BLUE PEACE BULLETIN

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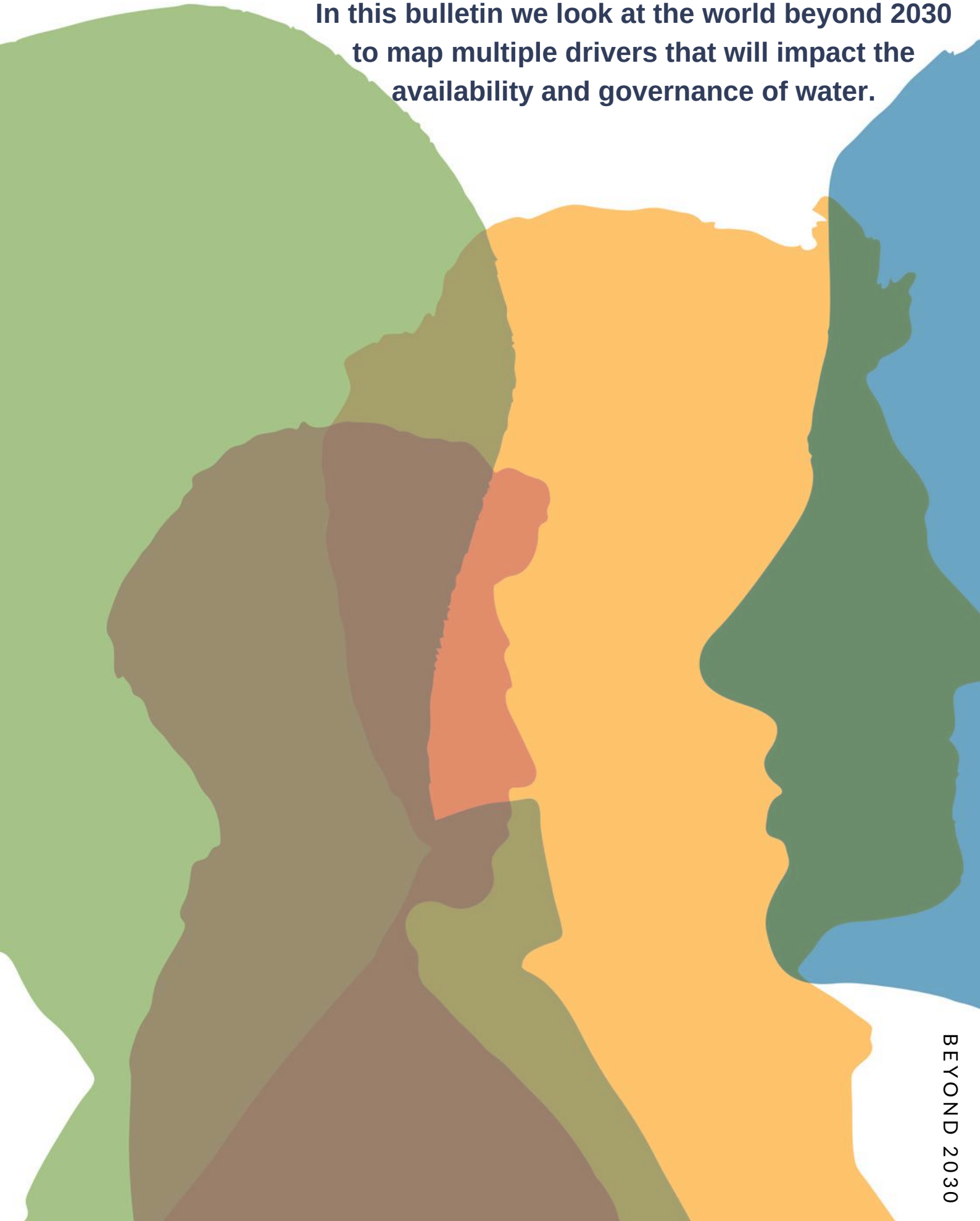
BEYOND

The Global High Level Panel for Water and Peace underlined the need to have a long term perspective on water governance.
In this bulletin we look at the world beyond 2030 to map multiple drivers that will impact the availability and governance of water.



BEYOND 2030

Introduction

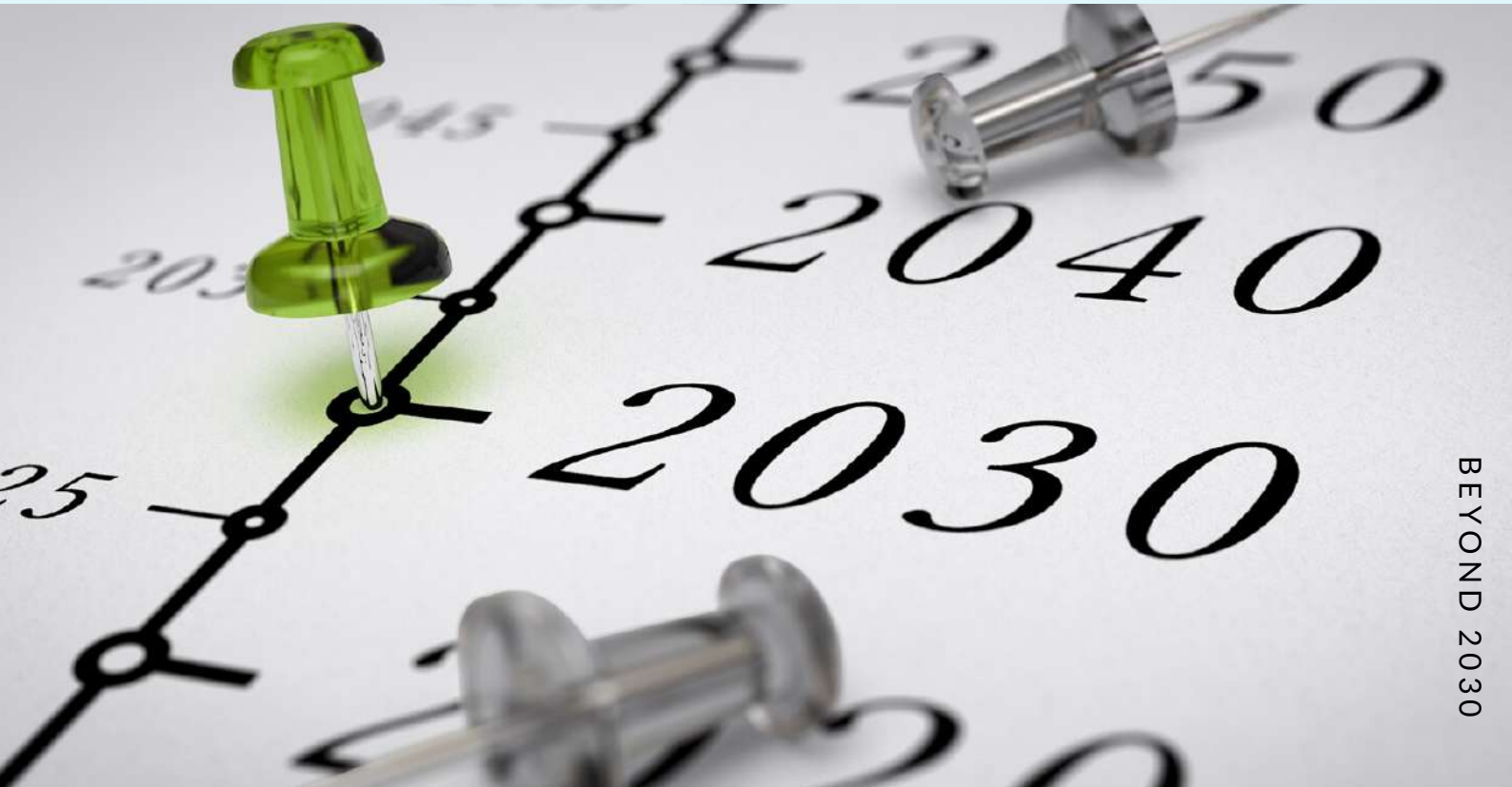
The global discourse on water mostly takes place within the framework of the Sustainable Development Goals. When these goals were formulated, water was assigned a dedicated goal (SDG 6). Therefore, currently much of our assessment of future challenges in the governance of water takes place with 2030 as the time horizon. It is necessary to look beyond.

Water is the most critical ingredient for human life. It is essential as long as humankind is there on the earth. Several factors have an impact on the availability of water over decades, not over years. It is therefore necessary to understand the dynamics influencing availability, governance and cooperation in the water sector on a long term basis. It is not too early to begin exploring how many different factors will have an impact on water in the twenty first century, or at least in the first half of it.

Water is intrinsically linked to food and energy as agriculture accounts for the largest use of water. Before mapping the long term drivers of change, it is necessary to have a basic understanding of this nexus.

The most significant other parameters are population growth, climate change, urbanisation, agricultural technologies and economy. Of these parameters, economy is influenced by myriad variables and therefore difficult to envisage how it will be shaped beyond the next decade. However, it is possible to identify the contours of the remaining four parameters for the period from 2030 to 2050.

The purpose of mapping long term trends with regards to these parameters is to alert policy communities of the likely scenarios beyond the horizon which they need to bear in mind in the course of perspective planning. Once we understand the long term trends, we can identify the requirements of resources, demand and supply management, and compromises required for cooperation. Such mapping is only the first step and the limited objective of this bulletin. It can provide a foundation for a substantive discourse on water governance and development options from 2030 to 2050.



Water Food Energy Nexus

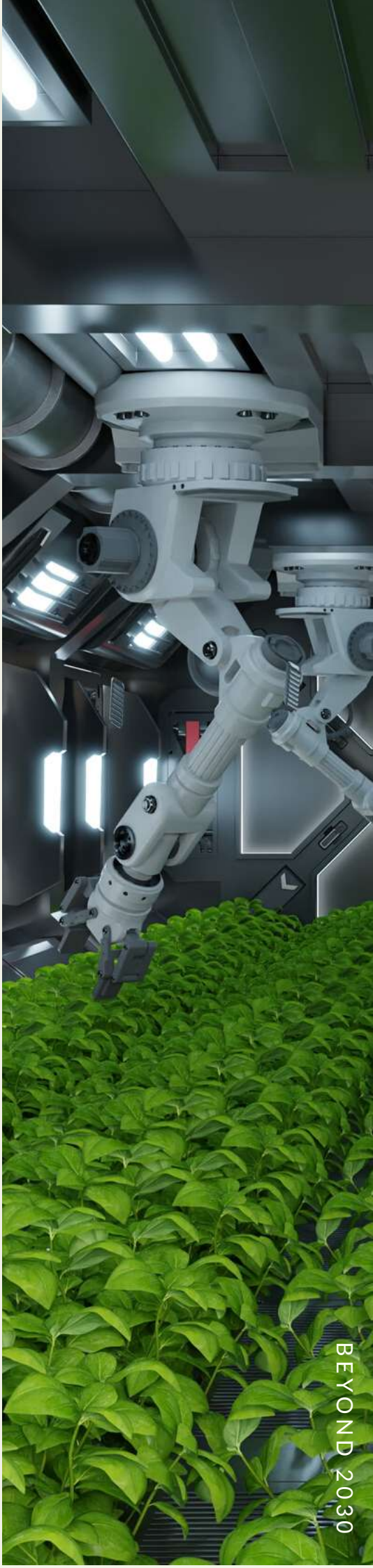
- Sustainable Development Goals (SDGs) are a roadmap set by the United Nations which commit nation states to achieve 17 global goals by the year 2030. The 17 SDGs are integrated - they recognize that action in one area will affect outcomes in others, and that development must balance social, economic and environmental sustainability.

- One of the key themes of the natural resource dimension of SDGs is water. SDG 6 focuses on ensuring a clean and stable water supply and effective water sanitation for all people by the year 2030. SDG 6 has a direct link with SDGs on food and agriculture (SDG 2) and energy (SDG 7).

- The water-food-energy nexus is central to sustainable development and has been highlighted by the UN in various reports. Agriculture is the largest consumer of the world's freshwater resources, and more than one-quarter of the energy used globally is spent on food production and supply. The inextricable linkages between these areas require an integrated approach to ensuring water and food security, and sustainable agriculture and energy production worldwide. This can also contribute to achieving other SDGs.

- As per a FAO report, agriculture (including irrigation, livestock and aquaculture) is by far the largest water consumer, accounting for 69 per cent of annual water withdrawals globally. Industry (including power generation) accounts for 19 per cent and households for 12 per cent. Approximately 80 per cent of the global cropland is rainfed, and 60 per cent of the world's food is produced on rainfed land. Research from different parts of the world shows that supplemental irrigation in rainfed agricultural systems double or even triple rainfed yields per hectare for crops such as wheat, sorghum and maize. Roughly 75 per cent of all industrial water withdrawals are used for energy production. The food production and supply chain accounts for about 30 per cent of total global energy consumption. 90 per cent of global power generation is water-intensive. More than 40 per cent of the global population is projected to be living in areas of severe water stress by 2050.

- Potential for growth in water supplies is limited, but domestic and industrial demand for water is growing rapidly. As a result, water is being transferred from agriculture to domestic and industrial uses. This transfer will make irrigation water scarcer in rapidly growing, less-developed countries, and particularly in China and some countries in the Middle East and North Africa.



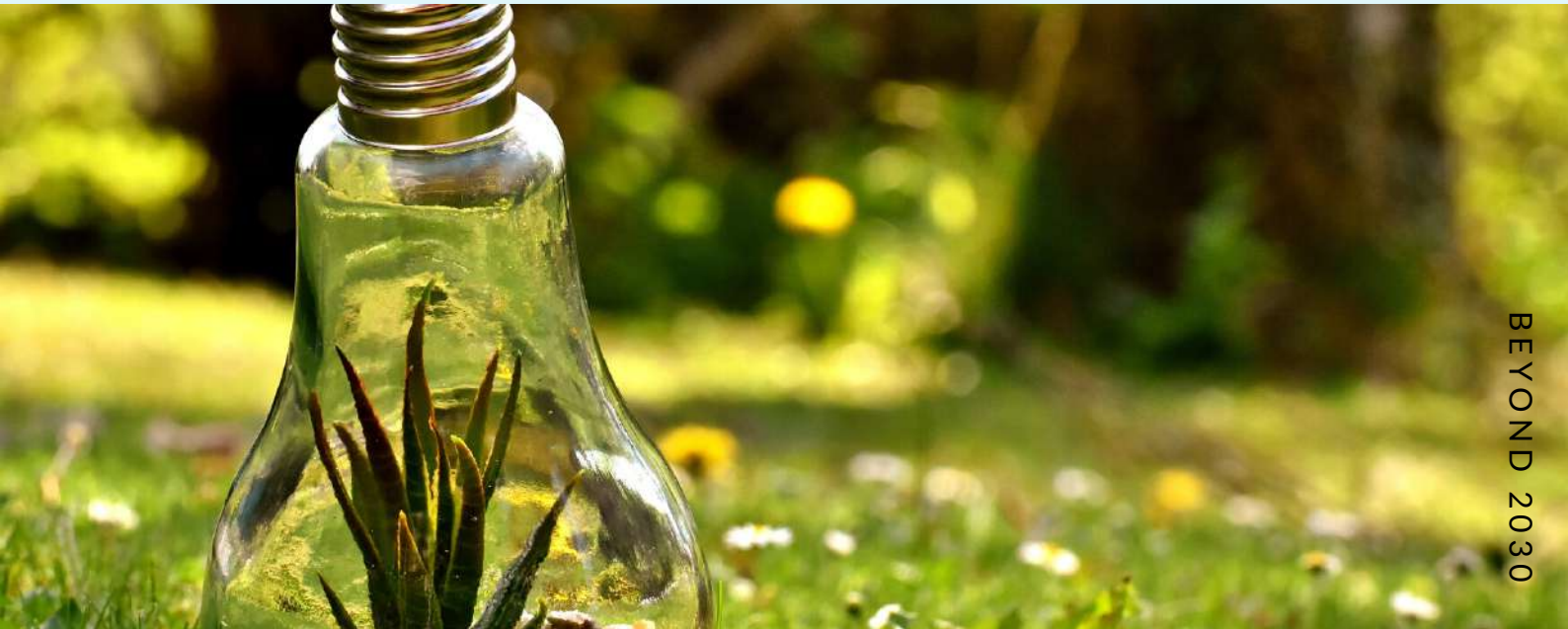
By 2050, only 66 per cent of irrigation water demands can likely be met, down from 78 per cent in 2000. The decline will be much steeper in water-scarce basins. Thus, current levels of water productivity, under a scenario of medium economic growth, will not be sufficient to ensure sustainability and reduce risks to people, food systems, and economies.

· Manufacturing industries bring together manufacturing and technically productive enterprises. These industries are not water consumers like the agriculture sector. They tend to use and then discharge water, which is often of poorer quality. Trends in water withdrawal vary regionally, within countries and within industries. Demand continues to rise in Australia and Oceania, Asia, South America and Africa. Industry accounts for up to 19 per cent of total water withdrawals globally, with substantial variations among countries and among the industrial, agricultural and municipal sectors. Future economic growth and rising GDP will increase industrial water use. Global industrial water demand (not including electricity) is expected to increase by 55 per cent by 2050, partly as a result of a 400 per cent increase in manufacturing.

· By 2035, water withdrawals for energy production could increase by 20 per cent and consumption by 85per cent, driven via a shift towards higher efficiency power plants with more advanced cooling systems (that reduce water withdrawals but increase consumption) and increased production of biofuel. It typically takes 3,000 – 5,000 litres of water to produce 1 kg of rice, 2,000 litres for 1kg of soya, 900 litres for 1kg of wheat and 500 litres for 1kg of potatoes. While almost 800 million people are currently hungry, by 2050 global food production would need to increase by 50 per cent to feed the more than 9.8 billion people projected who live on our planet.

· Fossil fuel production, still a dominant and growing part of the global energy mix, is highly water intensive, as is biofuel production and the growing practice of shale gas extraction – or 'fracking'. There will need to be much more support for the development of less water-intensive renewable energy, such as hydropower and wind, before it makes a significant impact on water demand. For instance, geothermal energy has great potential as a long-term, climate independent resource that produces little or no greenhouse gases and does not consume water.

· Estimates suggest that if the natural environment continues to be degraded and unsustainable pressures put on global water resources, 45 per cent of the global gross domestic product, 52 per cent of the world's population and 40 per cent of global grain production will be put at risk by 2050. Poor and marginalized populations will be disproportionately affected, further exacerbating rising inequalities.



Population Growth

A review of any population prediction beyond 2030 almost always reflects a 'substantial' increase. Any such increase in the population will congruently add to the stress on the finite natural resources. One of the chief natural resources which is on the frontline of facing imminent threat is water. The abstraction of water for domestic, food and industrial uses to feed such an increasing population have a major impact on ecosystems in many parts of the world, even those not considered "water scarce", thereby altering the hydro-demographics of a region. Additionally, the increasing population pressure and the change in the consumption patterns of water of such population will pose a challenge to sustainable management of water in the future.

· The population of the world will be 8.6 billion in 2030 and 9.8 billion in 2050. Global water demand is projected to increase by 55 per cent between 2000 and 2050 from 3500 to 5425 km3.

· More than 5 billion people could suffer water shortages by 2050 due to climate change, increased demand and polluted supplies, according to a United Nations (UN) report on the state of the world's water. The comprehensive annual study warns of conflict and civilizational threats unless actions are taken to reduce the stress on rivers, lakes, aquifers, wetlands and reservoirs.

· According to a World Bank Report of 2016, the combined effects of growing populations, rising incomes, and expanding cities will see demand for water rising exponentially, while supply becomes more erratic and uncertain. Unless action is taken soon, water will become scarce in regions where it is currently abundant – such as Central Africa and East Asia – and scarcity will greatly worsen in regions where water is already in short supply – such as the Middle East and the Sahel in Africa. These regions could see their growth rates decline by as much as 6 per cent of GDP by 2050 due to water-related impacts on agriculture, health, and incomes.

· A study by the Global Water Institute finds that nearly half the global population are already living in potential water scarce areas at least one month per year and this could increase to some 4.8–5.7 billion in 2050. About 73 per cent of the affected people live in Asia (69 per cent by 2050). 700 million people worldwide could be displaced by intense water scarcity by 2030 alone.

· The 2018 edition of the United Nations World Water Development Report stated that nearly 6 billion people will suffer from clean water scarcity by 2050. This is the result of increasing demand for water, reduction of water resources, and increasing pollution of water, driven by dramatic population and economic growth. It is suggested that this number may be an underestimation, and scarcity of clean water by 2050 may be worse as the effects of the three drivers of water scarcity, as well as of unequal growth, accessibility and needs, are underrated.

· UNICEF estimates that by 2040, one in four of the world's children under 18 – some 600 million in all – will be living in areas of extremely high water stress.

· A World Bank report of 2016, states that with population growth, and to less extent climate change, the number of urban dwellers who live with seasonal water shortages is forecast to grow from close to 500 million people in 2000 to 1.9 billion in 2050. This estimate may be on the lower side, since increasing competition between agricultural, industrial, and municipal water users will further strain cities.

· Domestic global water use currently accounts for 10 per cent of the total. Domestic water demand is expected to increase significantly over

the period 2010–2050 in all the world regions except for Western Europe. The greatest increment, 300 per cent, will occur in Africa and Asia. The increase will be 200 per cent in Central and South America. This growth is attributed to the increase in water supply services to urban settlements.

· The UN World Water Development Report of 2018 predicts that by 2050, between 4.8 billion and 5.7 billion people will live in areas that are water-scarce for at least one month each year, up from 3.6 billion today; while the number of people at risk of floods will increase to 1.6 billion, from 1.2 billion.

· By 2050, rising populations in flood-prone lands, climate change, deforestation, loss of wetlands and rising sea levels can be expected to increase the number of people vulnerable to flood disaster to 2 billion.

· The food demand by 2050 will increase by 60 per cent, and this increment will require more arable land and intensification of production. This will translate into increased use of water.

· A World Bank report of 2016, states that in order to feed an additional 2 billion people by 2050 using current practices and technologies, the global food system would have to increase irrigation water withdrawals by about 5 percent annually. This is the equivalent of building a new dam about one-and-a-half times the size of the Aswan Dam every year.

Population Projections until 2100

Major region	*Population (millions)*			
	2015	2030	2050	*2100*
World	7 349	8 501	9 725	11 213
Africa	1 186	1 679	2 478	4 387
Asia	4 393	4 923	5 267	4 889
Europe	738	734	707	646
Latin America and the Caribbean	634	721	784	721
Northern America	358	396	433	500
Oceania	39	47	57	71

Source: "World Population Prospects: The 2019 Revision", United Nations, Department of Economic and Social Affairs, Population Division https://population.un.org/wpp/

Climate Change

To state the oft repeated, climate change is one of the major drivers of global water scarcity. Climate change manifests itself primarily through changes in the water cycle. Several studies and scientific reports demonstrate that the impact on water resources as a result of climate change is not uniform. This inconsistency has resulted in debates on the consequent impact of climate variables such as temperatures, precipitations, greenhouse gas emissions (GHG), sea levels, rainfall, natural disasters such as floods and droughts and several other variables. Moreover, the uneven impact is felt geographically too – across continents, across different zones such as arid and temperate zones, coastal populations and inland populations, different demographics of the population etc. Undoubtedly, such variance in the impacts of climate change necessitates the need for a carefully calibrated adaptation mechanism which takes into account all of the aforementioned factors. However, the uncertainty of the impacts of climate change is most severely felt when it comes to water management and planning for the future. It is therefore imperative that climate change reports and studies take into consideration all of these uncertainties especially with regard to water resources.

· A Food and Agriculture (FAO) report states that by 2050, 1 in 5 developing countries will face water shortages.

· By 2050, 685 million people in cities will face a decline in freshwater availability by at least 10 per cent due to climate change.

· A World Bank report of 2016, states that climate change will increase water-related shocks on top of already demanding trends in water use. Reduced freshwater availability and competition from other uses—such as energy and agriculture—could reduce water availability in cities by as much as two thirds by 2050, compared to 2015 levels.

· It is estimated that the number of people living in environments with high water quality risks due to excessive biochemical oxygen demand (BOD) will affect one fifth of the global population in 2050, while people facing risks from excessive nitrogen and phosphorous will increase to one third of the global population over the same period.

· A UN report of 2017 states that several studies estimate that by 2050 between 150 and 200 million people could be displaced as a consequence of phenomena, such as desertification, sea level rise and increased extreme weather events.

· With the existing climate change scenario, by 2030, water scarcity in some arid and semi-arid places will displace between 24 million and 700 million people.

· Compared to today, five times as much land is likely to be under "extreme drought" by 2050.

· Extreme sea level events that used to occur once a century will strike every year on many coasts by 2050, no matter whether climate heating emissions are curbed or not, according to a landmark report by the world's scientists at Intergovernmental Panel on Climate Change (IPCC).

· With high climate sensitivity, the number of people flooded per year could be as many as 160 million by the 2050s and 420 million by the 2100s.

· Continuous increase in greenhouse gas emissions is affecting the global climate that altering the local precipitation, temperatures and atmospheric composition. The global temperature increased by 0.85°C during 1880–2012, and will further increase by 0.3–4.8°C until 2100. Such global warming will produce significant effects on water resources and freshwater ecosystems. The effects and intensity of climate change will vary from region to region.

· Eutrophication of surface water and coastal zones is expected to increase almost everywhere

until 2030. Globally, the number of lakes with harmful algal blooms will increase by at least 20 per cent until 2050.

· An IPCC study states that higher temperatures generally increase water requirements for both crops and livestock, in turn resulting in disproportionate impacts in areas dominated by rain-fed agriculture. Estimates suggest that in the South Asia region, farm-related income could decline by as much as 25 per cent due to diminishing crop yields.

· In 2005, global flood losses were approximately USD 6 billion. These are projected to increase to USD 52 billion by 2050 due to projected socio-economic changes alone (increasing populations and incomes). With climate change, these losses may reach at least USD 1 trillion per year according to a World Bank report.

· Rising seas and greater storm surges could force hundreds of millions of people in coastal cities from their homes, with a total cost to coastal urban areas of more than USD 1 trillion each year by 2050.

· A UN report of 2017 states that a 2°C rise in global average temperature could mean additional water-related costs between USD 13.7 billion and USD 19.2 billion per year from 2020 to 2050, mostly through water supply and flood management.

Agricultural Technologies

In order to reap the maximum benefits from agriculture with a finite resource like water, it is essential to invest in innovative technology which can manage water efficiently. There is a yawning gap between the increasing population and the water needs of such population for food growth and food production, with most of the water demands being unmet due to infrastructure or institutional inadequacies. New technologies, making a switch from water intensive agricultural methods, investments in water saving technologies and infrastructure can improve agricultural productivity through efficient water use. Some of the new technologies and innovations in agriculture which focus on saving water are currently in the early stage. They are likely to assume importance in the period beyond 2030.

· A new technology is developed by an irrigation company called N-drip in Israel in 2020 which combines the characteristics of drip and flood irrigation. Similar to common drip irrigation in some respects, the new irrigation system increases yield, saves water, saves fertilizer, and saves energy and all this in a very affordable price that allows the farmer a good return on investment from the first year.

· Bayer has implemented the DripByDrip program in partnership with irrigation pioneers Netafim to deliver targeted crop protection via drip irrigation. This method uses sensors and technology to precisely deliver water and targeted crop protection treatments based on specific geographic needs, pest and disease pressures as well as plant life cycle requirements. This water conscious solution also translates into economic savings for farmers.

· Derek Norman, head of Corporate Venture Capital at Syngenta Ventures, states that, by 2050, there will be gene-edited crops, and it will trigger a much wider variety of crops being

grown. In the future, gene editing would enable farmers to select specific crop varieties that have features like resistance to different types of disease, drought tolerance or more desirable oil content.

· The Israeli company Phytech, which is collaborating with Syngenta, has developed a monitoring system that features continuous plant-growth sensors, soil-moisture sensors and a microclimate unit. Monitoring data is then accessible on mobile devices and computers for immediate action, if needed, which is expected to be very important in 2050.

· Blue River Technology, another Syngenta collaborator, has developed a precision-smart technology called a LettuceBot, the implement uses cameras, processors, computers and quarter-inch sprayers to thin lettuce plants in the fields. This type of technology results in less chemical use and a lower environmental impact, which will be very important in 2050.

· 'Lettus Grow' shared their next level solution to soil-free growing: aeroponics at the Future Farm Technology Expo of 2019. Aeroponics sees the plant roots suspended in air and sprayed with a fine mist of nutrient solution, which significantly reduces the amount of fertiliser and water needed and increases the growth rate of a plant due to the high gaseous exchange around the roots.

· The concept of vertical farming is gaining popularity. It is an ingenious method to generate food in areas where the soil is scarce or not enough arable land to produce enough food. Plus, this farming method is also addressing the water scarcity problem as it lowers the requirement of water up to 70 per cent and it also significantly reduces the amount of land space needed to grow plants.

· Aerofarms, an American company, has developed vertical farming technology which reduces agricultural inputs while boosting productivity. The vertical farming technique uses 95 per cent less water, substantially less fertilizer and nutritional supplements and no pesticide. Additionally, produce can be grown all year round, thereby achieving potential productivity yields annually which are greater compared to a traditional field farm of the same square footage.

· Alexandru Predonu has designed an ingenious solution called 'Ring Garden', that exists in Santa Monica, California, uses solar energy to power its rotations and produce clean drinking water and food crops. The rotating garden uses 100 per cent solar energy to desalinate seawater and to rotate to irrigate the plants. The system uses up to 98 per cent less water than conventional farming methods do and yields up to 30 per cent more crops without needing pesticides or fertilizers.

· Bayer's partnership with Ginkgo Bioworks work on the issue of soil health which will look to improve plant-associated microbes and will focus on nitrogen fixation and utilization. If successful, this research could reduce the cost of crop fertilization, while driving down greenhouse gas emissions and the potential for runoff into waterways.

· 'Agriculture 4.0 – The future of farming technology' published by the World Government Summit in 2018, focusses on the innovative concept of 3D printing also known as additive manufacturing. Experts believe printers using hydrocolloids (substances that form gels with water) could be used to replace the base ingredients of food with renewables like algae, duckweed and grass. The Netherlands Organization for Applied Scientific Research has developed a printing method for micro-algae, a natural source of proteins, carbohydrates, pigments and antioxidants and is turning those ingredients into edible foods like carrots. The technology essentially turns 'mush' into meals.

· NASA's satellites are used to monitor major commodity crops like rice, maize, wheat, and soy

and also track key crop characteristics, such as the “greenness” of vegetation (NDVI), crop type and more. This kind of environmental data is incorporated into important crop assessment reports, such as the GEOGLAM Crop Monitor, a monthly bulletin on conditions for major crops around the world. Additionally, researchers funded by NASA have used satellite and airborne data to better inform existing tools for flooding, drought forecasts and famine relief efforts, and for planning and monitoring regional water supplies. Thanks to satellite intelligence, farmers can take the next crucial steps in adapting to water scarcity. By accurately monitoring their lands, they can irrigate using the right volume, at the right times and exact locations. This will result in saving water, energy and money.

· Remote sensing by NASA employs a variety of instruments onboard different satellites to monitor Earth’s health from space. High-resolution NASA satellite data helps water resource managers develop tools to plan for and mitigate their impacts. NASA’s Ames Research Center partnered with the California Department of Water Resources to do a project which aimed to help growers match irrigation with the biological needs of each crop.

· Thirsty plants can send text messages in order to “ask" for more water. NASA-supported research resulted in a leaf sensor that can monitor plants with electrical pulses, letting anyone from astronauts to farmers measure plant water levels directly.

· With its regulations already in place, drone technology is poised for a boom in farm usage. In the next 10 years, the agricultural drone industry will generate 100,000 jobs in the U.S. and USD 82 billion in economic activity, according to a Bank of America Merrill Lynch Global Research report. Potential use of on-farm drones by 2050 is huge, from imagery and product application to transporting supplies, providing water and jobs. Drones can map which part of the land needs water and how much, thereby avoiding wastage of time and water resources. According to experts in 2050 many appliances will be connected to the internet, and contain a sensor.

· Kellogg’s has begun a program to buy its staple ingredients, including corn, wheat and rice, solely from farms with a minimal carbon footprint and that prioritizes protecting water supplies and soil health. And Mondelez has an aggressive initiative that tackles, among other things, agricultural land deforestation and increasing the use of precision equipment on farms to optimize water use and limit the use of fertilizers and pesticides.

· By the year 2050, the UN projects that two-thirds of the world’s population will live in urban areas, reducing the rural workforce. New technologies will be needed to ease the workload on farmers. Operations will be done remotely, processes will be automated, risks will be identified and issues solved. In the future, a farmer’s skills will increasingly be a mix of technology and biology skills rather than pure agriculture.

Urbanization

Rapid and unplanned urbanisation will push the consumption levels of potable water and water for other uses like industrial and agricultural uses, thereby aggravating the water crisis. Urban areas are expected to absorb all of the world's population growth over the next three decades and a vast majority of these people will be living in overcrowded slums with inadequate water and sanitation services. Ensuring services of safe drinking water systems and adequate sanitation will play a key role in the health and security of cities, protecting economies and minimising the risk of pandemics. Drought, extreme heat, sea-level rise and other dangers of climate change are the central cause of displacing people which have wide-ranging consequences not only on water and the environment, but also have important political and security ramifications.

- For the first time in history, more than half of the global population live in towns and cities. By 2050, that proportion is expected to rise to two-thirds. Population growth is happening fastest in urban areas of less developed regions, with the urban population estimated to grow to 6.3 billion in 2050.

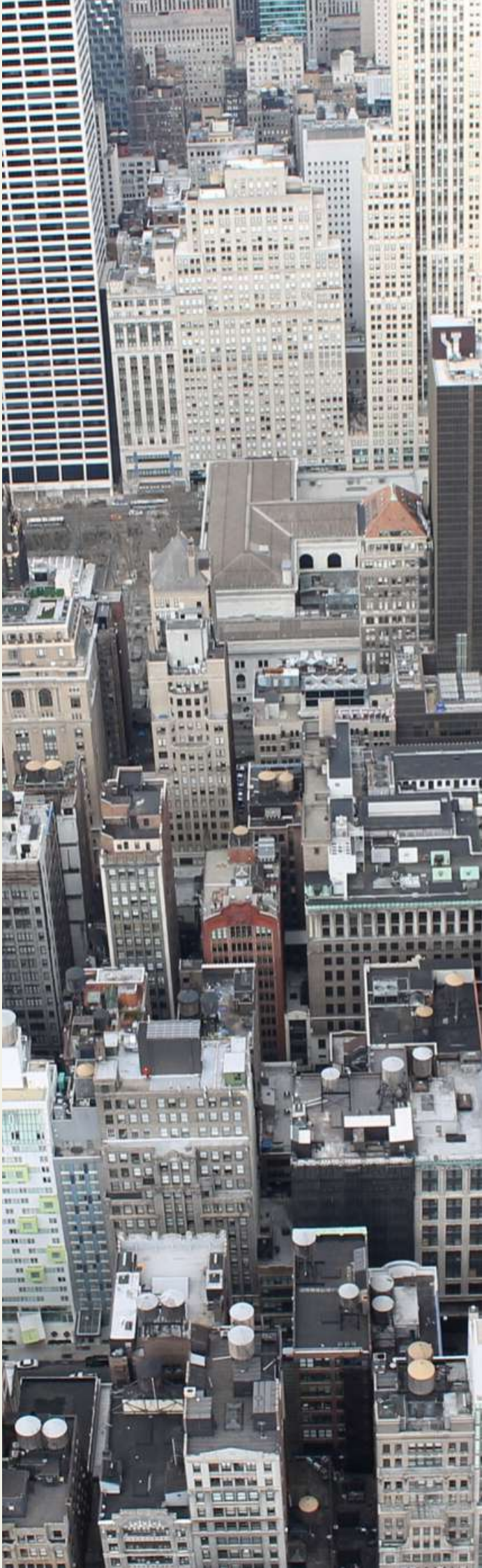
- By 2050, African and Asian urban population is expected to be around 57.7 and 64.4 per cent at urbanisation rate of 1 per cent and 0.9 per cent respectively.

- It has been estimated that by 2050, over 1 billion people will live in water vulnerable cities.

- By 2050, 800 million people will live in cities where sea levels could rise by more than half a metre. By 2050, a total of 570 cities could be affected. 1.4 billion people are expected to live along coasts. High-value coastal real-estate is also at risk.

- Global urban area is expected to expand by more than 70 per cent, not only in riparian and coastal areas and in deltas, but also in water-stressed regions, such as drylands.

- The World Bank estimates that the global costs of adaptation from 2010 to 2050 will be USD 70 billion to 100 billion a year.



The sectors requiring the main bulk of this investment will be water supply and flood protection, infrastructure and coastal zones, with urban areas requiring an estimated 80 per cent of the total funding required for adaptation.

· According to a 2016 report by Christian Aid, Miami, Guangzhou, and New York are the top three cities in terms of the value of assets exposed to coastal flooding between 2010 and 2070 - between 2 and 3.5 trillion dollars. But it's Kolkata, Mumbai and Dhaka that have the highest number of people at risk from coastal inundation- between 11 and 14 million.

· Today, one in every four Bangladeshis lives on land that could flood at least once a year, on average, by 2050. Even the country's refugee crisis could be exacerbated by sea level rise. In recent years, hundreds of thousands of Rohingya people have fled violence in neighbouring Myanmar, many settling in the low-lying region south of Chittagong—an area that could itself be vulnerable to at-least-annual ocean flooding.

· Migration caused by rising seas could trigger or exacerbate regional conflicts. Basra, the second-largest city in Iraq, could be mostly under water by 2050. If that happens, the effects could be felt well beyond Iraq's borders. Further loss of land to rising waters there threatens to drive further social and political instability in the region, which could reignite armed conflict and increase the likelihood of terrorism. This makes it a political, environmental and military problem.

· Research conducted by New York-based Urban Climate Change Research Network finds that Cape Town's ongoing battle with drought-driven water shortages could become far more common, with over 650 million people in 500 cities, among them Sao Paulo and Tehran, likely to see their access to water reduced by 2050. Many cities are already aiming to cap water use per person, with Los Angeles pushing for 200 litres a day, Melbourne for 155 litres and Cape Town, a dramatically reduced 50.

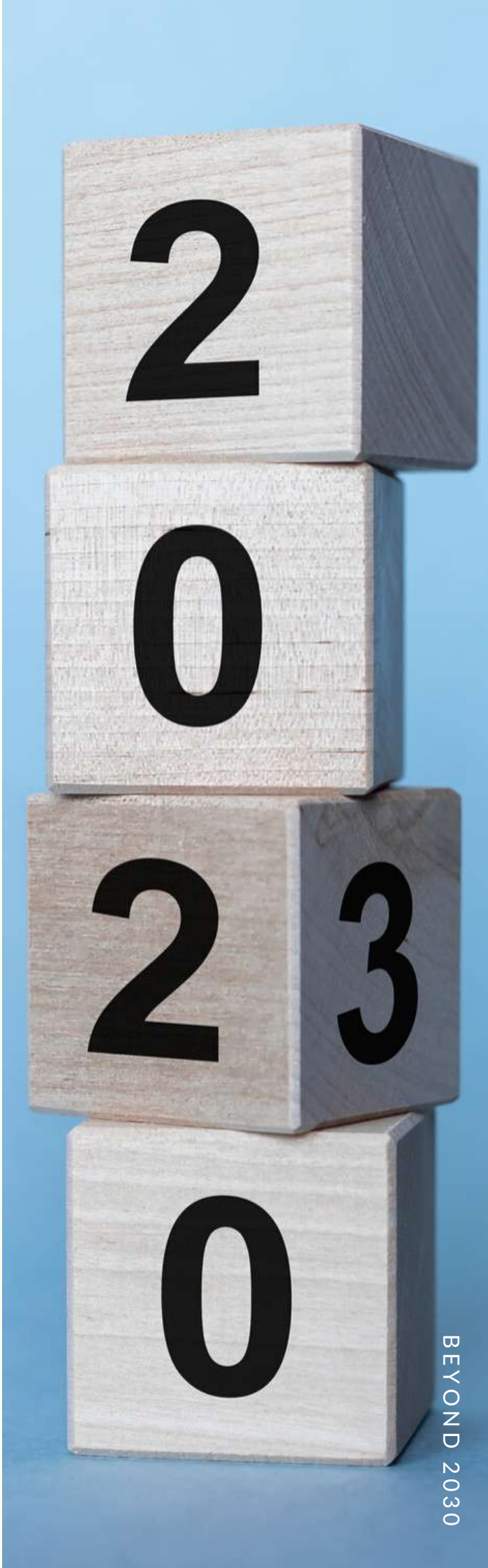
Conclusion

From the numbers presented above, it becomes abundantly clear that drivers such as population growth, climate change, urbanization, have an indivisible link with water.

With the demographic changes that will raise the population to around 9.8 billion by 2050 out of which two thirds will live in urban areas, the stress on water resources will be phenomenal. Consequently, the global food production will need to increase by 50 per cent to feed such a population will necessitate a subsequent increase in water withdrawals for irrigation and energy sectors. This will lead to a competition in water withdrawals for different uses such as industry and manufacturing and such withdrawals will contribute to significant water shortages compelling people to migrate to areas of water availability. However, the year 2050 is predicted to have more than 50 per cent people living in areas of high water stress and water scarcity. This, coupled with climate change effects such as rising sea levels and inundation will cause further loss of land which can also translate into political instability.

It is important to recognize and acknowledge that women are key stakeholders in water management and conservation across different sectors such as agriculture, rainwater harvesting and watershed management to name a few. Investing in the infrastructure needed to provide adequate water and sanitation facilities can sharply reduce health costs and loss of labour as a result of illness amongst women. It can also allow women to pursue productive activities by reducing the burden of collecting water for cooking, laundry and other household uses.

Harnessing new technologies will reduce inputs such as land and water, increase yields and significantly cut costs. It can achieve the dual objective of water management as well as feeding the rising population. We have given a few examples of new technologies in this bulletin, but scientists and entrepreneurs are always trying to invent new products and processes. The synergies between the various drivers and its resultant impact on water resources highlights the necessity for a coordinated and cohesive approach by all relevant stakeholders concerned with water management.



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