

WATER SECURITY

THE WATER-FOOD-ENERGY-CLIMATE NEXUS



The World Economic Forum Water Initiative

Summary of the World Economic Forum Water Initiative's Book

Water Security: The Water-Food-Energy-Climate Nexus

As an important step towards the understanding of the water-food-energy-climate nexus the World Economic Forum Water Initiative has helped publish the book *Water Security: The Water-Food-Energy-Climate Nexus* which is being launched at the Annual Meeting 2011 in Davos.

The book collects together for the first time, leaders from government, religious groups, business, NGOs, academics, entrepreneurs, financial experts, journalists, trade specialists and many others to share their perspectives on the common water challenge we face. Issue by issue, including agriculture, trade, national security, business and innovative water partnerships, they set out the case of how crucial it is to overhaul our management of freshwater to meet our future social and economic needs.

Water Security: The Water-Food-Energy-Climate Nexus is not meant to contain the last word on the water security issue. Instead, by drawing on a range of different viewpoints, and based on the multistakeholder ethos that lies at the heart of the World Economic Forum, the intent of this book is to simply set out for the reader the following:

- First, through a selection of expert perspectives, an exposition of the complex set of challenges we face across our economy in managing our future water needs when looking forward over the next two decades;
- Second, what the implications of these challenges to our social, political, and economic well-being may be if we fail to act, based on the best and current thinking on forecasts and growth trends;
- Third, including an introduction to a major initiative being undertaken by the World Economic Forum in alignment with many other actors, explore breakthroughs in the development of a new economic fact base on water for governments; experiences in developing public-private-expert coalitions that can work with governments to take action on water;

This book is an important and comprehensive piece of work that seeks to deepen the awareness and understanding of the nexus which spans across the issue of water and to explore solutions to the water scarcity challenge ahead.

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Since 1984, the nonprofit Island Press has been stimulating, shaping, and communicating the ideas that are essential for solving environmental problems worldwide. With more than 800 titles in print and some 40 new releases each year, we are the nation's leading publisher on environmental issues. We identify innovative thinkers and emerging trends in the environmental field. We work with world-renowned experts and authors to develop cross-disciplinary solutions to environmental challenges.

Island Press designs and implements coordinated book publication campaigns in order to communicate our critical messages in print, in person, and online using the latest technologies, programs, and the media. Our goal: to reach targeted audiences—scientists, policymakers, environmental advocates, the media, and concerned citizens—who can and will take action to protect the plants and animals that enrich our world, the ecosystems we need to survive, the water we drink, and the air we breathe.

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Water Security

Water Security

The Water-Food-Energy-Climate Nexus

“Water sits at the nexus of so many global issues . . . including health, hunger and economic growth. And sadly, water scarcity takes its greatest toll on society’s least fortunate. I am absolutely convinced that the only way to measurably and sustainably improve this dire situation is through broad-scale collaborative efforts between government, industry, academia and other stakeholders around the world.”

—INDRA NOOYI,
Chairman and CEO of PepsiCo, Inc.,
Member of International Business
Council, World Economic Forum

“To make a difference on the water challenges we all face, governments, civil society and businesses must work together as never before. For business leaders in particular, we need to speak up, stand up and scale up our efforts on water sustainability.”

—MUHTAR KENT,
Chairman and CEO, The Coca-Cola
Company, Member of International
Business Council, World
Economic Forum

“In 1911, John Muir observed how, ‘When we try to pick out anything by itself in nature, we find it hitched to everything else in the Universe.’ A century later, a gathering of the World Economic Forum discovered the same phenomenon. Four hundred top decision-makers listed the myriad looming threats to global stability, including famine, terrorism, inequality, disease, poverty, and climate change. Yet when we tried to address each diverse force, we found them all attached to one universal security risk: fresh water.”

—MARGARET CATLEY-CARLSON,
Patron, Global Water Partnership,
2008–2010 Chair of World Economic
Forum Global Agenda Council
on Water Security

“Over the last few years, the scale and speed of response from a leading group of large companies to the water challenge has been impressive. As this book illustrates, their engagement in partnerships with others to better understand how water works across the economy and how to manage water more efficiently as a result, can offer much potential.”

—PROFESSOR TONY ALLAN,
Kings College London, 2008
Recipient of the Stockholm Water
Prize, Member of the World Economic
Forum Global Agenda Council on
Water Security

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Industry Partners are select member companies of the World Economic Forum that are actively involved in the Forum's mission at the industry level.

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Water Security

The Water-Food-Energy-Climate Nexus

The World Economic Forum Water Initiative



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Preface

At the World Economic Forum Annual Meeting in Davos-Klosters in 2008, business leaders set out a Call to Action on Water; their goal was to raise awareness—to develop a better understanding of how water is linked to economic growth across a nexus of issues; and to make clear the water security challenge we face to 2030 if a business as usual approach to water management is maintained.

At the same meeting, Ban Ki-moon, UN Secretary-General, sent business a challenge: to use their call to action to help engage governments in the water discussion.

As a result, the last three years have seen an unprecedented level of discussion and analysis on water throughout the World Economic Forum's meetings and elsewhere. These discussions have been underpinned by a multi-company Water Initiative and informed by our Global Agenda Council on Water Security. This publication captures where the debate is now. It is a significant achievement. It sets out the challenge we face if nothing is done to improve water management in the next two decades. It also points to the future, introducing an important institutional initiative on water the World Economic Forum is now engaging in, to move from insight to action with the Water Resources Group.

The data and text contained in this publication are the products of a unique and unprecedented international, public-private-expert alliance to address the water challenge. It represents the multistakeholder ethos of the World Economic Forum: to bring together expertise and insight from all aspects of the economy to further the global, regional, and industry agenda on key issues, in this case water.

A broad network of World Economic Forum constituents has contributed to the ongoing success of this project. In particular, we express sincere appreciation for the foresight shown by the Industry Partners of the Water Initiative Project Board to conceive and develop this publication, and also to members of the Global Agenda Council on Water Security, past and present, for their continuous input to the overall water initiative and this book in particular.

A few special acknowledgments are due. For his vision and determination to grow the Forum's water security agenda, we are indebted to the leadership shown by Peter Brabeck-Letmathe, Chairman of Nestlé SA and Foundation

Board Member of the World Economic Forum. Within the Forum's International Business Council, we are particularly grateful to Indra Nooyi, Chairman and CEO of PepsiCo, Inc., and Muhtar Kent, Chairman and CEO of The Coca-Cola Company, for their extraordinary partnership and commitment to the Forum's work on water. Among our governmental partners we acknowledge with gratitude the long-term support for the Forum's work on water from the Swiss Agency for Development and Cooperation led by Director General Martin Dahinden and his water team at SDC; and our important partnership with the International Finance Corporation, led by Lars Thunell, CEO and his water team at the IFC. Our gratitude and thanks are also given to Margaret Catley-Carlson, Patron of the Global Water Partnership and Chair of the World Economic Forum Water Security Global Agenda Council, 2007-2010. Her contribution to help develop the water agenda through our various convenings and meetings over the past four years has been immeasurable.

This publication also represents the collective input of more than 350 individuals who have engaged in water initiative-related discussions at our various summits and meetings in Africa, China, Europe, India, and the Middle East during 2008–10, as well as in Davos at our Annual Meetings and Dubai at our Annual Meeting of the Global Agenda.

Our thanks to you all.

Finally, for further information, please contact water@weforum.org, or visit www.weforum.org/water.

—Richard Samans, Managing Director, World Economic Forum
—Dominic Waughray, Senior Director, World Economic Forum

Reproduction of Opening Remarks by the United Nations Secretary General Ban Ki-Moon to the Session of the World Economic Forum Water Initiative at the Forum's Annual Meeting in Davos, January 29 2009

Good morning, ladies and gentlemen.

It is a pleasure to see you and pick up the conversation we began here in Davos one year ago.

Lately, I have taken to saying that the past year was one of multiple crises. We have the economic crisis, the food crisis, the energy crisis. To these we can add climate change. All of these crises are still very much with us. They illustrate our world's vulnerability to the shock of diminishing resources. And as you all know only too well, water is very much near the top of the list. Your work is therefore essential and I commend you for it. Over the past year you have come together—academics, business people, government leaders—and put this issue on the global agenda. People are beginning to realize how connected it is to so many challenges—development, peace and security, economic growth. The global public has become increasingly aware how climate change and water scarcity threaten the populations of heavily settled parts of the world. They understand how it breeds conflict. They know how man-made climate change and growing consumption of water are putting unprecedented stress on this dwindling resource. The good news is that we also know how technology can play an important role in mitigating water stress. Many technologies—new and ancient—can improve water, for example, supplying more water from sea-water, harvesting rainfall or deploying new and simple methods of irrigation that save water. Farmers can diversify crops and plant drought-resistant seeds. All this we know. The problem is that we have no coordinated global management authority in the UN system or the world at large. There is no overall responsibility, accountability or vision for how to address the related problems of climate change, agricultural stress and water technology. This is where you come in. Some of you are members of the Global Compact's CEO Water Mandate, which I introduced here last year and has already made substantial progress. I hope many more of you will join. Your work to create a water security Global Agenda Council is essential. So is your effort to develop the economic and geopolitical forecast you are discussing today. For the first time, you are bringing together all the different perspectives and expertise required to define the full dimension of the problem and propose solutions. In doing so, you are creating the framework of a future partnership—bringing together businesses, governments, universities and NGOs. The problem is broad and systemic. Our work to deal with it must be so as well.

I look forward to seeing your work completed. I will help in any way I can.

Foreword

In 1911, John Muir observed how “when we try to pick out anything by itself in nature, we find it hitched to everything else in the universe.” A century later, a gathering of the World Economic Forum discovered the same phenomenon. Four hundred top decision-makers listed the myriad looming threats to global stability, including famine, terrorism, inequality, disease, poverty, and climate change. Yet when we tried to address each diverse force, we found them all attached to one universal security risk: fresh water.

To some degree, water stress is as old as time. But in past societies, scarcity found relief through commerce, as parched regions could import from greener pastures. That pressure valve no longer exists on our hot, hungry, crowded, and fast-evaporating planet. A recent McKinsey & Company study found that within two decades, the collective demand of humans for water will exceed foreseen supply by about 40%. That shortage escalates food prices, disrupts energy, constricts trade, creates refugees, and undermines authority. Thirst is now global.

Our collaboration illustrates where and why water is, quite literally, “hitched to everything else in the universe.” Water infuses not only our ground beef patty, lettuce, cheese, pickles, onions, ketchup, and sesame seed bun, but also the bag and packaging in which that hamburger is provided, the building in which it was grilled, the energy to cook it, and the financial system that lent the franchise capital. River currents turn turbines or grow fuel or cool plants that generate its electrical currents. On fresh water dangles the life or death of five thousand children each day, the clothing they wear, and whether their weak governing state will grow stable or start to unravel. Water is the single constraint on the expansion of every city, and bankers and corporate executives have cited it as the only natural limit to economic growth. What is striking is that the water nexus has remained on the periphery of priorities for so many for so long. This work seeks to transform our often-willful ignorance into intense interest and informed, pragmatic action.

This volume binds decades of collaborative work by seasoned veterans in the contentious yet fascinating struggle to quench human thirst. Yet this landmark book did not emerge overnight, out of nowhere. It builds on years of debate in dozens of meetings, initially gaining traction in an earlier report prepared for the Davos-Klosters Annual Meeting in 2009 titled *The Bubble Is Close to Bursting. Water Security*, however, pushes much further. It presents not only an urgent warning and unique forecast, but also offers positive recommendations; diverse perspectives, profound insights, and pragmatic case

studies by public and private authorities confirm the vital role water can and must play over the next two decades to secure the world's economy.

Water is an astonishingly complex and subtle force in that economy, shaping decisions in ways we only now begin to appreciate. But this much is already clear: if “business-as-usual” water management practices continue for another two decades, large parts of the world will face a serious and structural threat to economic growth, human well-being, and national security. Some will feel the heat sooner than others. Indeed, today we see troubling signs of flash points to come. Against various trend lines in agriculture, energy, climate change, urban growth, infrastructure, population, and environmental stress, this book will argue why we simply cannot manage water in the future as we have done in the past.

In 2009, the Forum's Industry Partners and Global Agenda Council on Water Security united to augment, revise, and strengthen the chapters that form this book's thematic backbone. That same year, the Forum persuaded an extraordinary group of CEOs, water experts, NGO heads, scientists, and international officials to provide insights on the various challenges to our common water future and how we must navigate them.

The next phase of the World Economic Forum's Water Initiative will build on the platform, analysis, and decision-making framework inscribed in this book. Yet the work in your hands is neither definitive nor final. Indeed, *Water Security* is by no means the ultimate word. It merely introduces a fresh tributary into a broad-based and collaborative current, seeking an efficient, productive, and equitable journey towards a natural cycle of rebirth and renewal.

—Margaret Catley-Carlson, Patron,
Global Water Partnership, Canada;
Vice-Chair, World Economic Forum
Global Agenda Council on Water Security

Introduction

The Water-Food-Energy-Climate Nexus: A Facts and Figures Overview

Water security is the gossamer that links together the web of food, energy, climate, economic growth, and human security challenges that the world economy faces over the next two decades.

There is a structural problem in how we manage water across the web of our global economy. Unless it is checked, worsening water security will soon tear into various parts of the global economic system. It will start to emerge as a headline geopolitical issue. The increasing volatility in food prices in 2008, 2009, and again in 2010 should be treated as early warning signs of what is to come. Arguably, it is water that lies at the structural heart of these agricultural challenges: our rapidly accelerating demand for food and fiber is meeting changing rainfall and weather patterns, overlain on land assets with increasingly depleted and polluted rivers and groundwater resources. As economies grow, more of the freshwater there is left available is demanded by energy, industrial, and urban systems. A massive expansion of agricultural land is one option, but this will need to be undertaken in a manner that does not exacerbate greenhouse gas emissions, thereby amplifying the challenge of adapting to changing weather patterns. More crops from much fewer drops is another option. Yet the agricultural sector, particularly in developing countries, often suffers from historically low levels of investment in technology and human capital as well as weak institutions. This means it does not yet have the necessary enabling environment or extraordinary political leadership required to deliver much, much more food and fiber with much, much less water. If we move quickly and together, we can make the needed changes to the system. But a weak international trade regime and a complex arrangement of tariffs and subsidies amplify the cost of crop shortages within the world system.

Why have we got to this state? In many places around the world, we have consistently underpriced water, wasting and overusing it as a result. We have depleted stocks of groundwater at the expense of our future water needs. In effect, we have enjoyed a series of regional water “bubbles” to support economic growth over the past fifty years or so, especially in agriculture. We have not thought through how our global arrangements should reflect water security in their incentives. Trading patterns are out of sync with water resource levels—three of the world’s top-ten food exporters are water-scarce countries.¹ For these and myriad other reasons, we are now on the verge of water bankruptcy in many

places around the world, with no clear way of repaying the debt. In fact, a number of these regional water bubbles are now bursting in many parts of China, the Gulf States, India, the Middle East, the Mediterranean, the southwestern US, and southern Africa, to name but a few regions. More will follow. The consequences for regional economic and political stability could be serious.

This set of regional challenges becomes a fast-approaching global crisis when placed against future needs for water. As the world economy expands, demand for water will inexorably rise and continue to outpace population growth. This means that there will not be enough water to do all the things we want to do as inefficiently as they are done now. Unlike energy, water has no substitutes or alternatives. We simply cannot manage water in the future as we have in the past, or else the economic web will collapse. Food shortages are a serious possibility. Ban Ki-moon, UN Secretary-General, puts it thus: “As our global economy grows, so will its thirst. . . . Water security is not an issue of rich or poor, North or South. . . . And yet there is still enough water for all of us if we keep it clean, use it more wisely, and share it fairly. . . . Governments must engage—and lead. But we also need private enterprise.”²

If we are to ensure sustained economic growth, human security, and political stability over the next two decades, how we manage water is fast becoming an urgent political issue. While businesses and nongovernmental organizations do what they can, water has potent social, cultural, and religious dimensions; it can never be viewed only as a pure economic good. Water requires government engagement in its management and reform. An unfettered reliance on markets will not deliver the social, economic, and environmental outcomes needed. Good regulation in water is indispensable.

The recent financial crisis and its aftermath give us a stark warning of what can happen if known economic risks are left to fester. It shows us that, in today’s world system, wide collaboration, although difficult, is the only effective way to address a widespread crisis. It also offers us an opportunity: led by government, a multistakeholder effort to improve the management of our future water needs stands out as an urgent, practical, and resolvable issue that, in times of economic austerity, can bring state institutions, business, and civil society together to address commonly (and often locally) felt challenges.

Growing water problems are recognized by rich and poor alike around the world as real issues that affect our businesses, our lives, and our health. In this respect, the effects of water security, with its strong social, cultural, and economic dimensions, can be seen at both very local levels (when a well or river runs dry) and through today’s networked and mass media at very global levels (the recent Pakistan floods, for example). Water security issues, whether too little over long periods of time or too much all at once, create emotive reactions from all sectors of society. Water is an environmental issue unlike any other.

Water also lies at the heart of a nexus of social, economic, and political issues—agriculture, energy, cities, trade, finance, national security, and human livelihoods, within rich and poor countries alike. Water is not only the indispensable ingredient for life, seen by many as a right, but also indisputably an economic and social good unlike any other. It is a commodity in its own right with no substitute and no alternative, but it is also a crucial connector between humans, our environment and all aspects of our economic system.

Collected together in this book for the first time, leaders from government, religious groups, businesses, NGOs, academics, entrepreneurs, financial experts, journalists, trade specialists, and many others share their perspectives on the common water challenge we face. Issue by issue, they set out the case for how crucial it is to overhaul our management of freshwater to meet our future social and economic needs.

In chapters 1 through 9, the following sectors are explored:

- Agriculture
- Energy
- Trade
- National Security
- Cities
- People
- Business
- Finance
- Climate

Each of these sections builds on earlier World Economic Forum reports on water³ and is supported by contributions from leading social, academic, NGO, and business figures or other commentators who have been involved in the Forum's Water Initiative, the Forum's Global Agenda Council on Water, or other related Forum water events over the past few years.⁴ Each section is framed within the context of a description of what the situation might be by 2030 if nothing is done, and then an exploration of what options exist for what can be done today.

As you read the following pages, it will become clear that the various commentators place their concerns not in terms of poverty and social justice alone, but also within a wider geopolitical and political-economic context: water security is arguably the arriviste issue in national security and global affairs. Across the contributions, the proposition resonates that water is no longer a niche technical or environmental issue. In the fast-changing world we can see stretching out to 2030, it is increasingly clear that our political, economic, and social stability into the 21st century will depend as much on how we manage our freshwater resources as it will on any of the other well-

recognized “hard power,” global security issues of the 20th century, such as terrorism, nuclear proliferation, and fossil-fuel security.

In short, the first nine chapters of the book set out the emerging realization of the extent to which water security underpins and connects the food, fiber, fuel, urbanization, migration, climate change, and economic growth challenges the world system faces at least through 2030, if not beyond.

In the final three chapters of the book, attention is turned to what can be done. Happily, and unlike many other issues we seem to face these days, there is the beginning of a good-news story here. These chapters explore breakthroughs in the development of a new economic fact base on water for governments; experiences in developing public-private coalitions that can work with governments to take action on water; and finally, a conclusion that sets out a major next step for the World Economic Forum Water Initiative with the Water Resources Group.

It is clear that governments can (and must) play a leadership role in setting frameworks for improved water management, but many other stakeholders have to also play a role in delivering solutions. This multistakeholder challenge means that coalitions are required—public-private-civil alliances commonly focused on meeting the water security challenge, each leveraging their own comparative advantage within a shared policy framework.

Yet coalition building is not easy. It is beyond the ability of an international agency, an NGO, a think tank, a farmers association, a trade union, or a company to create a “neutral convening” process to build a multistakeholder coalition to address the water security challenge in a properly holistic manner. And even governments find it sometimes difficult to do. Whoever takes the lead, the others suspect (rightly or wrongly) a particular agenda. Power politics dictate that the convener would treat not all stakeholders equally. Transaction costs are high, pace can be slow to start with, and trust takes time to build.

Finding effective ways to help governments take the lead in improving water security must be central in any process that aims to address these difficult issues. Throughout this book, all commentators agree that new arrangements have to be found that allow governments to be confident that citizens, civil society, business experts, and international agencies can work together with them to resolve the accelerating water security challenge in a practical way. We need new approaches. According to Indra Nooyi, Chairman and CEO of PepsiCo: “Water sits at the nexus of so many global issues . . . including health, hunger, and economic growth. And sadly, water scarcity takes its greatest toll on society’s least fortunate. I am absolutely convinced that the only way to measurably and sustainably improve this dire situation is through broad-scale collaborative efforts between government, industry, academia, and other stakeholders around the world.”⁵

As a result of sustained discussions on this issue over the past five years, such as at the World Economic Forum annual and regional meetings (in particular at the Annual Meeting in Davos-Klosters in 2008 and again in 2010), and through the impact of other significant developments and initiatives (such as the UN CEO Water Mandate⁶ and the International Finance Corporation–led 2030 Water Resources Group⁷), several governments are now indicating their readiness to champion such fact-based public-private-expert discussions. Some argue we are now on the cusp of change.

To build on this newfound momentum, proof points or case studies on how to actually make these new coalitions and transformations happen are urgently needed. Confidence needs to be created, especially for governments, that there are practical and fact-based ways of addressing this complex and multifaceted challenge. This is the objective of the next stage of the World Economic Forum's Water Initiative and its partnership with key international analytical initiatives, such as the Water Resources Group.

The following pages are certainly not meant to contain the last word on the water security issue. Instead, by drawing on a range of different viewpoints, and based on the multistakeholder ethos that lies at the heart of the World Economic Forum, the intent of this book is to simply set out for the reader the following:

- first, through a selection of expert perspectives, an exposition of the complex set of challenges we face across our economy in managing our future water needs when looking forward over the next two decades;
- second, what the implications of these challenges to our social, economic, and political well-being may be if we fail to act, based on the best and current thinking on forecasts and growth trends;
- third, some emergent approaches for tackling the problem, including an introduction to a major initiative being undertaken by the World Economic Forum in alignment with many other actors.

As a result, this book should be viewed as the start and not the end of a journey: an opening to a doorway that lets us peep into the forecasted world of 2030 if we fail to address the challenge of water security, and which shines a light on a possible new pathway we might follow in order to avoid this future. Available online on a wiki platform, as well in a hard copy book format, it is our hope that this introduction to the water security issue will encourage you to reflect, research, and then add your thoughts and experiences to the perspectives captured here. The aim is for this text to become a living document that gets added to as the journey towards managing our future water needs progresses over the next few years. The work will be returned to and updated

in two years to explore how the issues have developed, hopefully with your contributions captured, too.

The aspiration for this door opener into the water security issue is that when you have finished this book, you will think about water in a rather different way than when you began. To help you start the journey, the remainder of this section gives some facts and figures on water and how it sits at the nexus of food, energy, trade, economic growth, climate change, and other issues.

The Water-Food-Energy-Climate Nexus

Analysis from McKinsey & Company as part of the 2030 Water Resources Group report⁸ provides this clear and basic primer to the global water challenge through 2030:

- Globally, agriculture accounts for approximately 3,100 billion m³, or 71% of water withdrawals today, and without efficiency gains this will increase to 4,500 billion m³ by 2030.
- Industrial withdrawals account for 16% of today's global demand, growing to a projected 22% in 2030. The growth will come primarily from China (where industrial water demand in 2030 is projected at 265 billion m³), which alone will account for 40% of the additional industrial demand worldwide.
- Demand for water for domestic use will decrease by 2030 as a percentage of the total water withdrawals, from 14% today to 12% in 2030, although it will grow in specific basins, especially in emerging markets.

A common theme running through this book is how these different but growing demands on water also connect with one another. Based on work developed over the past three years by the World Economic Forum's Global Agenda Council on Water Security, and developed through wider collaboration with other Forum stakeholders, a better understanding of this water-food-energy-climate nexus and the implications it presents for political, civil society, and business decision-makers through 2030 is now beginning to emerge. If water is essential for all the core drivers of economic growth, we cannot afford to have our resources fail.

The vignette below is a first attempt to bring together some of the relevant facts and figures. Much of this information was presented in a paper prepared in August 2010 for the World Economic Forum's International

Business Council (IBC), a group that comprises one hundred of the world's top CEOs.⁹ As a result of discussions on the nexus issue, led by the Global Agenda Council on Water Security, within the wider Global Agenda Council network of experts, the IBC and elsewhere, awareness is rising on how interconnected the issues of water, energy, food, and climate actually are.

Deepening our understanding of these interlinkages and developing the new arrangements they will require will likely form a core part of the global, regional, and business agenda in the coming years, if we are to move onto a pathway of sustainable growth. Addressing our water security, so as to manage our future water needs for economic growth, increasingly stands out as a practical place to start.

A Facts and Figures Overview

The world's food, water, and energy resources are already experiencing significant stress or shortfalls—and yet, in the next twenty years, demand for these resources is projected to increase significantly as populations, economies, and consumption rates grow. The world appears ill equipped for the changes, investments, and trade-offs that will be required to meet that demand. Meeting our future food, water, and energy needs therefore presents a very real growth conundrum. The highly interlinked nature of these issues is particularly challenging, as it requires comprehensive solutions coordinated among diverse stakeholders who often lack the incentives or institutional structures required for effective action. A common thread running through this nexus is water.

Rapid Growth Will Intensify Global Demands for Food, Water, and Energy in the Next Twenty Years

In the coming decades, several significant global trends will intensify demand for food, water, and energy resources. These demand drivers include the following:

- **Population growth:** World population is expected to rise from the current 6.83 billion to 8 billion in the next two decades, largely in the developing world. By 2050, the combined population of Europe, the US, and Canada will account for only 12% of the global total.¹⁰
- **Economic growth:** This will be driven largely by emerging markets—the World Bank estimates 6% growth in developing countries in the medium term, compared to up to 2.7% in higher-income countries.

If historic trends continue, the proportion of global GDP produced by Europe, the US, and Canada will be less than 30% by 2050, compared to 68% in 1950.¹¹

- **Urbanization:** More than half the world's population now lives in an urban environment. There are twenty-four megacities with more than ten million people, seventeen of which are in developing countries. China already has more than one hundred cities with more than one million inhabitants; India has thirty-five; and the US has nine. By 2050, China's cities will house 73% of its population (up from 46% today), and Indian cities will encompass 55% of its people (up from 30% today).¹²

A growing, increasingly prosperous, and rapidly urbanizing global population will demand more food, energy, and water resources to meet its needs. Expected trends will include:

- **Increased food demand and changing diets:** The world's growing population, much of it more prosperous and more urban, will demand more quantities and different types of food. To meet growing demand in the next twenty years, farmers will need to increase production by 70–100% and reduce postharvest loss. Changing diets—driven by rising incomes and other shifts—will increase demand for resource-intensive products such as meat. Global demand for meat will increase 50% by 2025, helping to drive a foreseen increase of 42% in grain demand.¹³ In a world where nearly one billion people suffer from hunger or malnutrition, existing food and agriculture systems seem ill prepared to meet these challenges. Increased production alone will not solve the problem of hunger, which also results from lack of access or purchasing power by the poor.
- **Increased demand for energy:** The International Energy Agency forecasts that the world economy will demand at least 40% more energy by 2030 compared to today.¹⁴ McKinsey & Company in its work for Project Catalyst estimate that 77% of the requisite energy infrastructure has yet to be built. By 2030, China will need to expand its power-generating capacity by more than 1,300 GW (1.5 times the current level of the US), and India by 400 GW (equal to the current combined power generation of Japan, South Korea, and Australia).¹⁵ Increasing access to energy is a priority for many countries—1.5 billion people in the developing world lack access to electricity, and more than 3 billion rely on biomass for heating and cooking.¹⁶

- Accelerating rates of water use: As we get richer, we get thirstier. Between 1990 and 2000, the world's population grew by a factor of four, but freshwater withdrawals grew by a factor of nine.¹⁷ This means that withdrawals of water through 2030 will increase much more quickly than does global population, as people get wealthier and consumption patterns rise. Recent analysis suggests the world could face a 40% shortfall between water demand and available freshwater supply by 2030.¹⁸ Many countries are already extracting groundwater faster than it can be replenished (Mexico by 20%, China by 25%, and India by 56%).¹⁹ If current trends continue, by 2030 two-thirds of the world's population will live in areas of high water stress.²⁰

The Pressure On Water Resources as the World Economy Grows Will Be Particularly Intense

Increasing water scarcity could cause annual grain losses equivalent to 30% of current world consumption (recall, this is at the same time as we want to increase food production by 70–100%). It may be difficult to augment more surface water to overcome these challenges.²¹ The amount of water impounded behind dams has quadrupled since 1960, with recent estimates placing the volume of water trapped behind (documented) dams at 6,000–7,000 cubic kilometers. At the same time, water withdrawals from rivers and lakes have doubled since 1960.²² Related to this, cross-border water management issues have become geopolitical flash points in numerous regions. Yet, as demand continues to grow, competition for water will inexorably intensify between economic sectors, as well as between geographies. Where regional economies are growing fastest, demand for water for energy and industrial use is projected to rise sharply between 2000 and 2030 (56% in Latin America, 63% in West Asia, 65% in Africa, 78% in Asia).²³ Recall that across these regions, on average, 70% of water is already allocated to agriculture. How to square these seemingly impossible circles?

The effects of climate change—and the potential for poorly constructed policy responses to it—will accelerate the pressure on these challenges. Even the most conservative models predict that climate change will likely impose additional pressures on water demand, availability, and accessibility, tightening the margin between average water supply and demand. Climate change threatens major mountain glaciers, which act as the world's largest freshwater banks, feeding principal rivers and providing water to more than two billion people in Asia alone. In the 1990s, the Himalayan glacial mass shrank at three times the rate of the previous decade; given current trends, these

freshwater glacial banks may largely disappear by the end of this century.²⁴ While estimates vary and predictions are difficult, climate change may reduce agricultural yields in developing countries as a whole by 10–25%, including up to 40% in India alone—affecting not only food supplies but also employment and income.²⁵ The sector employs up to 65% of the global labor force and contributes up to 29% of GDP; significant losses in agriculture are likely to have substantial economic effects, particularly for the poor, which in turn may fuel further resource degradation.²⁶

These Issues Are Highly Interlinked, and Thus Must Be Addressed in Tandem

More complicated still, these various issues are all highly interlinked, and solutions to one can in fact worsen another. Currently, 70% of the world's freshwater withdrawals are used for agriculture,²⁷ and it takes one liter of water to grow one calorie.²⁸ This means that a near doubling in food production will not be sustainable without significant—perhaps radical—changes in agricultural water use. Yet energy production is the largest industrial user of water, and expanding energy production requires more access to freshwater. For example, in the US, energy demand is forecast to increase 40% by 2030.²⁹ The US Geological Survey estimates that to produce and burn the one billion tons of coal Americans use each year, the mining and utility industries withdraw between 208 and 284 trillion liters of water annually. That's equal to about half of all freshwater withdrawals in the US today.³⁰ An increase in energy demand by 40% using current energy systems could translate to an increase in freshwater access needs by 165% according to some estimates.³¹ How will this be achieved under business-as-usual approaches? Department of Energy officials have told the US Congress that future energy production will be dependent on water access.

The International Energy Agency forecasts that more than 75% of the increase in energy use from 2007 to 2030 will be met through fossil fuels, especially coal. By 2050, the resulting carbon emissions could lead to a concentration of carbon in the atmosphere (one thousand parts per million) that is more than double that which international negotiations are currently struggling (and failing) to achieve.³² The resulting rate of global warming would exacerbate water scarcity and affect food production.

By 2030, hydropower will become the world's dominant renewable energy source, providing more than twice the amount of its nearest rival, onshore wind power. About 170 GW of hydropower is currently under construction, 76% of this across Asia.³³ But as hydropower is estimated to evaporate about seventeen cubic meters of water per megawatt hour³⁴ (compared to between 0.7 and 2.7 cubic meters of water per megawatt hour in closed loop cooling

thermal electric power plants), the new hydropower capacity in Asia alone could lead to the evaporation of thousands of kilometers cubed of water from its reservoirs.

When water use is taken into account together with carbon emissions, some renewable energy sources begin to look less sustainable. It is not just hydropower. In the case of shale gas extraction, which is water-intensive and can pose a risk to water quality, US legislators and regulators are already expressing concern. Similar concerns are arising over the water requirements for concentrated solar thermal plants. In fact, thirty-five such plants in the California/Nevada desert are currently in negotiations with state regulators to try and get the water they need for cooling. One plant alone requested 4.9 billion liters, or 20% of the water in the local valley.³⁵

Policy decisions can help, but in some cases they can make matters worse. Due to policy incentives designed to reduce vehicle emissions, by 2030 the International Energy Agency predicts that at least 5% of global road transport will be powered by biofuel—more than 3.2 million barrels per day.³⁶ But producing those fuels could consume between 20% and 100% of the total quantity of water now used worldwide for agriculture.³⁷ This is clearly an unsustainable trade-off in terms of both water consumption and land use, as fields are converted to grow fuel rather than much-needed food crops.

This difficult reality is fast complicating the standard definition of “sustainable” energy. Do governments pursue increased energy access at the expense of decreased water access, or zero-carbon or zero-water energy policies, or must all be pursued simultaneously? Energy security and water security thinking are not yet aligned. But such multiple goals will become a necessity—raising the prospect of a future in which we may track both energy and water intensity per unit of GDP with equal vigor.

Cross-border Trade and Investment Can Help in Theory, but Are Problematic in Practice

For countries facing water resource shortages, trade—in theory—should be a viable solution. For example, countries can import “virtual water”—buying one kilogram of wheat from abroad rather than using 1,300 kilograms of water to grow it at home.³⁸ Trade in virtual water would then allow domestic water to be allocated away from irrigation and towards higher-value industrial and energy uses to help the economy grow. Some estimate that by trading in virtual water, Asia could reduce its water use for irrigation by up to 12% through increased cereal imports.³⁹

But by 2030, due to the growth of their industrial and energy sectors, all countries in South Asia, the Middle East, and North Africa will be facing such

trade-offs for domestic water use. Ideally, the 2.5 billion inhabitants of these regions would be able to turn to the world trade system to meet their food and fiber needs, so that they could allocate more domestic water to energy and industry. The international trading regime is, however, ill prepared for such a spike in demand for agricultural trade. In fact, agricultural exports had declined to just 9% of international trade in 2001;⁴⁰ staples in particular are thinly traded, as seen in the price volatility of wheat, sugar, rice, and other commodities during between 2008 and 2010. As mentioned above, trading patterns are also out of sync with water resource levels, as three of the world's top-ten food exporters are actually water scarce, and three of the top-ten food importers are water rich.⁴¹ While climate change may increase productivity in northern regions, some irrational and historically more protectionist trade regimes may limit other countries' access to those gains.

Without Effective Policy Frameworks, the Scramble for Resources May Drive a Retreat from Globalization

Unable to rely on trade to ensure their food security, fast-growing economies that need to secure food supplies are increasingly striking land-lease deals with poorer nations that have fertile, well-watered land. Between 2006 and 2009, the media reported deals totaling more than twenty million hectares in developing countries.⁴² Most are government-to-government deals with state-owned enterprises or investment companies acting as agents. Japan now has three times more land abroad than at home. Saudi Arabia, Kuwait, South Korea, and China have secured deals in Sudan, Ethiopia, DRC, and Pakistan. Libya has secured an oil-for-land deal with Ukraine.⁴³ Some NGOs report that countries such as Cambodia, Laos, and Sudan are leasing significant amounts of land to external investors while still receiving food aid.⁴⁴ In effect, one could better view these so-called land grabs as water grabs. The purchasing countries have plenty of land; what they are short of is water.

Regional and international organizations are trying to address the issue and define acceptable frameworks for such investments. But given forecasted resource trends, the scale and volume of such deals may well increase rapidly in the next two decades, with water-rich areas capturing significant investment from water-scarce countries. The growth in these bilateral arrangements could diminish the influence of many multilateral organizations with responsibilities for managing water and the environment. Further, as more deals like this occur, wider implications about securing and sustaining equitable water access for others (such as local society, business, ecosystems, etc.) who may share the river basin with these new arrangements could emerge, creating flash points in times of water scarcity.

The scramble for resources will generate new geopolitical dynamics, potentially coalescing around national interests and alliances, thereby bringing a retreat from multilateral globalization. The roles of international organizations may be thrown into question. Global companies, too, may face a baffling new landscape where the rules have significantly changed—or where there are no rules at all.

The challenges of natural resource scarcity—food, water, and energy—are closely interlinked, and policy and other attempted solutions must take this into account. But taking an integrated view of such issues is highly challenging to most institutions, given the complexity and cross-sectoral approach required. The political commitment necessary to take bold action is often hard to muster.

A Bold Shift Is Required to Transform Crisis into Opportunity

Finding sustainable growth models that can work across these issue areas while sustaining a global economic recovery will be challenging, but it is possible. Technical investigation, economic analysis, and policy formulation need to become much more interlinked. It is becoming clear that pursuing a low-carbon development path, for example, while crucial, must also be set in a wider context for sustainable growth, including water security. Growth strategies must accommodate the interrelated environmental constraints as well as meet the aspirations of countries and individuals for social and economic development. This means the new models must also generate more and better jobs and income opportunities if social cohesion is to be maintained in an ever more crowded and interconnected world. The new Green Growth paradigm, championed by South Korea, offers a useful new approach.

While the transition in political, economic, and business thinking is just beginning, the challenge of this water-food-energy-climate nexus is arguably larger and more systemic than any one business or government can deal with on its own; a wholesale shift is required. Coherent policies across a range of portfolios, as well as socially buttressed, stable policy frameworks and investment climates, will be crucial for a successful transition. The creation of multistakeholder platforms can help to generate the necessary consensus and also engage the wide range of expertise and implementation capacities that effective responses will require. Designing them to move from analysis to convening to transformational reforms (“ACT”) can help focus such diverse groups on making an impact. These are the kinds of “new normative approaches” that will be required,

This is a difficult agenda for governments to lead by themselves. In this challenging and complex landscape, civil society and business leaders can play

an important and constructive role to support governments in a comprehensive water-food-energy-climate reform process by driving progress along several tracks:

- sharing and developing knowledge among relevant stakeholders to access the best available data and developing common frames of reference on the need for solutions;
- innovating new business models that address resource challenges through new technologies, investments, or efficiency gains;
- initiating or engaging in policy dialogue with other stakeholders to develop broad-based support for effective policy frameworks and incentives;
- demonstrating leadership commitment to develop market-based solutions and forming partnerships and collaborations with other relevant stakeholders to implement them.

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