United Nations Global Compact

Climate Change and the Global Water Crisis: What Businesses Need to Know and Do

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0. Introduction

Virtually every business decision is also a decision about the use of natural resources. In this paper, we describe how global warming is affecting water and energy resources, and the challenges and opportunities this presents globally. We summarize the way in which connections among climate, energy, and water are likely to affect business and offer general guidance on how companies can respond to the challenges in an integrated way. The paper highlights how regions of the world that will experience the worst impacts of climate change are those near the equator and overwhelmingly impoverished. And we conclude by focusing on the UN Millennium Development Goals (MDGs) as they relate to climate change and alleviating the global water crisis, and suggest ways that business can partner with the UN to work toward their achievement.

1. Linkages among climate change, energy, and water

There is overwhelming scientific evidence that burning fossil fuels has altered the chemistry of the atmosphere. Figure 1 shows that atmospheric CO_2 concentrations are reaching levels that are likely higher than in the last 20 million years. Rising CO_2 concentrations along with other greenhouse gases (GHG) are changing the planet's climate. Global mean temperatures have increased three-quarters of a degree Celsius since 1900 and 11 of the 12 warmest years since 1850 have occurred since 1996.[ii] These climatic changes are expected to accelerate over the coming decades.

> ***"Water and its availability and quality will be the main pressures on, and issues for, societies and the environment under climate change." IPCC 2007***

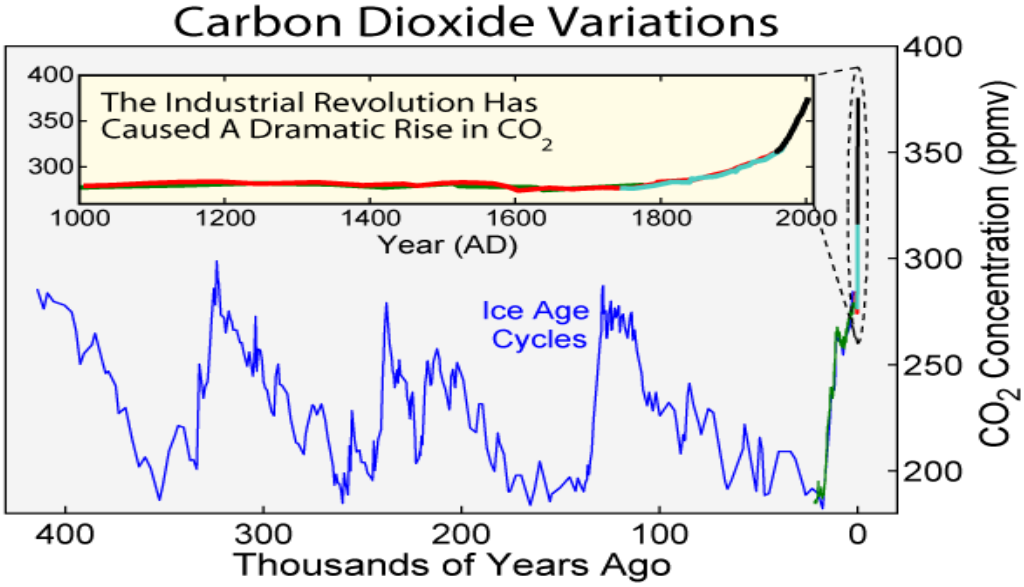

Figure 1: Variations in atmospheric carbon dioxide concentrations[iii]

In its most recent report, the Intergovernmental Panel on Climate Change (IPCC) concludes that "water and its availability and quality will be the main pressures on, and issues for, societies and the environment under climate change."[iv] Climate-related impacts on water resources are already being documented. In all corners of the world, there is growing empirical evidence of increased severe weather events, flooding, and diminished ice cover, all of which can be attributed to climate change. Numerous scientific studies also show increases in the intensity, duration, and spatial extent of droughts, higher atmospheric temperatures, warmer sea surface temperatures, changes in precipitation patterns, and diminishing glaciers and snowpack. In the future, climate change will affect water supply, quality, and demand in the following ways.

Climate change will **affect water scarcity and sustainable supply**. It will:

- Increase water shortages due to changes in precipitation patterns and intensity. In particular, the subtropics and mid-latitudes, where much of the world's poorest populations live, are expected to become substantially drier.[v] Reduced precipitation in some arid regions could trigger exponentially larger drops in groundwater tables.[vi]
- Decrease natural water storage capacity from glacier/snowcap melting, and subsequently reduce long-term water availability for more than one-sixth of the world's population that lives in glacier- or snowmelt-fed river basins, including major regions of China, India, Pakistan and the western U.S.
- Increase the vulnerability of ecosystems due to temperature increases, changes in precipitation patterns, frequent severe weather events, and prolonged droughts. These factors, in turn, will further diminish the ability of natural systems to filter water and create buffers to flooding.
- Affect the capacity and reliability of water supply infrastructure due to flooding, extreme weather, and sea level rise. Most existing water treatment plants and distribution systems were not built to withstand expected sea level rise and increased frequency of severe weather due to climate change.[vii] Furthermore, climate change will concentrate snowmelt and precipitation into shorter time frames, making both water releases more extreme and drought events more sustained. Current infrastructure often does not have the capacity to fully capture this larger volume of water, and therefore will be inadequate to meet water demands in times of sustained drought.
- Impair non-consumptive water uses, including transportation on inland waterways such as the Mississippi River in the U.S. and Rhine River in Europe, where freight transport has already been disrupted due to floods and droughts.[viii] Tourism sectors that are dependent on the availability of water or snow are also vulnerable to water scarcity due to climate change. Freshwater fisheries, many of which supply food to the world's poorest populations, also depend on abundant, high quality water resources to remain productive.

Climate change will **impact water quality**. It will:

- Increase extreme precipitation and flooding, which will increase erosion rates and wash soil-based pollutants and toxins into waterways.
- Contaminate coastal surface and groundwater resources due to sea level rise, resulting in

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saltwater intrusion into rivers, deltas, and aquifers.

- Increase water temperatures, leading to more algal and bacterial blooms that further contaminate water supplies.
- Contribute to environmental health risks associated with water. For instance, changes in precipitation patterns are likely to increase flooding, and as a result mobilize more pathogens and contaminants.[ix] It is estimated that by 2030 the risk of diarrhea will be up to 10 percent higher in some countries due to climate change.[x]

Climate change will **increase water demand**. It will:

- Increase water demand for agriculture, primarily for irrigation, due to prolonged dry periods and severe drought. Some research estimates an over 40 percent increase in land needing irrigation by 2080.[xi]
- Increase water demand for hydration needs for billions of farm animals due to higher atmospheric temperatures.
- Increase quantities of water needed for industrial cooling due to increased atmospheric and water temperatures.[xii]

The impacts of climate change on the water cycle will vary regionally (Figure 2). While some areas will benefit from having more water, these benefits are "tempered by the negative effects of increased precipitation variability and seasonal runoff shifts on water supply, water quality and flood risks." Overall, the report IPCC concludes, "the negative impacts of climate change on freshwater systems outweigh the benefits."

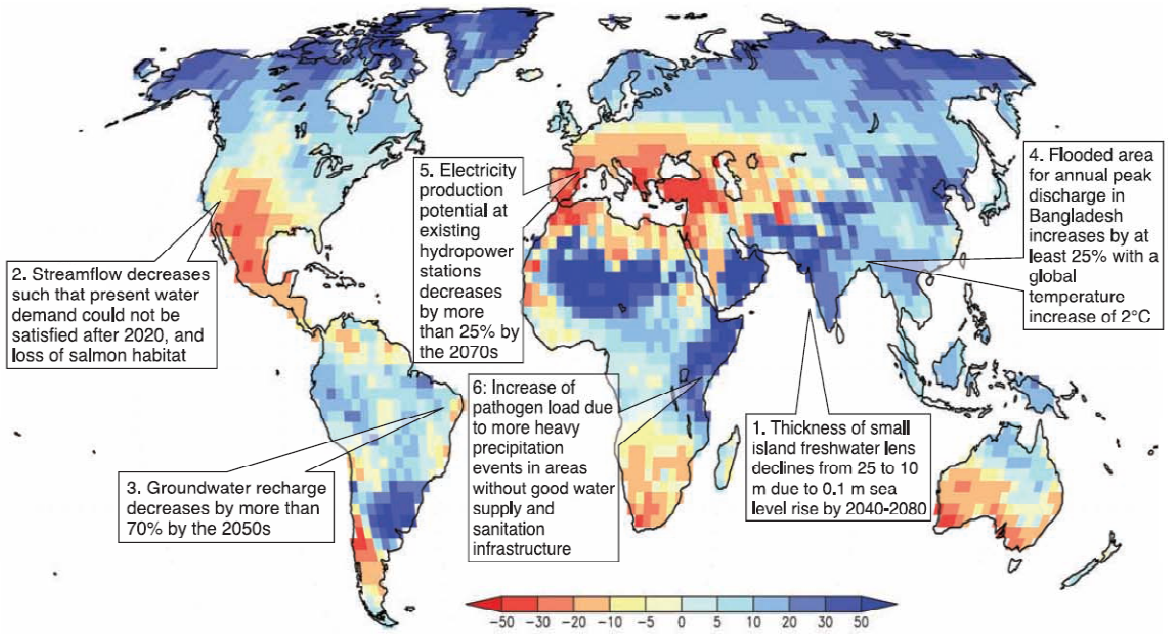

Figure 2: Future climate change impacts on freshwater by world regions.[xiii] (Color-coding signifies estimated percent change in annual run off by the end of the 21st Century under IPCC scenario A1.)

In addition, hundreds of millions of people who live in the floodplains of rivers and along the

coast will face more severe flooding if nothing is done to protect them. Investments to prevent future catastrophes will be made in some regions, but poor countries lack the financial resources for needed infrastructure. These conditions have the potential to create environmental refugees at a massive scale. It is estimated that 60% of the population live below an elevation of 1 meter in Bangladesh alone. Some islands, like the Marshall Islands or Kiribati, will have to be abandoned altogether.

The risks of managing water and energy/climate change in isolation of one another are woefully underappreciated by policy-makers.

Providing a safe and reliable supply of water already poses a challenge for water managers throughout the world. Almost 900 million people lack access to improved drinking water, and another 2.5 billion lack proper sanitation. Population and economic growth will likely exacerbate these challenges. Furthermore, feeding more people and the rising percentage of meat based diets can increase water demand in agriculture, which already uses about 70% of the world's water. In many industrialized nations, the environment has suffered from over-allocation and pollution of water resources, and many citizens are urging that these aquatic systems be restored. Climatic change will make meeting these existing and future challenges even more difficult.

Water and energy are strongly interconnected

Another important aspect of the water-climate change linkage is the strong connection of both to energy. Upon hearing the terms water and energy, most people immediately think of hydropower. And while hydroelectric generation is certainly reliant upon large quantities of water, the connections between water and energy run much deeper. Water is used for extracting, refining, processing, and transporting all forms of energy, from coal to solar. Large volumes of water are used as cooling water in conventional thermal generating plants. Energy production can also cause significant water pollution.

A much less recognized connection between water and energy are the vast amounts of energy used to treat, distribute, and use water. Water is heavy (1 liter weighs one kilogram), so moving it requires a lot of energy. Energy needs are particularly high for places where water is pumped from very deep wells, or where it is piped over long distances and steep terrain. Additionally, heating water is energy-intensive. In California, for example, 19% of the electricity use, 33% of the non-electricity natural gas, and 33 million gallons of diesel consumption is water-related.[xiv]

Presently, the risks of managing water and energy/climate change in isolation of one another are woefully underappreciated by policy-makers. Indeed, water and energy policies often compete with one another, with decision-makers frequently inadvertently valuing energy production over water protection. Further, many current activities to manage and reduce GHG emissions require large amounts of water, often inadvertently increasing water-related risks. For instance, first-generation biofuel production has an especially large water footprint, and can also compromise water quality through the leaching of pesticides and nutrients.[xv] A large-scale replacement of the gasoline-guzzling U.S. vehicle fleet with plug-in electric vehicles – an important potential solution to reducing GHG emissions from tail pipes – would have significant implications for power production, and thus water use. Recent research in the USA has found that generating electricity for plug-in hybrid electric or all-electric vehicles requires as much as three times the water per mile as gasoline production given the country's current power mix.[xvi]

Climate change is likely to exacerbate water availability and quality, which will have a wide range of implications for business.

Similarly, some measures to manage water scarcity or quality issues require significant amounts of energy. For instance, water pipelines that transport water from water-rich to water-scarce regions – a popular solution for addressing water scarcity – require considerable amounts of energy. Likewise, seawater desalination, increasingly considered an option to meet growing water demand, is extremely energy intensive. In California, for example, more energy is required to produce water from desalination than from any other water-augmentation or demand-management option. The future cost of desalinated water will be more sensitive to changes in energy prices than will other sources of water, presenting reliability risks. Water recycling and re-use are seen by many as a low-cost, sustainable water supply option, however, treating water to the high standards required for potable re-use consumes significant amounts of energy.

While these links present challenges, they also provide opportunities, particularly as managers seek to develop climate change adaptation and mitigation strategies. An analysis by the California Energy Commission found that water efficiency programs could provide 95% of the energy savings of traditional energy efficiency programs at 55% of the cost. Thus, saving water is likely to be an important part of reducing energy use and GHG emissions and helping to mitigate climate change. Additionally, water conservation and efficiency reduces vulnerability to climate change by alleviating scarcity and can be an important adaptation strategy.

2. Business risks of water and climate change

Climate change will exacerbate many water and energy-related business risks. As discussed, climate change is likely to exacerbate water availability and quality, which will have a wide range of implications for business.

- Water scarcity directly affects business operations, raw material supply, intermediate supply chain, and product use in a variety of ways. Declines or disruptions in water supply can undermine industrial and manufacturing operations where water is needed for production, irrigation, material processing, cooling and/or washing and cleaning. For example, information technology firms require vast amounts of ultra clean.

- Water quality risks are often overlooked but may have significant financial implications. The quality of process water is critical in many industrial production systems, and contaminated water supply may require additional investment and operational costs for pre-treatment.

- Water scarcity, changes in precipitation patterns, and glacier melt caused by climate change directly affect power generation, curtailing hydro-based power production, and also impacting any power plants that run steam turbines. Whether fired by coal, natural gas, or nuclear energy, electricity generation relies on having an adequate supply of cooling water. Businesses that depend on highly reliable energy from these power sources will be at risk.

- Physical water resource constraints make companies more susceptible to reputational risks. Declines in water availability and quality can increase competition for clean water. In water-scarce regions, tensions can arise between businesses and local communities, particularly in developing countries where local populations often lack access to safe and reliable drinking water. Community opposition to industrial water withdrawals and perceived or real inequities in use can emerge quickly and affect businesses profoundly. For instance, in Kerala, India, opposition to beverage company operations developed over concerns about the effects of bottling plants on local groundwater levels and supplies. When villagers' wells ran dry, local government revoked company operating licenses, affecting both revenues and company reputations.

- Reputational risks increase as people become more aware of their rights to access water. The concept of "access to clean water as a human right" is gaining more recognition globally, yet the failure of governments to provide 100 percent coverage for water services means that international and local businesses may find themselves using copious amounts of water in regions where people lack sufficient water to meet basic needs.

- Growing awareness around the ecological impacts of water withdrawal and discharge increases both reputational and regulatory risks. Healthy freshwater ecosystems are an essential part of local communities and livelihoods, not only by serving as a source of clean drinking water, but also by providing cultural, social, aesthetic, and economic value. As a result, significant water withdrawal or wastewater discharge, regardless of the extent of actual impacts on the neighboring communities or ecosystems, inevitably increase the risk of conflict with local communities. Moreover, the vulnerability of ecosystems is expected to increase due to climate change.

- Physical and reputational pressures affecting water availability and wastewater discharge can result in more stringent water policies. Water scarcity, coupled with increased concern among local communities about water withdrawals, will put pressure on local authorities and policymakers to consider water reallocations, regulations, and development of water markets that cap usage, suspend permits to draw water, and lead to stricter water quality standards.

- Water scarcity will increase water prices. Among other factors, water scarcity is driving shifts toward full-cost pricing aimed at providing economic incentives for efficient water use. In many places, artificially low water prices are rising as subsidies are phased out. Utilities in industrial countries are increasingly implementing "block" or "tiered rates," where water users pay more for increased consumption. These tariff structures are specifically designed to encourage commercial and industrial users to use water efficiently.

- Water-intensive products and services face increased socio-political risks. As water scarcity becomes a serious problem in many parts of the world, there may be corollary pressure, both regulatory and reputational, on products that require a significant quantity of water. Products and services that require large amounts of water or energy to produce or to use may be phased out by law, lose market share to less water-intensive products, or cause reputational damage for the company.

Taken together, this means that businesses will face vastly increased uncertainty about the availability and quality of their water supplies. One of the strongest conclusions in the latest IPCC report is that "climate change will challenge the traditional assumption that past hydrological experience provides a good guide to future conditions." Therefore, it will become increasingly crucial for businesses to incorporate climate change factors when assessing and managing their water risks. Indeed, a critical driver of success in the 21st Century economy will be how companies and investors balance the competing demands for water and energy.

3. What businesses can do to manage water-climate risks strategically[xvii]

To evaluate and effectively address water and climate change risks, companies can take the following actions:

1. Measure water and carbon footprint throughout the value chain. Some of the most significant water and climate-related risks can be embedded in a company's value chain, well outside of its direct operations or control. In many cases, such as in agriculture-based industry sectors, a company's direct water use pales in comparison with water embedded in the supply chain. Even should water use or GHG emissions occur outside of a company's sphere of influence, they can still pose financial or reputational risks to the company. Companies can only mange what they measure, so in order to accurately assess risks and opportunities, a first step for companies is to conduct a comprehensive and integrated water and carbon accounting. By aligning measurement of water and carbon/energy, businesses can identify how the three are interlinked, providing key basic information for developing a holistic management strategy.

A first step for companies is to conduct a comprehensive and integrated water and carbon accounting.

2. Assess physical, regulatory and reputational water risks associated with climate change. Explicit attention should be paid to understanding energy-related risks posed by water (and vice versa), as well as any potential competing demands the company may have for water and energy. Companies should also seek to align, if not integrate, their water and climate risk assessments. Having a detailed understanding of local water conditions, including hydrological, social, economic, and political factors, can give companies room to anticipate and plan for a wide range of climate change scenarios. Companies should be prepared to provide details on the risks they face from water challenges and to be transparent about the energy trade-offs they may need to make to address them.

3. Integrate water and climate issues into strategic business planning and operational activities. When developing water management plans, companies will need to consider and integrate the potential impacts of climate change on water supplies and water quality. Climate-related impacts on water should also be considered when making a range of business decisions from factory design and siting to new product development. Companies should also consider potential energy/water synergy (or conflict) in business planning and decision making. For instance, integrated approaches to reduce water and energy use simultaneously have allowed companies at a single plant to achieve millions of dollars in savings while increasing output. In addition, such efficiency measures can demonstrate a company's commitment to water management, boost public image, and help build positive relations with the communities where it operates.

4. Engage key stakeholders as a part of water and climate risk assessment, long-term planning and implementation activities. When developing a corporate water and climate change management plan, managers can benefit from sharing information with employees, investors, customers, local communities, and other key stakeholders in order to gain valuable feedback. Through early and continuous engagement with concerned stakeholders, companies can better understand, anticipate, and respond to emerging issues and expectations. Open dialogue with water providers and local communities may also be helpful in preventing and reducing the risk of future water and climate change related disputes or disruptions. Such discussions may also identify pivotal inputs that help prioritize action steps.

Most solutions to water supply, quality and sanitation, and climate change issues require co-management approaches involving sound water governance, collective action, and partnerships.

5. Disclose and communicate water and carbon performance and associated risks. Companies should publicly report management activities and key metrics on their water and energy performance. This information can help shareholders and stakeholders assess how companies are addressing their water and climate change risks. Such metrics are also a useful tool for engaging employees across the enterprise.

6. Seek opportunities for collective action. Because water and energy are connected to social, cultural, and environmental issues, companies can rarely achieve the best management outcomes on their own. Most solutions to water supply, quality and sanitation, and climate change issues require co-management approaches involving sound water governance, collective action, and partnerships. By pooling resources and bringing together a wide range of expertise and knowledge through partnerships for a common goal, companies can respond to water and climate change concerns more efficiently and effectively than through individual actions. Collaborative actions are particularly helpful in assessing and addressing climate change impacts, since there are large gaps in knowledge related to climate change and water, especially data and prediction modeling at the watershed level.

Partnering with the United Nations

There are numerous opportunities for companies to partner with the UN to take action on both climate and water. The UN Global Compact – an initiative within the UN system devoted specifically to improving corporate stewardship practices – has worked since its inception in 2000 to facilitate actions and partnerships that help companies become more sustainable and equitable. The UN Global Compact manages two sub-initiatives for business engagement – The CEO Water Mandate and Caring for Climate – focusing on water and climate, respectively.

Established in 2007, The CEO Water Mandate is currently one of the most comprehensive and visible cross-sectoral, public-private partnerships on water. It represents both a call-to-action and a strategic framework for responsible water management by business. It is voluntary in nature, but is built around six core areas of responsibility with which its endorsers must commit to and demonstrate improvement: Direct Operations, Supply Chain and Watershed Management, Collective Action, Public Policy, Community Engagement, and Transparency.

Also launched in 2007, Caring for Climate is a voluntary global initiative that seeks to mobilize the business community to develop solutions that reduce climate risk while at the same time create value for the company. The initiative was jointly developed by the UN Global Compact, the United Nations Environment Programme (UNEP), and the World Business Council for Sustainable Development (WBCSD). Caring for Climate helps companies to advance practical solutions, share experiences, inform public policy as well as shape public attitudes. When endorsing the initiative, chief executives are prepared to set goals, develop and expand strategies and practices, and to publicly disclose emissions within the framework of the Compact's Communication on Progress policy.

Companies can work to understand water-related climate risks and help to support resiliency building and adaptation strategies related to water.

The overarching objective of both UN Global Compact initiatives is to support achievement of the Millennium Development Goals.

4. Linkage between climate and water and the Millennium Development Goals

Industrialized nations, which have produced most of the greenhouse gases that cause global warming, are already spending billions of dollars to adapt to climate change impacts, such as coastal flooding and drought. However, countries near the equator face the greatest vulnerabilities and have the least capacity to deal with the challenges posed by global warming.

International aid organizations traditionally focus on social and economic development. In addition to efforts to reduce GHG emissions, decision-makers are targeting some development assistance to create more resiliency and help countries avoid some of the worst impacts of global warming.

Responsible businesses can play a role in helping avert climate catastrophe among the world's poor. Because water is one of the resources most affected/vulnerable by climate change, companies can work to understand water-related climate risks and help to support resiliency building and adaptation strategies related to water.

Table 1: The Millennium Development Goals (MDGs), Climate Change, and Water[xviii]

MDGs	Role of water management	Climate change impacts on water management[1]	Climate change management - adaptation/resiliency building[2]
Goal 1- Eradicate extreme poverty and hunger	• Increase agricultural production and productivity to keep up with rising demand • Protect freshwater	➢ Changes in precipitation pattern increase irrigation water demand	• Increase irrigation efficiency, develop drought resistant crops • Develop/provide technologies to prevent

[1] UNDP. Climate Change and the UN Millennium Development Goals (MDGs). http://www.undp.org/gef/adaptation/dev/02a.htm

[2] Intergovernmental Panel on Climate Change. 2008. Climate Change and Water. IPCC Technical Paper IV

	ecosystems to deliver food and livelihoods • Increase water access and water allocation for poorest users • Deliver water infrastructure for health and sanitation	➢ Increase in ecosystem vulnerability ➢ Increase in water demand ➢ Drought, flooding increase vulnerability to water infrastructure	water logging, erosion and leaching • Develop water infrastructure considering potential climate change impacts
Goal 2 – Achieve universal primary education	• Reducing water-related diseases, which cost millions of school days each year	➢ Increase in water-related diseases	• Implement integrated health, environment and development policies
Goal 3 – Promote gender equality and empower women	• Enhancing equitable access to water and thus the ability to produce food and improve health. • Eliminating lost time for water collection, a burden on women and young girls	➢ Decrease in water availability and quality ➢ Extreme weather events increase vulnerability of water infrastructure	• Develop water infrastructure considering potential climate change impacts • Public participation in water and climate planning
Goal 4 – Reduce child mortality *Goal 5* – Improve maternal health *Goal 6* – Combat HIV/AIDS, malaria, and other diseases	• Reducing water-related diseases which kill millions of people each year • Provisioning of clean water that contribute to better hygiene and diets • Provide clean and adequate supplies of water for basic needs	➢ Increase in water-related diseases ➢ Decrease in water quality and supply ➢ Extreme weather events increase vulnerability to water infrastructure	• Implement integrated health, environment and development policies • Develop and implement cost effective water treatment technologies
Goal 7 – Ensure environmental sustainability	• Plan and implement all aspects of water management in a manner that integrates environmental flows for lake and river systems and draws on groundwater systems within natural limits of recharge • Halving the proportion of people without sustainable access to improved drinking water and sanitation by 2015	➢ Fundamental alterations in ecosystem relationships ➢ Decrease in water availability and quality, increase vulnerability to water infrastructure	• Ensure that basic needs of all people are met by provision of improved drinking water and sanitation • Ensure that the urban and rural poor have access to robust resilience strategies that ensure that climate change impacts do not deny them any source of water • Increase diversity of water supply and household and community water storage
Goal 8 – Develop a global partnership for development	• Involve a diverse range of practitioners, researchers, water users and decision makers when planning water management projects	➢ Climate change requires integrated water energy approach, and global level strategy and partnership	• Develop and implement integrated water and climate change policy • Coordinated responses among businesses, governments and practitioners

Endnotes

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