenge as an opportunity, and developing new technology to solve the problems of high water use and chemicals. Dutch company DyeCoo, offers a CO2-based dyeing technology that eliminates the need for water and processing chemicals in the dyeing process of fabrics and also reduces energy consumption [23]. Nike, IKEA and Peak Performance are already using this water-free and chemical-free dying process. DyeCoo made the 2015 Global Cleantech 100 list, a list featuring companies that are best positioned to solve tomorrow's clean technology challenges [24].

How and where in the value chain water risk manifests, will vary greatly by industry and sector. Some industries, such as Metals and Mining, are more exposed in their own operations, such as Metals and Mining, while others are more exposed in their supply chain. Ceres, a sustainability nonprofit organization, provides an overview of material water risk by industry, and impacts at different parts of the value chain [26]. See illustration on the top of next page.

INDUSTRY-LEVEL WATER RISK OVERVIEW

■ = High Risk ■ = Medium Risk □ = Unclear or Low Risk ▨ Indicates Ceres Addition

GICS Industry	Supply Chain		Operations		Product Use / End of Life	
	Water Quantity	Water Quality	Water Quantity	Water Quality	Water Quantity	Water Quality
Food Products	■	■	■	■		
Beverages	■	■	■	■		
Household & Personal Products	▨	■	■	■	▨	▨
Internet & Direct Marketing Retail			■	■		
Health Care Equipment & Supplies			■	■		
Pharmaceuticals			■	■		▨
Household Durables		▨	■	■	■	■
Construction Materials		■	■	■		
Paper & Forest Products		■	■	■		
Oil, Gas & Consumable Fuels	■	■	■	■		
Energy Equipment & Services			■	■		
Metals & Mining			■	■		
Water Utilities			■	■		
Electric Utilities			■	■		
Chemicals			■	■		▨
Containers & Packaging		▨	■	■		
Hotels, Restaurants & Leisure	■	■	■	■		
Real Estate Management & Development			■	■		
Internet Software & Services			■	■		
Semiconductors & Semiconductor Equipment	■	■	■	■		■
Electronic Equipment, Instruments & Components	▨	▨	■	■		■

Ceres

DyeCoo Textile Systems release liquid CO2 into the dye vessels of the machine, where heat and pressure transform the liquid CO2 into a supercritical fluid that is used to dye fabrics. The machine then lowers the heat and pressure, and the CO2 leaves the dye vessels as a gas. In the process, 95% of the CO2 is recovered and stored as liquid ready for reuse, which makes DyeCoo an almost closed-loop technology. The result is that no processing water or chemicals s required, with a 50% reduction in energy consumption for the process. Moreover, the process is substantially quicker than conventional textile dyeing methods. [25]

Water-energy nexus

One industry that is inherently linked to water is energy, and this relationship is being referred to as the water-energy nexus. Like water, energy is essential to human civilization, and a necessity for meeting basic human needs like cooking and heating. Water is needed for each stage of energy production, from fossil fuels to biofuels and power plants, and energy is crucial for the provision and treatment of water. Water availability has an impact on energy access and security, and threats to global water supply are widened by failures in energy management. Today, the amount of energy used in the water sector is almost equivalent to the entire energy demand of Australia. Most of this is in the form of electricity. In 2014 some 4 % of global electricity consumption was used to extract, distribute and treat water and wastewater, along with 50 million tons of oil equivalent of thermal energy, mostly diesel used for irrigation pumps and gas in desalination plants.

Furthermore the demand for energy used in the water sector is projected to more than double before 2040 [27].

Several studies show that the quantity and quality of water demanded varies significantly by energy process and technology, from rather negligible quantities of water used for wind and solar electricity generation to vast, agricultural-scale water use for the cultivation of biofuel and feedstock crops. Hence, the selection of technologies deployed for energy production within a given location has important implications on regional water use [28]. The United Nations World Water Development Report 2015 [29] states that in terms of water impacts, wind and solar PV are clearly the most sustainable forms of power generation. However, power generation is dominated by thermal electricity, which accounts for over 80% of global electricity production [13]. Thermal power plants use fuels such as coal, gas or nuclear energy to make heat, which is then converted into electrical energy. For most thermal plants, large volumes of water are a crucial part of the process, cooling high temperatures and powering turbines with steam [30]. Maximizing the water use efficiency of power plants will be a key determinant in achieving a sustainable water future [29].

A GUIDELINE TO THE ASSESSMENT OF WATER RISK

Whatever industry a company operates in, we recommend a structured approach to assessing water risk, and appropriate actions to mitigate the risks discovered. The Corporate Water Risk Dashboard from Ceres might be helpful as a starting point [26]. It encourages your company to look at three different areas: water dependency, water-resource security and management's response.

Water dependency

The first step is to evaluate how dependent the organization is on water. Water resource dependency refers to the amount and quality of water needed. Assessing where water risk lies in the value chains, helps with understanding your water-resource dependency, and the financial risks that are related to water. A company's water risk can lie in direct operations, in the supply chain, or in the large volumes of wastewater it produces that needs treatment.

Water Security

The second step to assess is if the organization's need for water is secured, at present and in the future. Water security refers to geographical locations, or supply chain characteristics, with their related physical, regulatory and reputational risks, that threaten the organization's access to water.

Management response and mitigation strategies

After assessing water dependency and security, it is important to look at how well water-related risks are mitigated in the organization. There are many different options available for organizations, from water efficiency improvements to a thorough assessment of locations for operations.
Some actions that may be considered are:

- Assess what types of water risk that are material for your organization.
- Integrate water risk in business strategy and decision making.
- Collect and monitor water usage data. Include water withdrawals, water consumption and water discharge.
- Make policy commitments to reduce water use.
- Set performance standards and goals, through water reduction targets and deadlines and establish clear accountability.
- Provide context. Reducing 10 % of water usage in water scarce area is more valuable than reducing 10 % in an area of water abundance.
- Treat waste-water before discharge.
- Engage with stakeholders.
- Report and be transparent.
- Assess future conditions, and start preparing for extreme weather and flooding.

Remember the supply chain in the analyses.

Tools

There are several analytical tools that have been developed to guide and help companies evaluate water risk. These are some examples:

The GEMI Local Water Tool™ (LWT) [31], developed by the Global Environmental Management Initiative (GEMI), is a free tool for companies and organizations to evaluate the external impacts, business risks, opportunities, and management plans related to water use and discharge at a specific site or operation.

The WBCSD Global Water Tool (GWT) [32] is a free online module that helps companies compare their water use, wastewater discharge, and facility information with validated watershed and country-level data (based on nearly 30 external datasets on water availability, sanitation, population, and biodiversity information, among other things). This process is intended to allow companies to conduct an initial high-level assessment of relative water risks in order to identify risk "hot spots." This initial assessment is meant to be followed by more-detailed local assessments where appropriate.

The Water Footprint Assessment (WFA) Tool [33] is a free online application that helps users define their water footprint in a particular river basin or around a product, determine the impacts of that water footprint, and identify ways to reduce it.

World Resources Institute's (WRI) Aqueduct Tool [34] is a publicly available online global database of local-level water risk indicators and a global standard for measuring and reporting geographic water risk. It aims to inform public-private engagement on sustainable water management, facilitate smarter public and private investments on water technologies and infrastructure, and enable investors to better respond to differences in company exposure and water risk. Their Water Risk Atlas depicts the world from dark red (extremely high water risk), to light yellow (low water risk). In their assessment, they take into account both physical quantity and quality as well as regulatory and reputational risk.

The Water Risk Filter developed by World Wildlife Fund for Nature (WWF) [35] in collaboration with the German development bank Deutsche Investitions- und Entwicklungsgesellschaft, is a free online tool that allows investors and companies from all industry sectors to assess and quantify water-related risks across the globe. The filter's assessment is based on a company's geographic location (for basin-related risks) and impact (for company-specific risks).

The Ceres Aqua Gauge [36] offers a comprehensive assessment tool for evaluating an existing water strategy or building one from the ground up. It helps assess the maturity of corporate water management systems across the enterprise—from risk assessment, goal-setting and accountability systems to procurement, siting and CapEx decisions. The Aqua Gauge is aligned with relevant water tools and directs companies to risk assessment tools, resources and initiatives that can further support their water strategy. It is also a resource for improving disclosure and informing engagement with investors on water issues.

The Water Risk Monetizer [37], by Ecolab and Trucost, allows users to input their facilities, amount of water used at each location, and revenue. Once these are entered into the system, the online tool provides a water scarcity risk score (from low to high), a reputational risk score, and a regulatory risk score.

Net Zero Water Building Toolkit [38] is a downloadable excel workbook tool from the Brendle Group. Inside the workbook there are 5 "modules" (tabs) to work through: calculating a water footprint, vision and goals, footprint reduction strategies, plan implementation, and tracking & reporting. This allows your company to create a comprehensive water management plan all within one document.

Key insights: Water reporting 2017

In Storebrand's water risk analysis we utilize data collected through CDP. CDP, formerly Carbon Disclosure Project, is a not-for-profit charity that runs the global disclosure system for investors, companies, cities, states and regions to manage their environmental impacts. CDP now holds the world's largest corporate water dataset, with more companies reporting than ever before, and we encourage companies to report to CDP. In 2017, 2,025 companies worth approximately $20 trillion in market capitalization reported to CDP. CDP has analyzed water response data from 742 of the world's largest publicly listed companies of most interest to investors, and here are some key insights from reporting year 2017: [44]

70% of companies have board-level oversight of water issues.

20% of companies are developing a comprehensive view of their water risk exposure

63% of companies are measuring and monitoring water withdrawals.

56% of companies have set water targets or goals.

41% of companies are engaging with their suppliers,

WATER MARKET OPPORTUNITIES

The global population boom, improving living standards, aging infrastructure, increased pollution of water, climate change and overexploitation of resources. These are not just risk factors, but do in fact provide market opportunities for companies that produce products and services that help companies reduce water use and secure a stable supply. Innovation and development of new technologies are needed, and companies that are first-movers or well positioned in the delivery of key products and solutions, are well placed for long term profitability. Examples of current and future opportunity areas are as follows:

Recycled wastewater

Recycling wastewater is a "downstream" supply solution that involves treating wastewater (sewage) to remove solids and impurities. The reclaimed water can be used for irrigation, industrial use and as drinking water. It is expected that the demand for wastewater treatment processes and technologies will increase as a response to the water scarcity problem [15]. In China it is estimated that the market for the current membrane technology used to clean wastewater will grow by more than 30 % a year over the next two decades. New and more efficient technology could provide additional opportunities [39]. By 2020, the market for industrial water treatment technologies is predicted to grow by 50% [10].

Desalination

Desalination is a process that turns seawater and brackish water into fresh water. It is a solution that adds to the supply side of the water scarcity problem, and the global water desalination market is set to reach USD 26.81 billion by 2025 [40]

Desalination is an increasingly common method of improving water security in arid and semi-arid regions. A decade ago, there were slightly more than 13,000 desalination plants in operation globally. Together they provided 0.5 % of the world's water. Today about 1 % of the world's freshwater is sourced from desalination facilities. According to the International Desalination Association, the 19,000 desalination plants that operate globally each day produce 88.6 gigalitres of water. The water from those facilities supports 300 million people. [41]. Desalination has the advantage of being a proven technology, able to tap into unlimited supplies of seawater and independent of rainfall.

Historically, desalination has been very expensive, and it is still more expensive than recycling wastewater or simple conservation measures. Also, desalination is controversial from an environment perspective as it requires large amounts of energy. However the use of renewables in the desalination sector is emerging and cost of production is falling [15]. Graphene

Photo: Shutterstock

Forty years ago, it cost as much as USD 10 to produce one cubic meter of desalinated water. Newer desalination plants have brought the costs down to well below USD 1 per cubic meter [16].

is one example of market opportunities, as it could be used to make more efficient membranes that are thinner, stronger and more porous than existing polyamide ones. Graphene is a recently discovered material made from honeycomb sheets of carbon just one atom thick. It is the strongest metal ever tested, and also the lightest and thinnest. While the technology is still in the testing phase, early indications suggest that pushing water through graphene membranes requires 15 % less energy for seawater and up to 50 % less for brackish water [41].

Infrastructure upgrading

Water supply and sewage systems have a service life of roughly 60 to 80 years. In many industrialized nations, they are reaching the end of their useful lives [22]. Aging infrastructure provides business opportunities for companies that manufacture and supply water infrastructure, such as water pipelines, smart meter, pumps, valves and analytic equipment. The water infrastructure market in the US alone have been estimated to be USD 500bn, while the global figure has been estimated to be USD 25trn. Even if these numbers may be inflated, demand for infrastructure will, with a high degree of certainty, increase dramatically over the years to come [9].

Smart irrigation

Irrigated agriculture currently contributes to 40 % of the world's food production [16]. Finding ways to use water more efficiently in agriculture is critical. Agricultural companies are already looking for ways to design seeds and fertilizers that require less water, and better drip irrigation technologies will keep farmers from overwatering their fields [38]. Today most fields are irrigated through using a system of ditches or sprinkler equipment. These are not very effective and a lot of water is wasted. Modern water irrigation systems could save as much as 30% to 70% of water consumption, and the micro irrigation market is expected to grow in the coming years. [32].

Smart water technologies

Globally, utility companies could save an estimated USD 7-12 billion each year by using smart water solutions such as advanced leakage detection, information systems enabling collection and interpretation of data, and smarter monitoring systems through remote-controlled devices and sensors [16]. In Spain, Semtech and IoTsens are teaming up to deliver 30,000 water meters. The sensors, with their long range and low power capabilities, are able to collect and communicate important household data to accurately track and control water flows. The IoTsens' system can also quickly detect leaks, breakdowns and manipulation of the water supply network in real-time, preventing loss of service and costly repairs [42].

In total, market opportunities related to the water sector are expected to reach USD 1 trillion by 2025. Companies that are early to respond and take steps to exploit the market opportunities associated with the water-related challenges are more likely to gain a competitive advantage and achieve commercial success [32].

One company that has embraced the opportunity side of water risk is Grundfos, a global pump company with Danish roots. They state that: "We are a global company with a drive to develop solutions for the world's water challenges. The world is facing a major water crisis and Grundfos is committed to being part of the solution. We can and want to make a real difference by working with especially SDG #6 on clean water and #13 on climate change. Our knowledge and water technology can move the world in a positive direction, by purifying surface water for drinking, by making water available in refugee communities and by moving water energy efficient". On World Water Day in 2018, Grundfos challenged its employees to live for less than 50 liters of water per day, just as citizens of Cape Town were doing, as an act of awareness and sympathy

FROM TOILET-TO-TAP:

WOULD YOU DRINK YOUR OLD TOILET WATER, IF TREATED RIGHT?

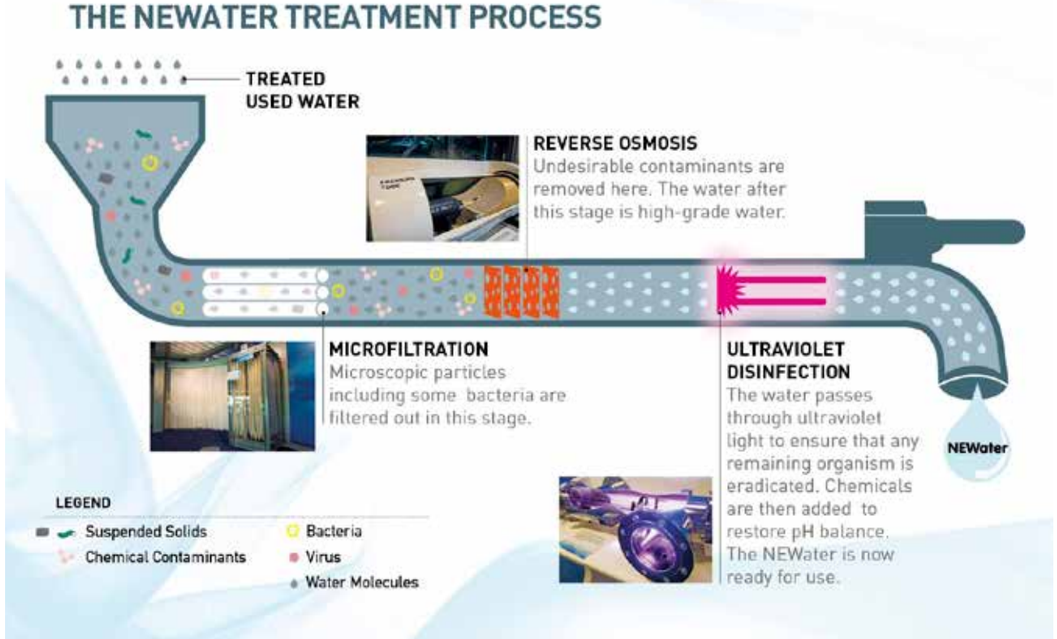
In Singapore, water security has been a major concern since its independence in 1965. Land scarcity, lack of natural water resources and limited land space forced Singapore to rely on Malaysia for their water supply for many years. The government has been working hard to make Singapore more self-sufficient, and water reuse is a key element in their water sustainability strategy.

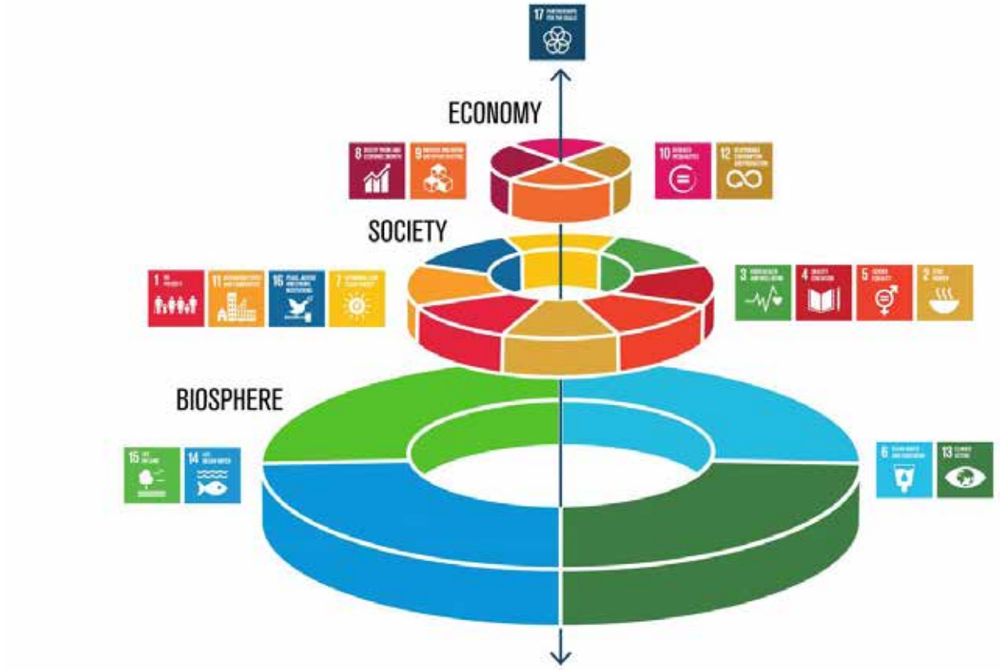
In 2003, Singapore introduced NEWater, which is water that is recycled from treated sewage and produced using a rigorous 3-step purification process. NEWater is injected into reservoirs to allow it to mix with rainwater before being collectively treated at the water treatment plants for potable use. This is done to be mindful of public attitudes and acceptance of reused water, as well as to provide an environmental buffer and allow for trace minerals to be reintroduced by blending with reservoir water.

For this project, technology was key. However, gaining community support was just as important, as many are negative to the idea of drinking recycled sewage. The government have put a great deal of effort into branding strategies, word-phrasing (used water vs wastewater), community and media engagement. In addition knowledge-sharing about the treatment process, endorsement by water experts, positive storytelling and political leadership are needed to convince the general public that this water is safe to drink.

The technology was also praised in 2012, by United Nations Secretary-General Ban Ki-moon. He called NEWater the "elixir of life" and toasted at a dinner in NEWater instead of wine. He went on to say that Singapore's experience and know-how should be shared with many countries facing water scarcity.

Over the years, PUB, Singapore's National Water Agency, has expanded NEWater supply capacity to meet up to about 40% of Singapore's total water demand. Future plans aim to increase NEWater capacity to meet up to 55% of total water demand by 2060 [43].





The SDG wedding cake, or the Rockstöm model [45], developed by the Stockholm Resilience Centre is an alternative way of viewing the SDGs and shows how the SDGs are interdependent and inherently dependent on well-being of the biosphere. The social, economic, and ecological sectors, which are traditionally seen as separate systems, are all dependent on the biosphere. The pressure on the biosphere creates risks both for businesses and communities and it calls for action and cross-sector partnerships.

CONCLUSION

Water is essential for all life and vital for healthy economies. The demand for water is increasing rapidly at the same time as supply is becoming more unstable. For both humans and the planet to prosper over the long term, we must manage our water in a far more efficient and sustainable way. The drastically increasing gap in water supply and demand is causing conflict in society, between the rich and the poor, between communities and industry and between neighboring countries. Water is about to become one of the most fiercely contested resources on the face of the planet.

As this report has demonstrated, water risk is a complex area, with many aspects to consider. Governments, civil society and companies must spend more time assessing water risks, and working on risk mitigation strategies. If the risks associated with extreme water situations are not handled immediately, the consequences have the potential, at least in some parts of the world, to be catastrophic. Human livelihoods, health and ecosystems are at stake. In our opinion, the water crisis is too great to be solved by any one actor or group of actors alone. By building partnerships across sectors and societies, we have the opportunity to find better more sustainable solutions that will bring prosperity for all.

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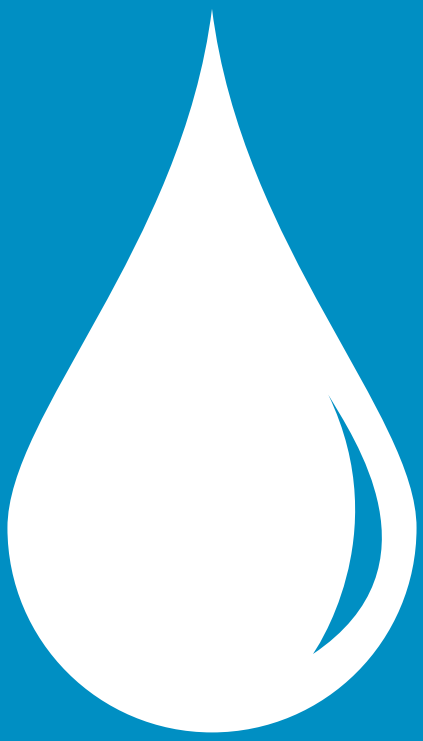

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