# Blue Books

**Experts' views for expert investors**

**Global**

**Environment**

**January 2006**


**Nick Cashmore**
nick.cashmore@clsa.com
(852) 26008279

Guest authors:

**The Pacific Institute**

**Peter Gleick**
pgleick@pacinst.org

**Jason Morrison**
jmorrison@pacinst.org

**Bio-Era**

**James Newcomb**
jnewcomb@bio-era.net

**Todd Harrington**
tharrington@bio-era.net


# Remaining drops

## Freshwater resources: A global issue

## Straight to the source with CLSA

When industry innovations change as quickly as they are created, your ability to respond could mean the difference between success and failure. In this volatile environment, why rely entirely on broker research when you can tap into unfiltered, unbiased primary research?

**CLSA U is a value-added executive education programme created to allow you to gain firsthand information and draw your own conclusions and make better informed investment decisions.**

CLSA U offers tailored courses on a broad range of macro themes with a special focus on technology and telecoms. The format ensures you learn as we do and obtain firsthand information about prospects and trends in industries and sectors that underline the companies in your portfolio.

**You will interact and learn from the trailblazers at the centre of today's fastest moving industries - experts, engineers and scientists who design, implement and shape the new technologies today, which impact the market tomorrow.**

CLSA U is not a one-off event. It is an ongoing education programme restricted to CLSA's top clients. The syllabus will constantly evolve to meet your needs and help you debunk the latest technologies, investment styles and industry trends that affect the markets and sectors you invest in.

**For more information, email clsau@clsa.com or log on to www.clsau.com**

## About the Pacific Institute

The Pacific Institute is an independent, non-profit research institute dedicated to protecting our natural world, encouraging sustainable development and improving global security. Founded in 1987 and based in Oakland, California, we provide research and policy analysis on issues at the intersection of development, environment and security. The Pacific Institute currently has five main areas of research: Water and Sustainability, Environment and Security, Community Strategies for Sustainability and Justice, Economic Globalization and the Environment, and Global Change. More information on our programs, publications and staff can be found online at www.pacinst.org or contact 1-510-251-1600.

## About Bio-Era

Bio Economic Research Associates (Bio-Era) is a leading provider of independent research and advisory services on the emerging bio economy. Bio-Era's mission is to help decision-makers understand and respond to the economic risks and opportunities arising from human-induced changes to biological systems. The firm's practice areas include biosecurity, bioenergy and biotechnology. For more information, visit www.bio-era.net or contact Stephen Aldrich at 1-617-876-2400.

# Foreword

*The lack of water is one of the two most worrying problems for the new millennium, the other is global warming*

United Nations Global Environment Outlook 2000

Water is *the* scarce resource of the 21st Century. Of the many things that we take for granted in life, clean air and water rank among the highest. There is no substitute for water. While the quantity of water is finite, demand is inelastic and rising.

Water covers two-thirds of the world's surface, yet most of it is not usable or too hard to reach, indeed only 0.08% of the Earth's water is consumable by humans. Thus, water is a scarce resource whose premium is set to rise.

Statistics on the scarcity of clean water are mindboggling. One person in five across the world has no access to safe drinking water, and one in two lacks safe sanitation. Even the Chinese government admits that 300m people drink contaminated water every day there and 75% of the water that flows through China's urban areas is not safe to drink, a situation highlighted by the recent catastrophe in Harbin. The lessons of Harbin and elsewhere are that government inaction means Asians are paying for prosperity with their health.

Water demand is a function of population growth, urbanisation, agriculture, industrialisation and energy consumption. With 60% of the world's population, Asia faces tremendous challenges providing clean potable water to a rapidly urbanising population. According to the United Nations, almost half of the region's forecast 4.5bn people are expected to live in urban areas by 2020.

Consequently, there is an enormous need for water investment to supply and support water use in major metropolitan areas to treat water and provide filtration services. As has been the case with other previously considered public goods, governments are increasingly turning to the private sector to fund investment.

There is plenty of anecdotal evidence to support a new market-based approach to managing water as a resource is needed. Aside from Harbin, Thailand has also gone though a severe drought lately, while irrigation and industrialisation mean the Yellow River, the cradle of Chinese civilisation, now runs dry for a large part of the year.

The purpose of this report by the Pacific Institute and Bio-Era is to examine the challenges facing policymakers relating to the provision of water. Understanding these issues is vital if investors are to assess and address the growing business risks and opportunities posed by the scarcity of water.

To complement this report, we have included the universe of water-related companies listed in Asia (see Appendix). While CLSA covers only a handful of these stocks, we firmly believe the sector will offer attractive investment opportunities in the time to come.

**Nick Cashmore**
**CLSA Asia-Pacific Markets**

# Contents



# Preface

Corporations and institutional investors face new risks and challenges relating to water. Uninterrupted access to reliable, affordable and clean water is now a critical issue for the investment and corporate communities because of the increasingly significant effects that water-resource availability and quality are having on economic growth and activity, paths to development and markets around the world.

In recent years, multinational corporations have had to close major factories or change operations because of scarce water resources, community action, water-quality concerns and disputes over demand for water. At the same time, poor, high-risk investments have been pursued, while key investment opportunities have been overlooked.

This assessment outlines key trends in water use and availability, describes new water-related risks and identifies strategies the financial community can take to assess investment opportunities and dangers and to reduce the risks they face. Understanding these issues is vital if investors, companies and policymakers are to successfully address the growing business, social and environmental risks posed by water problems.

**Peter Gleick**
**Jason Morrison**
**The Pacific Institute**

**James Newcomb**
**Todd Harrington**
**Bio-Era**

# Remaining drops

## Freshwater resources: A global issue

**Water is vital to all human activities from basic survival to complex industrial production**

Water resources are vital to all human activities from basic survival to the most complex industrial production. In recent years, a broad set of national and international water issues has begun to receive significant attention. In part, this is due to a growing understanding of the complex interconnections between water and many other major issues, including energy, climate, economic development, environmental health, and peace and security. Governments, media and decisionmakers are increasingly focusing on conflicts over supply, problems with water quality, responses to extreme events and sociopolitical tensions over water privatisation and globalisation.

**Corporations and institutional investors face water-related risks and opportunities**

Corporations and institutional investors face risks and opportunities relating to water. The challenges include changing water allotments, more stringent water-quality regulations, growing community activism and increased public scrutiny of water-related private-sector activities. These factors affect site selection, license to operate, productivity, costs, revenues and, ultimately, profits and corporate viability. Opportunities for businesses and investors include access to multibillion dollar markets for water supply and treatment equipment, improved public perception and goodwill and reduction in supply-chain risks for forward-thinking companies.

**Yet they are generally unfamiliar with the measures available to reduce/capitalise on them**

With few exceptions, corporations and investors are unfamiliar with freshwater-related risks or opportunities and are unfamiliar with the range of measures available to reduce or capitalise on them. Neglecting water factors is not prudent. Indeed, evaluating risks related to water is vital for sectors where water plays an important role in production and operations or in the supply chain. Understanding opportunities may offer unusual or unexpected rates of return. It is increasingly critical that investors, managers and directors work toward a better understanding of the business sectors with the greatest exposure to water-related problems and of approaches for reducing their exposure. Ultimately, organisations that fail to think strategically about water will find themselves embroiled in highly public and emotionally charged disputes over a resource considered by many to be a basic human right.

This paper provides a snapshot of current global water issues, assesses the water-related risks and opportunities most relevant for the private sector, and describes the general kinds of activities the business community could and should be taking to address them. We offer here both background on these issues and some strategies to assess investment opportunities and dangers and to reduce the risks they face.

**A snapshot of current global water issues, risks and opportunities**

In summary:

- ❑ Water resource issues will be important factors affecting corporate performance for specific industry sectors and companies in coming years.
- ❑ Water availability and quality will be an increasingly significant driver of national/regional competitive advantage and growth in coming years.
- ❑ Water-related equipment, systems and management services will offer investment opportunities in some regions, with varying degrees of risks and returns.

**Northern China and parts of India are areas of Asia at risk of severe water-supply problems**

- Some major regions are at risk of severe water-supply problems in the decade ahead, including parts of the Asian subcontinent such as northern China and parts of India. These supply problems are the result of several integrated factors, including economic and population growth, depletion and contamination of groundwater resources, a lack of water governance capacity and climate-change related changes in freshwater availability.
- While the trend toward privatisation of water utilities will continue to take place, especially in Asia, we see "full privatisation" as a risky investment. Other private investment opportunities, such as more limited project-based public-private partnerships (ie, build-own-operate-transfer approaches (BOOT)) may offer investment opportunities, but these will require careful evaluation using new criteria.
- The entry of major multinational corporations such as GE, Siemens and 3M into water services and related technology areas will continue to drive consolidation in this field.
- The ability to finance projects may be a critical success factor for companies providing water project services and technology in rapidly growing markets such as China.
- Corporate water use will be subject to increasing public scrutiny and, sometimes, criticism. This has already affected several major multinational corporations, leading to losses of tens of millions of dollars and incalculable damage to brand reputation.
- Water risks in the corporate supply chain are often overlooked or ignored, posing some significant and material future risks for those companies.

**Identifying and managing water-related risks will enhance competitiveness**

- Companies taking steps to identify and manage their water-related risks are likely to improve their competitive position through increased operational performance and exploitation of strategic opportunities.
- Desalination is a significantly growing market with opportunities and risks.
- Home water purification is a significantly growing market and offers opportunities and risks.
- Water efficiency services business is an underdeveloped market.
- In most areas, the water-related risks of global climate changes are currently modest, but these risks are growing and are likely to be substantial in some regions and for some industrial sectors.

# Water in the 21st Century

**Businesses face new water-related challenges**

Businesses face new challenges related to water. During most of the 20th Century, commercial or industrial access to water was taken for granted or ignored, even in regions with scarce supplies. The high value of most industrial production compared to agricultural production, the relatively low volumes of water often required and the ability of the industrial sector to pay substantial price premiums, made water resources a relatively minor factor in production.

These circumstances are changing. Indeed, the availability of safe and adequate water may be as crucial to economic development for some sectors in the coming years as access to oil was to development in the 20th Century. There are important trends and factors that are behind these growing water-related risks; we describe here six major themes and trends that have a direct bearing on the business community:

**Six major themes and trends with a direct bearing on business**

- Increasing demands on limited resources.
- Changing valuations of water create controversy.
- Environmental impact is intensifying.
- Climate change is worsening water uncertainty.
- Emerging role of the public in water policy.
- Water privatisation.

## Increasing demands on limited resources

**Freshwater resources are under pressure**

The world's freshwater resources are under pressure from growing populations and significant increases in agricultural and industrial demand for water. Growing demand is increasing competition for this fixed resource, raising new concerns about water quality and contaminants, and fostering greater levels of public participation and concern about local control and management.

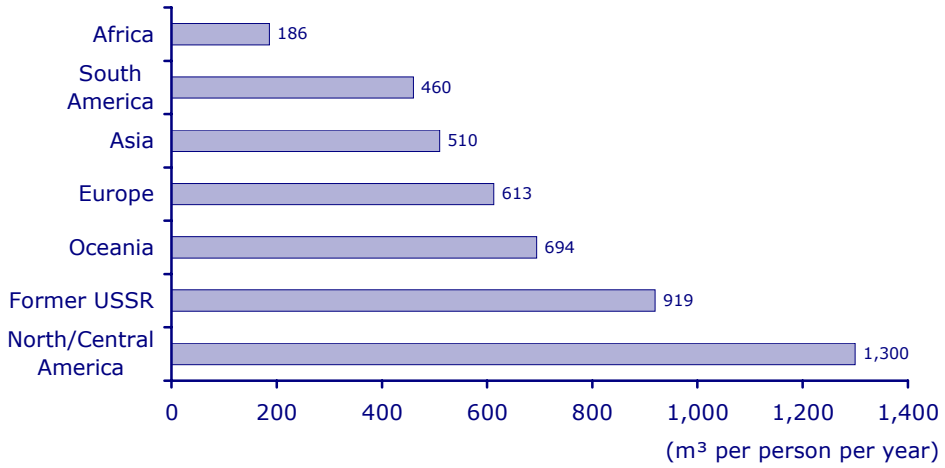
Access to freshwater is highly variable from region to region, as is regional use. While most industrialised nations have well-developed physical and institutional systems for managing water, most developing regions still lack reliable water systems. And even in wealthier regions, access to water is increasingly political. Figure 1 shows water withdrawals per person by broad continental areas for 2000, showing the great disparities in regional water use. Even greater disparities can be seen for water-use by country. Figures 2 and 3 present per-capita withdrawals for a small number countries in Asia and Europe, respectively, showing the wide differences.

Today, the World Health Organisation estimates that more than a billion people lack reliable access to clean drinking water and 2.6 billion lack adequate sanitation. About one-third of the world's population lives in countries with moderate to high water stress (ie, where water consumption is more than 10% of the renewable freshwater supply). The problems are most acute in Africa and West Asia but lack of water is already a major constraint to industrial and socioeconomic growth in many other areas, including China, India and Indonesia.[1] According to the United Nations, if present consumption patterns continue, two-thirds of the world's population will live in water-stressed conditions by the year 2025.

**Great disparities in regional water use**

Figure 1

**Water withdrawals by continent (per capita, 2000)**




**Even greater disparities between countries**

Figure 2

**Water withdrawals for selected countries in Asia (per capita, 2000)**

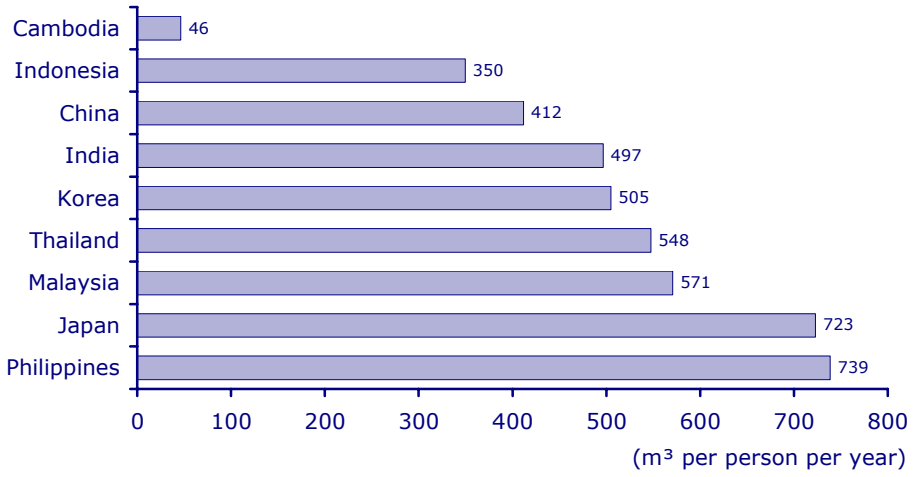
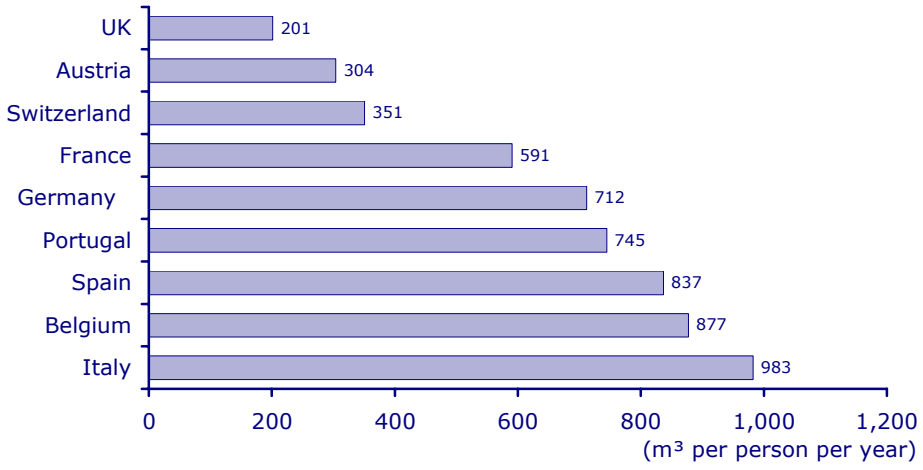



Figure 3

**Water withdrawals for selected countries in Europe (per capita, 2000)**

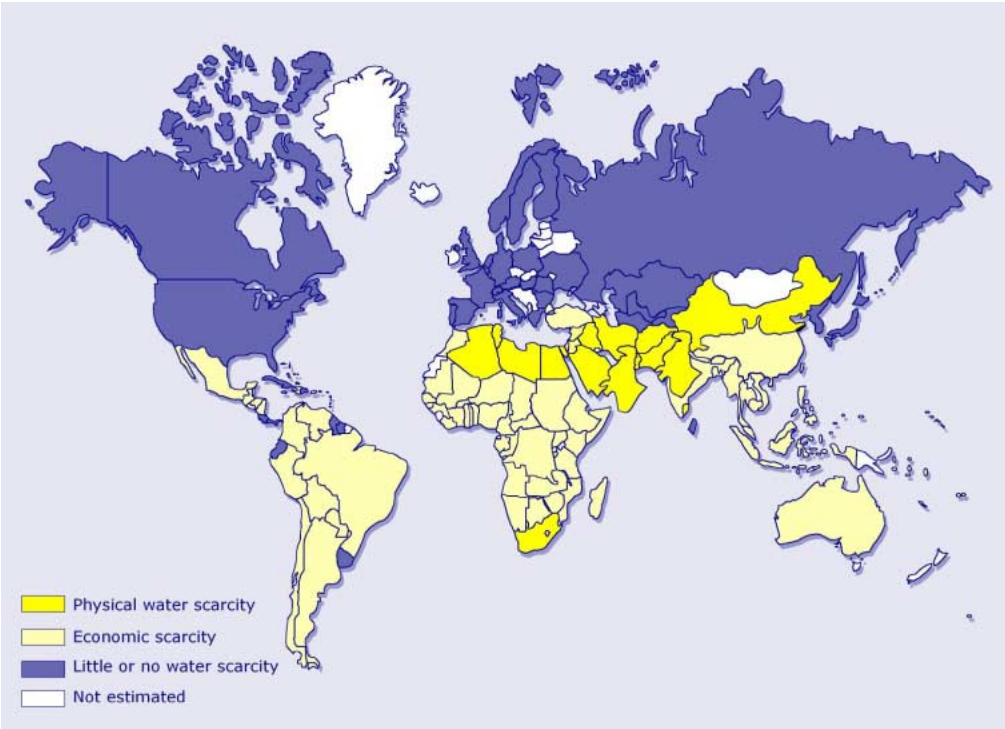



Source: Gleick et al, *The World's Water 2002-2003*

Figure 4

**Projected water scarcity in 2025**

**Most of Asia endures economic water scarcity; parts of China and India suffer physical scarcity**




Source: International Water Management Institute

**Governments unlikely to meet UN goals for expanding water access**

A lack of clean drinking water leads to nearly 250 million cases of water-related disease and between 5 and 10 million deaths every year. To meet the Millennium Development Goals adopted by the United Nations and most countries, the number of people served by water supply must increase by 1.6 billion (32%), and those served by sanitation must increase by 2.2 billion (59%).[2] These goals for the year 2015 are unlikely to be met given current efforts and commitments.

**Human use of available freshwater may rise from half to 90% by 2025**

At the same time, the amount of water required to secure food for a growing population is likely to increase. The United Nations Food and Agriculture Organisation (FAO) predicts irrigation water withdrawals in developing countries will grow by 14% by 2030.[3] And of the 93 developing countries surveyed by the FAO, 10 are already using more than 40% of their renewable water resources for irrigation - a threshold used to flag the level at which difficult choices must be made between countries' agricultural and urban water sectors. Likewise, industrial water demands are expected to rise at rates that parallel, if not exceed, population growth. According to the International Monetary Fund and other researchers, humans already use more than half of the world's available freshwater. By some estimates, that number could increase to 90% by 2025.[4]

## Changing valuations of water create controversy

**Freshwater is a complex commodity, with both public and private values**

Freshwater is a complex commodity, with both public and private values. There is growing recognition of the ecological, cultural and geopolitical value of freshwater resources, particularly as competing demands for limited supplies lead to growing scarcity. At the same time, among the most powerful and controversial new ideas in the international water debate is that water should be considered an "economic good," increasingly subject to the rules and power of markets, prices, multinational corporations and international

trade regimes.[5] In the last decade, this idea has been put into practice in many ways, in hundreds of places, affecting millions of people. Prices have been set for water that was previously provided for free. Markets in water have been proposed and implemented. Private entities are increasingly involved in water management previously dominated by public agencies. These ideas and trends have generated enormous controversy.

**A growing trend toward "full-cost" water pricing**

Because water is important to the process of economic development, essential for life and health, and laden with cultural or religious significance, it has often been provided at subsidised prices or for free in many situations. The proper use of subsidies can help provide water for the poorest populations, but subsidies can also encourage wasteful use of water. As a result, there is a growing trend toward "full-cost" pricing of water. In many places, artificially low water prices are rising as subsidies are phased out. In the United States, water prices are increasing to cover the full cost of operating and maintaining water-delivery systems such as storage and treatment, and even the marginal costs of adding new supplies. Where the cost of water is a very minor fraction of the overall cost of production, these price increases alone may have little impact on large-scale enterprises. In other places, price increases may adversely affect profit margins for water-intensive industries and sectors or may drive improvements in the overall efficiency of water use.

**While treated as an economic good, also a growing recognition of water's social value**

At the same time that water is being treated as an economic good, there is growing recognition of its social value. In November 2002 the United Nations Committee on Economic, Social and Cultural Rights recognised that access to water is an essential human right.[6] And the UN, working in conjunction with national governments, has laid out an ambitious set of goals, known as the Millennium Development Goals, which among other things aim to halve the proportion of people without access to clean water or adequate sanitation by 2015. The economic costs of meeting these goals, or failing to meet them, are not well understood, and adequate financial resources have not yet been made available by governments or the world community. In regions of the world where substantial populations lack safe and affordable water for basic needs, there is growing tension between public and private uses of water.

## Environmental impact is intensifying

**Human freshwater use can damage or destroy ecosystems, as is already happening in China**

The environmental problems associated with human water withdrawals and use, and with discharge of treated or untreated wastewater, are growing. Water scarcity often results in unhealthy aquatic ecosystems because of changes in the timing, quantity and quality of freshwater flows needed to sustain their natural functions. Data looking at the number of endangered or threatened species of fish, amphibians, gastropods and freshwater mussels show that aquatic species are exposed to higher extinction risk than other species.[7] Major dam construction and water withdrawals on river systems in arid parts of the world, including parts of China, Mexico and the southwestern United States mean that virtually the entire flow of some of these rivers is now captured and used before reaching the rivers' mouths. This, in turn, desiccates delta estuaries, shrinks wetlands, cuts off nutrients to the sea, reduces critical habitat for marine fisheries, and brings adverse economic, social and cultural impacts to downstream and coastal human populations. Such conditions have already struck southern China, where severe drought, coupled with high water withdrawals, has led to salt water contamination of freshwater resources threatening supplies to homes and industries and damaging crops in Guangdong's coastal areas.[8]

Over the past century more than half of all wetlands on the planet have been lost to development and conversion, or have been lost due to human withdrawals of inflows. Wetlands are important to the health of natural systems and people because they act as filters and flood buffers.

**Northern China and India are among the regions with the most serious groundwater problems**

Annually, groundwater overdraft occurs in many parts of the world, with negative consequences for the environment and human health. Overuse of limited groundwater is unsustainable in the long run, threatening both agricultural and industrial production. Contamination of groundwater by biological and chemical pollutants is turning renewable water resources into nonrenewable ones. Among the regions with the most serious problems of groundwater overdraft are northern China and India, where groundwater levels are dropping far faster than they can be naturally recharged, leading to growing energy and economic costs for pumping, as well as uncertainty regarding the source of future supply This condition is unsustainable, and agriculture and industrial users dependent on non-renewable groundwater are vulnerable.

## Climate change is worsening water uncertainty

**Global warming will impact water supplies**

There is compelling scientific evidence that climate change will impact water supplies and pose formidable challenges to water systems.[9] Global warming threatens to disrupt traditional precipitation and runoff patterns and could increase the frequency and severity of both drought and floods. Changes in water availability caused by climate change will affect water management, allocations, prices and reliability. Changing climate may also degrade water quality by changing water temperatures, flows, runoff rates and timing, with significant potential impacts on water users. Rising sea levels will threaten coastal aquifers and water supplies, with potential implications for coastal metropolitan areas reliant on groundwater resources.

**Parts of Asia will be severely affected by the recession of the Himalayan glaciers**

These problems could be especially severe for parts of Asia, where Himalayan glaciers account for a significant part of rivers such as the Yangtze and Yellow Rivers in China, the Ganga in India, the Indus in Pakistan, the Brahmaputra in Bangladesh and Burma's Irrawaddy. About 67% of the nearly 12,000 square miles of Himalayan glaciers are receding and, as the ice diminishes, glacial runoffs and river flows in summer will also go down, leading to severe water shortages.[10] According to recent studies, a quarter of the world's glaciers could disappear by 2050 and half by 2100 (see Figure 5).[11] According to estimates by China's Academy of Sciences, that country's highland glaciers are shrinking by an amount equivalent to all the water in the Yellow River each year.[12]

**Climate change may increase the intensity of hurricanes, tropical storms and typhoons**

One of the most serious risks of climate change may be its effect on the frequency and intensity of severe events. There is growing evidence that rising temperatures may increase the intensity (not the frequency) of hurricanes, tropical storms and typhoons. This continues to be debated in the scientific community, and new information will likely be developed in coming months and years. At the same time, the vulnerability of businesses in coastal communities to such severe events is increasingly clear.

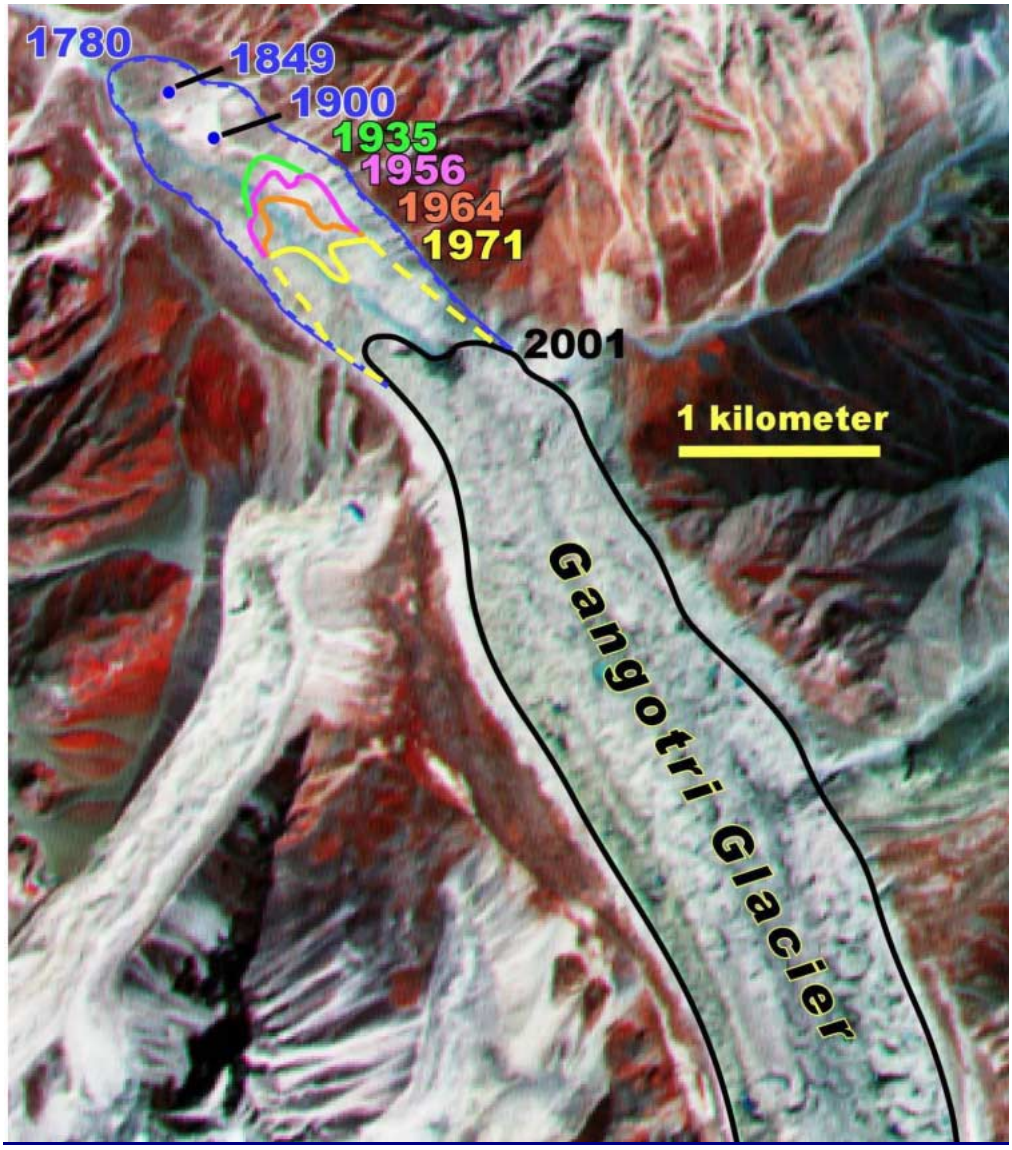
In particular, the dramatic impact of hurricanes Katrina and Wilma on the oil and gas industry in the Gulf Coast region of the United States, with the subsequent ripple effects on the economy of the United States and the rest of the world, show this vulnerability. Figure 6 shows the spot price of gasoline during the summer and fall of 2005 as it varied with the formation and

landfall of Hurricanes Katrina and Rita. These kinds of extreme events have serious adverse implications for sectors as diverse as insurance, tourism and water infrastructure, with potential opportunities for redevelopment, anticipatory construction and reconstruction.

**A quarter of the world's glaciers could disappear by 2050 and half by 2100**

Figure 5

**Gangotri glacier from 1780 to 2001**




Source: Nasa satellite and historical records

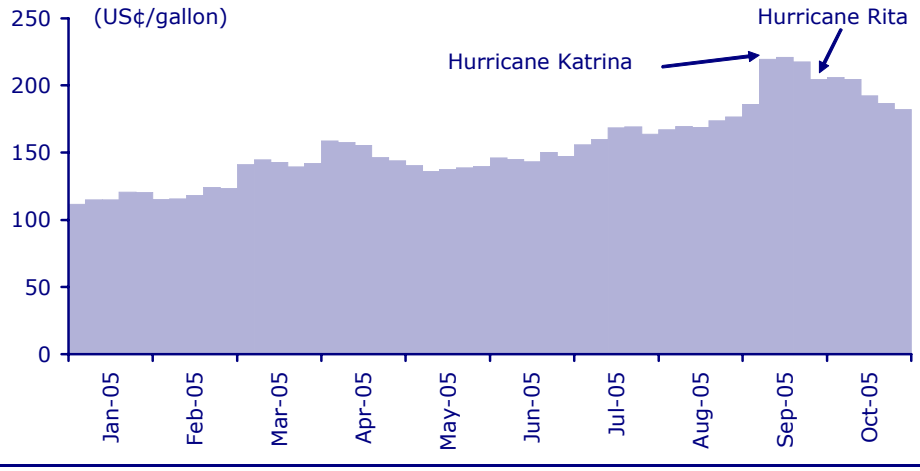
**At the least, climate change should make water management more challenging**

These effects and many others will vary regionally, but at the least, climate change is expected to add more complexity and unpredictability to water-management efforts. Organisations as diverse as the Intergovernmental Panel on Climate Change, the US National Academy of Sciences, the American Water Works Association and the California Department of Water Resources have all urged water managers to reexamine water-management policies and tools in the context of climate change. There will be economic costs and benefits for water utilities associated with both climate change and efforts to respond to it.

Paying a higher price for our worsening weather

Figure 6

**Spot price of gasoline (NYMEX) and the effects of severe hurricanes**




Source: US Energy Information Administration

## Emerging role of the public in water policy

Importance of public participation in water decision-making

There is a dramatic shift underway in the role of the public in setting water policy. In the 20th Century, water-policy decisions were typically made by a small number of technical or engineering experts responsible for water systems. By the end of the century, many countries had witnessed a transformation in the way that water decisions are made toward more public participation and overall transparency. In support of this trend, numerous major international water conferences in recent years have called attention to the importance of public participation in water decision-making.

Water is a resource considered by many to be a basic human right

In part, this change has come about because of some spectacular and highly publicised water project failures or controversies, where decisions were made that affected large numbers of people, but without consultation. A high-profile example of this is the displacement of more than a million Chinese by the construction of the Three Gorges Dam. This project led to public protests and opposition in a country with limited public debate over government projects. Similarly, opposition has arisen to large-scale water projects in India, Southern Africa and much of the developed world. This public interest and activism is increasingly also targeting the private sector, with some high-profile examples discussed briefly below. Governments and corporations that fail to think strategically about water typically find themselves embroiled in highly public and emotionally charged disputes over a resource considered by many to be a basic human right.

Increased public and media attention on water has direct consequences for businesses

Not surprisingly, as public interest has grown, so has the mainstream media's attention. It is not uncommon to see headlines on disputes in water-scarce regions, protests against water infrastructure proposals, or unusually severe droughts and floods. Growing public opposition to "globalisation" has also brought renewed attention to water, especially bulk transfers from one region to another, and corporate control and use of water. As one North American example, the media has widely covered protests and controversy surrounding a Perrier water-bottling plant in Michigan, which the public perceived to be pumping substantial amounts of groundwater in the Great Lakes basin.[13] This increased public and media attention has direct consequences for businesses, and the stakes, in terms of brand image and reputational capital, are growing. This phenomenon will likely have increased relevance in terms of companies' long-term strategic plans, markets and public affairs.

## Water privatisation

**Privatisation is one of the most important and controversial trends**

One of the most important - and controversial - trends in the global water arena is the accelerating transfer of the production, distribution or management of water or water services from public entities into private hands - a process loosely called "privatisation." There are many forms of water privatisation, ranging from simple contracting for minor operation or maintenance activities to full and integrated ownership of water resources and infrastructure. The actual economic and political implications of privatisation are complex and regionally specific.

**Growing public awareness and attention to problems with water privatisation**

Increasingly, private companies have been invited to take over the management, operation and sometimes even the ownership of previously public water systems. International development agencies that used to work with governments to improve water services are now pushing privatisation efforts. Treating water as an economic good, and privatising public water systems, are not new ideas. What *is* new is the extent of privatisation efforts underway today and the growing public awareness of, and attention, to problems associated with these efforts.[14]

**Opponents include local community groups, international NGOs, unions, human rights groups, public providers**

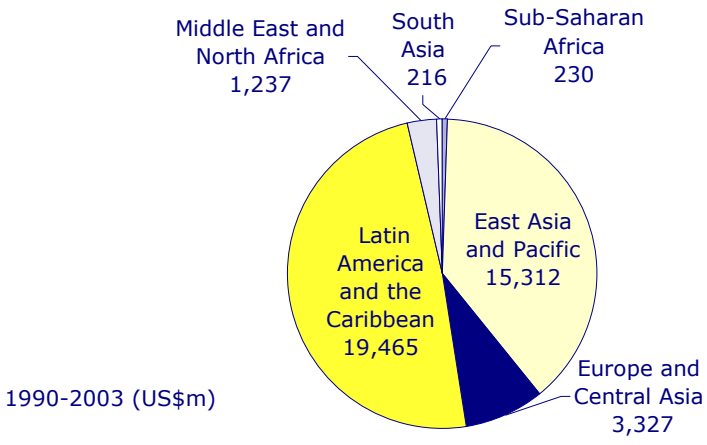
Proponents of privatisation argue that private companies are better equipped to address many of the obstacles confronting public water agencies, including government inefficiency and corruption, access to capital and limited technical expertise, and that privatisation can help fulfil unmet basic water needs. Accompanying the trend toward water privatisation, however, has been rapidly growing opposition among local community groups, international non-governmental organisations, unions, human rights organisations and even public water providers.

According to the World Bank, from 1990-2003, 53 low and middle-income countries had private activity in the water supply and sanitation sectors. In those countries, 261 projects with private participation, involving investment commitments for about US$40 billion, reached closure (See Figure 7). Concessions, which typically take the form of management and operation contracts with major private capital expenditure, were the most frequent form of private participation in the sector, representing 42% of the projects and 67% of total investment. Water treatment and distribution, and sewerage collection and treatment, represented about 63% of the sector's total.

**Between 1990 and 2003, East Asia and the Pacific saw US$15.3 billion in private water investment**

Figure 7

**Private investment in water supply and sanitation in low/middle-income countries**



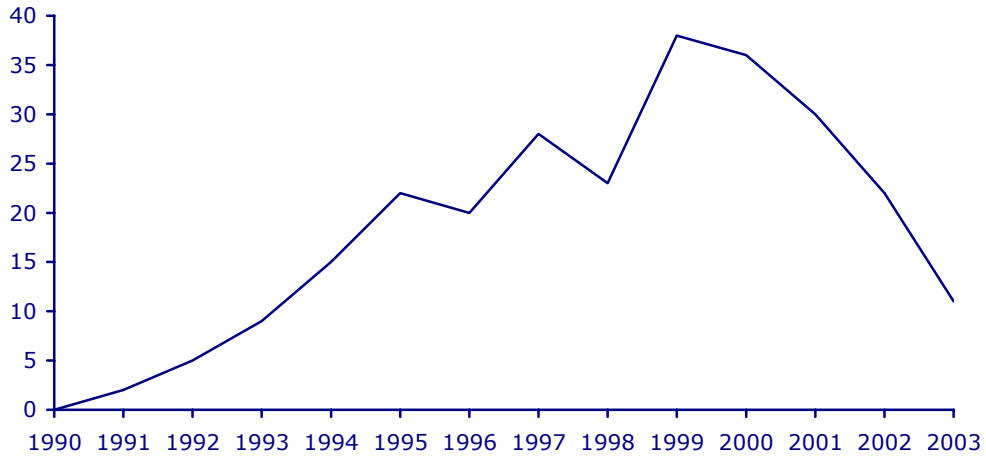

Source: World Bank

Overall, the number of water and sewage projects with private participation in these countries has decreased substantially in recent years (Figure 8). Efforts to develop new projects are slowing, and a substantial number of the largest deals, ultimately failed. Figure 9 shows the magnitude of the annual private investment in these projects from 1991 to 2003.

**Substantial decrease in number of public-private projects in recent years**

Figure 8

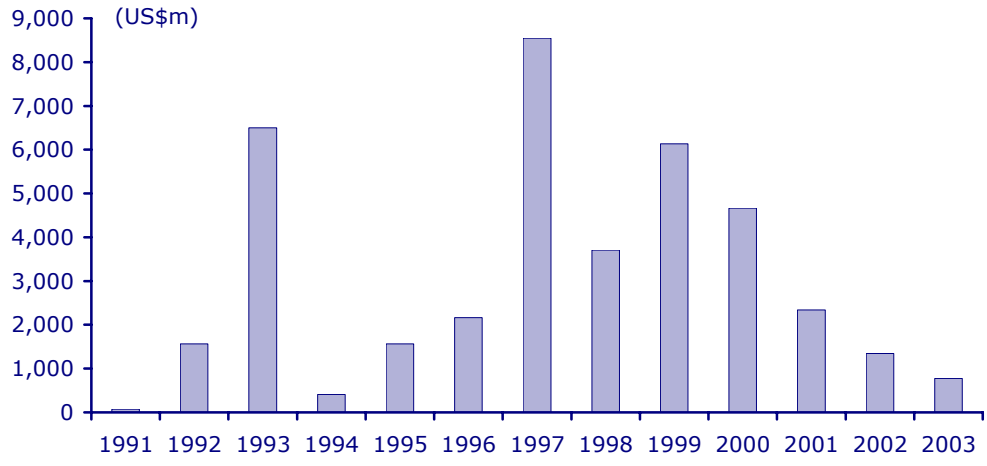
**Number of water and sewerage public-private partnership investment projects**




**Private-sector investment has fallen off since 1999**

Figure 9

**Financial investment in water and sewerage public-private partnership projects**



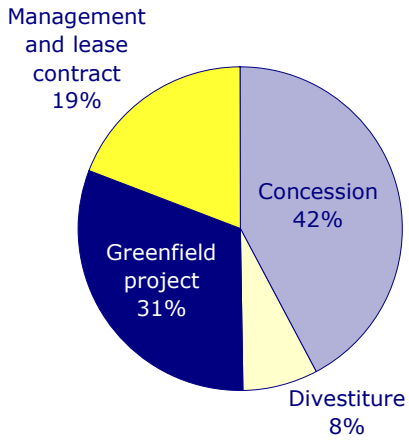

Source: World Bank

Of the 261 projects, 15 projects (representing 36% of total investment) to the sector, were either cancelled or under distress by 2003. Contracts under distress are either in the process of being cancelled, or are in international arbitration. Only two of the five largest efforts are still in operation, according to the World Bank's database on private participation in infrastructure.[15]

**Concessions have been the most frequent type of private participation**

Figure 10

**Number and type of water and sewerage projects, by type of private investment**




Source: World Bank

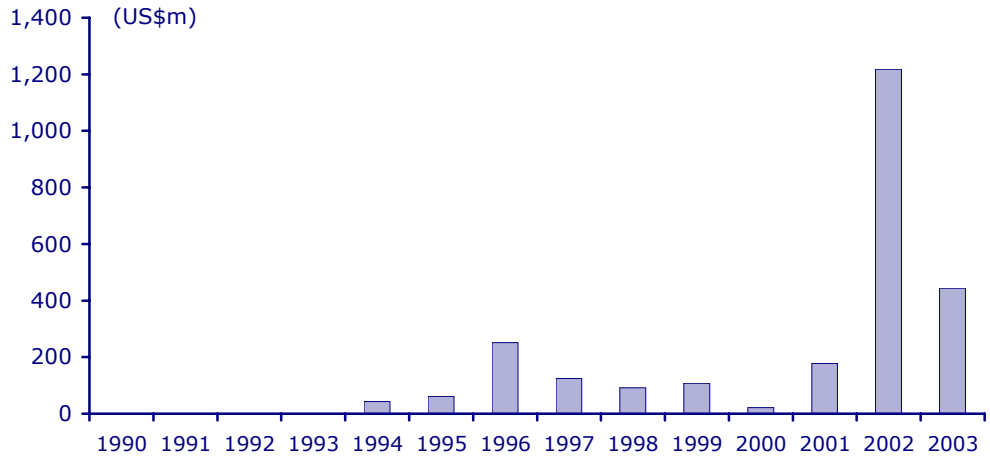
**India and China provide some context for efforts in Asia and elsewhere**

India and China provide some context for efforts in Asia and elsewhere. The failure of government agencies in both countries to satisfy rapidly expanding urban water and wastewater needs led to calls for privatisation in the 1990s. Nevertheless, the earliest private projects were rarely successful. For example, the large Krishna Water Supply Project for Hyderabad, the capital of the state of Andhra Pradesh, was ultimately rejected by all bidders as economically infeasible and a review in the late 1990s argued that none of the water and sewerage privatisation projects in India up to that point could be considered successful.[16] Despite these problems, the sector remains active, particularly in China where more large investments are underway in numerous projects (see Figure 11). Both governments have, in the past, offered incentives for such private investments, such as exemption from customs and excise duties on imported machinery and exemption from all taxes for the first five years of water and sewerage projects.

**More investment is underway**

Figure 11

**Level of recent private investment in water and sewerage projects in China**




Source: World Bank

# Businesses face water risks

**Increasingly significant and direct threats to businesses**

Water supply and quality problems are likely to pose increasingly significant and direct threats to businesses in the decades ahead. In this section, we describe the major areas of water risk that businesses face. These areas are likely to become increasingly important for investor scrutiny, especially in regions where water supplies are under the greatest stress.

## Decreasing water availability and reliability of supply

**Already a problem in parts of India and China**

Water shortages are increasing as demand exceeds the available supply due to natural events or factors such as growth in population, new developments or irrigated acreage. In Kerala, India, for example, Pepsi and Coca-Cola lost their license to use local groundwater at bottling plants after drought raised competition for local aquifers. Coca Cola announced it might permanently shut down its Kerala facility - its largest bottling operation in India - after continuing difficulties regaining a groundwater-pumping permit from local authorities.[17] Similarly, the city of Bangalore, India is losing information-technology firms because of worries about water scarcity and reliability.[18] Textile plants in India have been forced to shut down due to water shortages and conflicts with local farmers over water allocations.[19]

In China meanwhile, facing severe water shortages, Beijing authorities have announced plans to severely limit development of new water-intensive businesses in the region. They explicitly will be focusing on constraining the location of new textile, leather, metal smelting and chemical industries, according to reports in the *China Daily*. Makers of beverages, plastics and pharmaceuticals may have to meet water conservation restrictions to gain approval.[20]

## Declining water quality

**The effects are felt in a number of ways**

Water-quality issues affect businesses in a number of ways. As countries try to improve water quality, some governments are considering restrictions on the type, size or location of specific industrial investments. Contaminated water supply may preclude new industrial activities where good water quality is needed for facility operations or product manufacture. And contamination of water resources by industrial operations may pose liability issues and affect their license to operate. The government of Victoria, Australia, for example, is considering plant closures to help eliminate the discharge of untreated industrial wastewater in the pulp and paper industry.[21]

**Water-treatment costs are bound to rise in developing countries**

Growing concerns about water quality may lead to new and costly requirements on company's wastewater discharges. Some national governments already impose strict water-quality standards for water supply or wastewater discharge; some impose both. Other governments have yet to develop, impose and enforce water-quality standards. While most industrialised countries have managed to curtail concentrated "point source" pollution emitted from factories and sewage treatment plants, an estimated 90% of wastewater in developing countries is still discharged directly to rivers and streams without any waste processing or treatment.[22] As economic development continues in these countries and per capita income rises, this is bound to change, and companies will likely have to absorb the costs associated with meeting new water-treatment requirements as they become increasingly stringent.

**Burgeoning middle classes in China and India are already spurring government action**

Already, for example, the burgeoning middle classes in China and India have spurred government action toward more stringent environmental protections. Five of the seven major river systems in China are considered to be severely polluted, with the Haihe River near the Beijing and Tianjin industrial centres in the worst condition. These conditions are already affecting local industrial development plans.[23] Poor water quality can also affect national strategies for economic development. China's new Five-Year Plan, announced in October 2005, calls for a departure from "old, growth-at-any-cost model that has led to many rivers being polluted."[24] This will require massive investment in water-quality treatment systems.

**Businesses are poorly assessing and managing water-quality problems**

The quality of water is a critical input in many industrial production systems and some products. Because of the importance of water quality, specific industries - such as high technology, biotechnology, pharmaceutical and food processing - incorporate extensive water treatment prior to use. This pretreatment can include filtration, disinfection, reverse osmosis and other water-purification techniques. Such industries can be particularly vulnerable to degradation or contamination of source water, which can lead to higher pretreatment costs. In cases where current high-quality input water precludes the need for pretreatment, degradation of supply can necessitate costly capital expenditures for treatment technology. The risks and costs associated with these kinds of water-quality problems are poorly assessed and managed by businesses at present.

## Supply-chain vulnerability

**Water-related risks run beyond a company's immediate operations**

Understanding the full extent of water-related risks to a company involves assessing factors outside the company's immediate operations. For industries as diverse as apparel, forest products and agriculture-based products, water is required to produce key upstream inputs that many companies use in production (see callout below). Indeed, it can take more than a 1,000 times as much water to produce some inputs than is used in all onsite activities. However, businesses' traditional water-use estimates fail to address the water risks throughout the supply chain and entire production cycle.

**An example of the often-complex nature of water risk embodied in a company's supply chain**

### Anheuser-Busch, water and their supply chain

In 2001, Anheuser-Busch, the world's largest brewer of beer, experienced business impacts from unexpected water shortages affecting its supply chain. A temporary drought in the US Pacific Northwest increased the prices and reduced the availability of key inputs to Anheuser-Busch's brewery operation - barley and aluminium. An unusually dry winter, coupled with a turbulent West Coast electricity market that is highly dependent on water for power generation, created intense short-term competition for limited freshwater resources. Reduced allocations of water for irrigation in Idaho resulted in reduced acreages of barley, a key brewery ingredient. At the same time, aluminium production, which relies on large amounts of low-priced energy generated from hydroelectric dams in the region, was drastically reduced as electricity prices skyrocketed. This experience in facing water-related challenges along the supply chain has expanded [Anheuser-Busch's] business case for taking a more comprehensive, strategic and sustainable approach to water issues.

*Connecting the Drops Toward Creative Water Strategies: A Water Sustainability Tool,* Global Environmental Management Initiative, 2002

**No corporate approach is complete unless it addresses broader supply-chain issues**

No corporate water risk-management approach can be considered complete unless it addresses these broader supply-chain issues. As an example, Unilever has been analysing its water impact, taking into account water used by suppliers in growing raw materials and water used by consumers in using Unilever products.[25] Since introducing systematic measurement of water use 10 years ago, the company has reportedly reduced its water consumption per tonne of production by 54% and it notes specific initiatives address water use in its supply chain.

**Competitiveness, public perceptions and profitability are all put at risk by a failure to address these issues**

Unilever provides financial and technical support to help tomato farmers in Brazil convert to drip irrigation, which can reduce water consumption by up to 30% while increasing crop yield. At the consumer end of its industry, the company estimates that a reformulated version of laundry detergent requiring less rinsing could have a considerable impact on water use in water-stressed areas of India where washing clothes accounts for more than 20% of water consumption. Other companies are also beginning to address these more comprehensive supply-chain issues associated with their production and companies that do not do so in the future risk challenges to competitiveness, public perceptions and profitability.

## Failure to meet basic water needs

**Businesses operating in developing countries face a broader set of risks than those in richer nations**

Businesses operating in developing countries face a broader set of risks than those in richer nations. In addition to the deficit in water infrastructure discussed above, these risks include the failure of governments to meet basic human needs for clean water and sanitation services, widespread water-related diseases, inadequate expertise and institutional capacity, and major economic problems finding the capital necessary to deal with these problems.

**Balancing public and private benefits is a growing challenge in poor communities**

The failure of governments to provide 100% coverage for water services means that international and local businesses will increasingly find themselves with operations in regions where people lack some of the basic resources either used (or produced) by the company. A related but less serious issue that can cause tensions between businesses and communities in developing countries is when the relative cost of a unit of water for a commercial facility is negotiated to be below what local residents pay. This can lead to resentment and community opposition. Balancing these public and private benefits is a challenge increasingly facing corporations with facilities (and extensive water use) in poor communities.

# Managing these challenges

## The water-energy factor

**Links between energy and water are strong, yet not widely appreciated**

There are strong, yet not widely appreciated, links between energy and water. Water is required to produce and use energy, and substantial amounts of energy are used to clean, transport and use water. Some parts of the world are heavily dependent upon hydropower as the primary means of fulfilling their energy needs. For example, Brazil, a favourite recipient of foreign direct investment, generates over 90% of its electricity from hydropower. Areas that disproportionately reply upon hydroelectricity for energy (or lack energy diversity in general) can present particular risks.

**Areas that rely on hydroelectricity can present particular risks**

The case of the state of Sao Paulo, Brazil in 2001 illustrates how severe drought cycles, coupled with cumulative political decisions, can lead to profound disruptions in economic productivity. Energy production in 2001 was highly constrained as a result of both severe drought and government energy tariff policies that favoured the development of hydroelectric systems over thermal plants. In order to prevent blackouts, the government was forced to take severe measures, including quotas aimed at reducing energy consumption by 10-35% based on the level of added value of particular industries and the number of jobs affected.

**Water-related issues can cost companies and even hurt GDP**

Private electric companies were hard hit by the reduction quotas, including the hydroelectric company AES Tiete, which had closed a US$300 million 15-year bond offering the year before. While the company scaled back costs in order to pay dividends, the effects of the rationing were so severe the bond payment schedule had to be postponed and ultimately renegotiated. Many other industries based in the Brazilian southeast region (which accounts for almost 60% of the country's GDP) were plagued by reductions in operational capacity, production delays or increases in the costs of production. In fact, the effects of the drought-induced energy rationing extended to the national economy, with an estimated reduction of 2% of the country's GDP or a loss of around US$20 billion.[26]

## Nexus between water development and economic prospects

**Water supply will be key to the resiliency of some national economies**

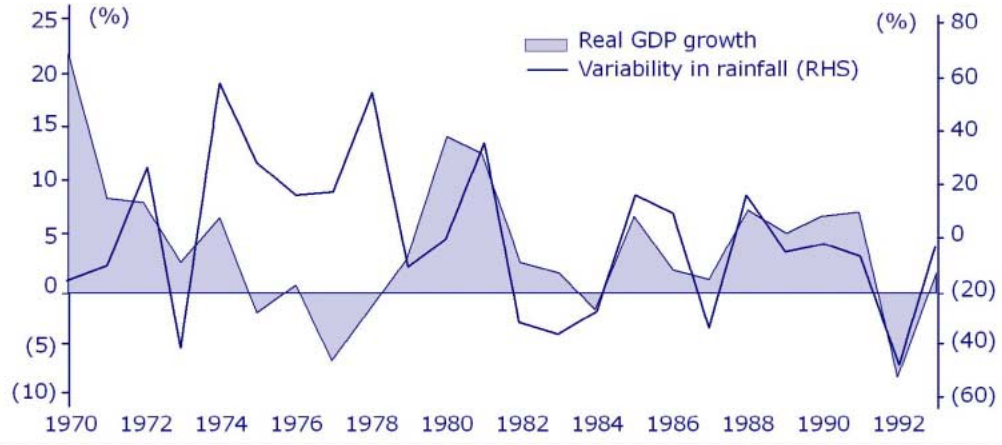
In some parts of the world, water supply will be so important in the decades ahead that it will be an important investment theme well beyond its implications for any company or industrial sector. Water problems may constrain growth, shift competitive advantage, disrupt operations and necessitate costly investments in new equipment and infrastructure. Many developing countries lack both the physical infrastructure and water-management capacity to address the natural variability in the hydrologic cycle, which has direct ramifications on the resiliency of the national economy as a whole. Figure 12 illustrates the high correlation between hydrologic variability and Zimbabwe's GDP over a 20-year span. Other countries in Asia and Africa could face a similar fate in the decades ahead.

**When water is scarce, the private sector takes a backseat to domestic and agricultural uses**

Countries with poorly developed infrastructure are less able to decouple their economy from climatic variability, which has perhaps the most direct impacts on the agriculture and food sectors. The private sector is also at risk, however, because in times of drought or water crisis governments typically prioritise water allocations for domestic and agricultural uses.[27] This has exacerbated business risks for enterprises with operations in such regions, from Africa to South Asia. According to a recent study, poor countries with improved access to clean water and sanitation services showed average GDP growth rates of 3.7% compared 0.1% GDP growth in countries without such access.

Figure 12

**The dependency of the Zimbabwe economy on rainfall (1970 to 1990)**




Source: World Bank

**Parts of Asia and Africa will experience the same high correlation in the decades ahead**

## Due diligence: Evaluating businesses' water risk exposure

**Most companies ignore water-related risks or consider them only in an *ad hoc*, piecemeal fashion**

Few companies around the world are taking comprehensive steps to strategically address water-related risks in ways that protect long-term value. Most companies either ignore water risks altogether or consider these issues only in an *ad hoc*, piecemeal fashion.[28] Although companies' water risks vary significantly depending on their business sector and areas of operations, many businesses would benefit from strategically assessing their current water-related risks and developing a plan to mitigate them. This is particularly true for companies dependent on high quality, reliable supplies or on large volumes of water; companies with key operations in arid areas; and companies that rely on inputs that are themselves highly water dependent.

Comprehensive water-risk management activities should include:

**Measurement of water use and wastewater discharges by one's company and suppliers**

- Companies need to measure water use and wastewater discharges in their own operations, as well as assess water use and discharges by key suppliers. This will provide the baseline data for a company to assess risks, prioritise efforts and evaluate progress. For example, Coca-Cola Company reports that it uses approximately three litres of water for every litre of beverage it produces, identifying both a benchmark of current use and a way to measure improvements in water-use efficiency over time.

**Assessment of the water "landscape" and associated risks**

- For key areas of operation and sourcing, companies should be assessing local water conditions, including hydrological, social, economic and political factors. This includes flagging risk areas of current shortage, rapidly growing demand, insufficient institutional and political "water governance" capacity and large disparities in water access and/or pricing issues between large commercial users and local communities. In high-risk regions, businesses should also have in place contingency plans to respond to water supply and related risks, such as decreasing water quality, higher water prices, disruptions due to extreme hydrologic events and local concerns about the scope and pace of economic development.

**Supply-chain planning**

- Companies should assess and evaluate water use in their supply chain and work collaboratively with suppliers to reduce water use and minimise risks of supply-chain disruptions from water-related problems.

**Stakeholder engagement**

- By engaging other key stakeholders concerned with water resources, companies can better anticipate and respond to emerging issues. Transparent and open discussions with local communities and water managers is a key factor to good business planning here.

**Strategic water outlook and policy**

- A high-level water strategy can guide decisions at many levels of operation. For example, Procter & Gamble estimates that nearly 85% of its product sales are associated in some way with household water use and has focused product research and development on addressing water use efficiency. The company has directed its product development team, "As you improve current products or develop new-to-the-world products and services, think about how you could apply our technologies to use less water, use water differently or use no water at all."[29]

**Commitment to continuous improvement**

- A commitment to continuous improvement in assessing and managing water risks and lessening impacts of the company's water use on local communities and the environment can help protect operations from unexpected water-related business disruptions. Such a commitment can be part of an organisation's overall environmental policy, such as the one required in ISO 14001.[30]

**Performance reporting**

- Publicly reporting key metrics of water use improves transparency and feedback for employees, customers, local communities, investors and other key stakeholders. In a recent Pacific Institute internal review of corporate environmental/sustainability reporting, almost all the surveyed companies measure and report at least one metric for water, typically total water consumption.[31] The Global Reporting Initiative, which seeks to define reporting standards for environmental and other dimensions of corporate performance, has established a "water protocol" encompassing four different performance measures. [32]

# Investing in the water industry

**Diverse range of water-related companies**

The water industry includes companies involved in the manufacture or sale of a diverse range of goods and services related to water, including:

- Conveyance/storage infrastructure, such as dams, reservoirs and aqueducts.
- Automation systems.
- Monitoring and testing equipment.
- Large-scale municipal water and wastewater treatment.
- Residential water treatment/filtration.
- On-site industrial water treatment (including equipment, services and chemicals).
- Engineering/consulting services.
- Production of pumps and valves.
- Bottled water production and sale.
- Services for water utilities (such as billing, operation and maintenance, management).
- Irrigation systems and equipment.
- Pool and spa equipment.

**Revenue from these water-relate sectors totals over US$400 billion annually**

Altogether, global revenue from these sectors totals more than US$400 billion annually, including over US$50 billion in sales of bottled water alone.[33] Over the past decade, water industry companies have performed well relative to other industrial sectors. Figure 13 illustrates the long-term total return of some US investor-owned water utilities in comparison to selected high-performing American stocks over the past decade.

**Key global driving forces for future investment**

We believe the key global driving forces for future investment opportunities in the water sector include:

- Significant growth - on the order of 10-15% annually - will occur in some segments of the water industry in developing countries, with growth of around 5% or more in developed countries.
- Financial requirements are mounting for upgrading ageing water infrastructure, especially in the US and Europe, but also in some developing countries where old or poorly built systems lead to substantial water losses, contamination or delivery reliability problems.
- Demand for water in developing countries is growing rapidly, accompanied by shifts in allocations of water from agricultural to urban centres.
- There is an increased awareness of the links between safe water and human health.
- The water services and technology sectors are experiencing consolidation.

- New water-quality standards are, or will be, put in place in countries like China, which will drive major new investments in water treatment and purification.
- Water shortages will be inevitable in some regions, requiring changes in water use through investment in efficiency improvements, and new investments in water-supply projects, desalination and other infrastructure.
- Increased foreign and private investment opportunities will arise, especially China.
- Increased demand will arise for water risk-management systems and water-efficiency technologies and services.
- New technologies will be developed for water treatment, including advanced membrane systems and nanotechnology materials.

**Water-related stocks are among the top performers in the US in 1994-2004**

Figure 13

**Top-performing American stocks from 1994-2004 (water-related plays in bold)**

| Name | Symbol | 1994 - 2004 | |
|---|---|---|---|
| | | Total return (%) | Annualised (%) |
| **Southwest Water** | **SWWC** | **848.37** | **25.20** |
| **Aqua America** | **WTR** | **642.97** | **22.18** |
| American Express | AXP | 537.54 | 20.33 |
| International Business Machines | IBM | 477.53 | 19.14 |
| Johnson & Johnson | JNJ | 437.75 | 18.30 |
| **Pennichuck** | **PNNW** | **431.46** | **18.16** |
| Walmart Stores | WMT | 430.61 | 18.14 |
| Gen Electric | GE | 422.78 | 17.96 |
| **SJW** | **SJW** | **397.70** | **17.39** |
| **Artesian Resources** | **ARTNA** | **385.38** | **17.09** |
| Exxon Mobil | XOM | 342.94 | 16.03 |
| Home Depot | HD | 339.08 | 15.93 |
| Procter & Gamble | PG | 327.48 | 15.62 |
| **Connecticut Water Services** | **CTWS** | **307.44** | **15.06** |
| **York Water** | **YORW** | **280.19** | **14.27** |
| **California Water Services** | **CWT** | **274.56** | **14.10** |
| **Middlesex Water** | **MSEX** | **274.09** | **14.09** |
| **American States Water** | **AWR** | **252.91** | **13.42** |
| Dow Jones Industrial Average | INDU | 242.71 | 13.09 |
| S&P 500 Index | SPX | 212.41 | 12.05 |
| Nasdaq Composite | CCMP | 201.35 | 11.65 |
| Gillette | G | 179.03 | 10.79 |
| McDonalds | MCD | 140.13 | 9.14 |
| Merck | MRK | 123.22 | 8.35 |
| Kellogg | K | 102.72 | 7.31 |
| Disney | DIS | 96.53 | 6.98 |
| Coca-Cola | KO | 85.75 | 6.38 |

Note: All returns are with dividends reinvested. Source: Bloomberg Analytics, as cited by John Dickerson, President & CEO Summit Global Management in Financial Sense Online

**Substantial new private investment opportunities**

Investment interest is surging based on expectations that increasing water demand and the need to upgrade ageing infrastructure in the years ahead will create a boom for companies engaged in supply, delivery, purification, storage, monitoring, testing and treatment of water, among other areas. Improvements in water treatment and water-management technologies, coupled with institutional changes and consolidation trends in the water industry, are already generating substantial new private investment opportunities around the world and driving significant growth for companies providing technology, engineering and construction services for water projects.

**Multinationals have already invested billions in water-related activities**

Global corporations such as **GE** (US), **ITT Industries** (US), **Siemens** (Germany), **Tyco International** (US), **3M** (US), **Pentair** (US) and **Danaher** (US) have invested billions in water-related endeavours and acquisitions. Some of these investments are beginning to yield rapid growth in revenues and profits, while others have proved disappointing. Smaller regional players are also growing fast and some may become targets for acquisition by larger companies with deeper pockets to finance projects. Meanwhile, some well-run publicly traded water utilities, which have caught the eye of investors anticipating expansion opportunities related to privatisation and industry consolidation, have recently posted strong returns.

**Significant challenges, however, with mixed results for privatisation**

Companies hoping to expand in this sector also face significant challenges. In many parts of the world where investment in water infrastructure is most needed, opportunities are constrained by inadequate financial resources, limited environmental awareness, the need for capacity building and adjustments in government policies to align private and public interests. As noted above, the track record for privatisation is decidedly mixed, from both a financial and public policy perspective. And operational efficiencies typically expected to be achieved through consolidation and greater economies of scale are not always a sure thing in this sector.

Hence, while there is plenty of opportunity for success on the strength of the fundamentals, it is also complex enough to lead to serious disappointments in this high-flying sector where valuations ride on bullish expectations for the water industry in general. Among the challenges we foresee are:

**Financing challenges**

- The potential investment requirements for meeting water needs around the world are vast, but many of the greatest needs are in regions where financing water projects is difficult. As is the case in China, institutional changes may open the door to foreign companies and private capital, but much still depends on the underlying economic health of the communities and regions where such projects are contemplated. Companies with deep pockets and extensive international finance expertise have advantages for moving strongly into the water sector. Smaller firms with engineering and technology expertise will have to pick their targets judiciously. The companies with the strongest balance sheets will have leverage opportunities to meet working capital needs and investment outlays.

**Intensifying competition**

- Dozens of major corporations have targeted growth opportunities in the water sector. The recent wave of M&As in the sector has brought companies like GE to the fore, with ambitious growth plans. Competition for major water projects will be intense as these players vie with smaller regional companies to win projects. In China, for example, more than 100 international enterprises have entered the environmental industry and capital markets since the 1990s. While the size of the overall pie is growing, competitive entry will sustain pressures for efficient operations.

**Fragmentation**

- The water utility sector is highly fragmented compared with other utilities such as energy or telecom. Only around 10% of customers globally are served by investor-owned water utilities. While the structure of the water services industry may present opportunities for consolidation in the long run, there is relatively little indication that this is a major trend today. From the perspective of suppliers and service providers, on the other hand, the fragmented industry structure leads to higher transactions costs. Companies capable of efficient business development and account management will have an advantage.

**Deferred maintenance and ageing infrastructure for water utilities**

- Some water utilities face serious deferred maintenance problems and may struggle in the years ahead to be able to finance critical repairs and upgrades. While this may present opportunities for service providers, the utilities themselves may face financing challenges. In the US, despite evidence of a growing crisis in water infrastructure, spending in this area is under downward pressure at all levels of government. Facing growing problems with leaks in its ageing water system, New York City has proposed a 40% increase in water rates by 2009. Similar problems face utilities outside the US as well. In India, a recent World Bank report warned that unless water-management practices are changed soon, the country will face a severe water crisis within the next two decades and will have neither the cash to build new infrastructure nor the water needed by its growing economy and population.[34]

**Uncertainty about public funding and water policy**

- Many of the potential water projects in the years ahead depend on government decisions to help finance projects and/or environmental regulations that will drive investments, especially in water treatment. While the water sector is generally less cyclical than many other industries, an economic slowdown could lead governments to defer new projects and initiatives.

**Privatisation gone awry**

- Some highly visible water utility privatisations have run into problems (eg, Cochabamba, Manila, Atlanta) with disappointing results for governments, customers and companies alike. Global water companies looking to expand by riding the wave of privatisations will have to learn to identify the critical success factors and manage accordingly.

## Water industry sectors

**Assessing major functional areas in the water industry**

Efforts to provide a taxonomy for the water industry face problems of overlap and layering of functional categories. Our approach here focuses on assessing major functional areas in the water industry. We do so by briefly profiling areas of investment interest by sector, with special attention to those sectors with emerging technologies or growth prospects that could be drivers for future opportunities. We also highlight particular risks associated with these sectors.

### Desalination

**Desalination market could reach US$9-30 billion in a decade**

Desalination processes, which remove dissolved minerals from seawater or brackish water to produce useable freshwater, provide substantially less than .003% of global freshwater supplies. Nevertheless, some believe the desalination market will grow rapidly as major cities in some regions come up against freshwater supply constraints or are affected by drought conditions. GE projects that the desalination market will grow at a compound annual growth rate of 9-14% over the next decade, growing from US$4.3 billion in 2005 to US$9.2-14.1 billion by 2014.[35] German consultancy Helmut Kaiser sees the market growing even faster, reaching US$30 billion by 2015.[36]

### The "petroleum for the next century"?

**While water will come to the fore in years ahead, there are major differences between water and petroleum**

Is water "the petroleum for the next century," as some analysts claim? The phrase invokes the idea that supply crises will drive water prices sharply higher, creating a wide array of new investment opportunities and yielding above-average returns for companies in the water business. But, while fundamental trends will likely bring water to the fore in the years ahead, the analogy to oil presents a potentially misleading characterisation of the water industry. Here are some of the major differences between water and petroleum, all of which have significance from an investment perspective:

**Water-supply utilities are natural monopolies and will remain regulated**

- While petroleum prices throughout most of the world are highly responsive to global supply and demand conditions, regulatory oversight in companies that provide water supply moderates price movements and the rates of return earned by water companies, sometimes resulting in under- or overinvestment in infrastructure. A similar challenge faces energy utilities.

**Water resources are regional**

- International petroleum trade is supported by highly developed global transportation systems capable of high-volume long-distance transport. There will not be a global market for water comparable to that for oil because of the high cost of transporting water long distances.

**Technical factors must be balanced with management**

- Water resources depend critically on watershed management policies and management of these resources commonly requires collaboration among many public and private stakeholders.

**Many water resources are renewable**

- The renewable character of many water resources puts a high priority on stewardship and suggests a significant role for government in balancing and protecting private and public interests.

**Access to clean water is a basic human right**

- "Ownership" of water resources is inherently more complex than ownership of petroleum resources. Indeed, basic water provision is increasingly considered a basic human right.[37] Providing safe water supplies to meet basic human needs is therefore a goal for most governments, with which private companies' roles in the water industry must be aligned.

**There is a wide variety of desalination technologies**

A wide variety of desalination technologies effectively take salts out of salty water, producing water with a low concentration of salt (the product) and another with a high concentration of remaining salts (the brine or concentrate). Many different approaches can be used to separate water and salt, but they all require significant amounts of energy. Various distillation and membrane technologies are widely used for seawater desalting. Ultimately, the selection of a desalination process depends on site-specific conditions, economics, the quality of water to be desalinated, the purpose for which the water is to be used and local engineering experience and skills.

**Distillation and filtration are the two main types**

There are two main types of desalination technologies in large-scale plants, distillation and filtration/membrane methods, with specific systems used for each. The distillation process mimics the natural water cycle by using thermal energy to produce water vapour that is then condensed to form fresh water. Separation systems, such as reverse osmosis, use sophisticated membranes to selectively separate ions from water. Membrane systems now account for around half of all desalination capacity and they are expanding more rapidly than thermal distillation systems because of their lower energy costs.

**Operating costs are high for ocean desalination**

Some new plants are being designed as hybrids, using reverse osmosis in combination with thermal distillation plants. Operating costs, and especially energy costs are high for all types of ocean desalination plants. Energy costs can run from 30-50% of the total costs of producing desalinated water. The minimum cost of desalination via reverse osmosis in large-scale plants is typically US$1-8 per $m^3$, typically much higher than typical urban water costs, though optimistic observers suggest that desalination costs are dropping rapidly. Until they do, ocean desalination will only be affordable in coastal regions with serious water scarcity or with significant public subsidies.[38]

**Leading providers include Doosan in Korea and HyFlux in Singapore**

**Leading providers: GE/Ionics** (US), **Doosan** (Korea), **Sidem** (France), **Fisia** (Italy), **Emco** (US), **Hydranautics** (US), **Poisedon Resources** (US), **Hyflux** (Singapore) and **IDE Technologies** (Israel). Membrane suppliers include: **Toray** (Japan), **Toyobo** (Japan) and **Saehan** (South Korea).

**Major drivers:** Growing demand for high-quality urban water in water-scarce regions; the need for improved reliability of supply and "drought-proofing"; technological advances.

**Major risks:** Recent advances in desalination technology offer the potential to reduce costs, but this potential has not been fully realised. Improvements are emerging in the efficiency and performance of membranes, in energy efficiency improvements, in distillation processes and, in the near future, in new nanotechnology-derived materials that could improve filtration efficiency and effectiveness. Industry observers should pay close attention to the reality (not the hype) of desalination opportunities and risks.

**Disinfection/purification of drinking water**

**Disinfection is a US$18 billion market, growing 10-15% per annum**

Disinfection of drinking water is a US$18 billion per year market growing at an annual rate of 10-15%. Chlorination has been the dominant technology in this sector, accounting for more than 80% of the market, but there are rapid technological advances underway in this area. Other technologies, including ozone treatment, membrane filtration and ultraviolet (UV) treatment could account for half or more of the new sales of disinfection systems in the next decade. UV water disinfection is a US$500 million global market today that could see rapid growth as a result of tightening environmental regulations and concerns about cryptosporidium and other microorganisms.

**Adsorption techniques should see further growth**

Adsorption techniques, such as those offered by **Calgon Carbon** (US), and membrane-based processes are likely to see further growth. In September 2005, **GE Infrastructure Water & Process Technologies** (US), announced the opening of the world's largest ultrafiltration (UF) plant, designed to provide up to 78 million gallons per day of potable water to over half a million residents of the city of Minneapolis. In 1993, the Milwaukee battled a cryptosporidium outbreak that resulted in the deaths of an estimated 100 residents and nearly 400,000 illnesses.

Combined methods of disinfection, involving UV or UF treatment in conjunction with, for example, chlorine dioxide, could become increasingly popular approaches for protecting water quality.

**Leading providers: GE** (US), **Danaher** (US), **ITT/Wedeco** (US), **Calgon Carbon** (US) and **Saehan** (South Korea).

**Major drivers:** Growing demand for water-purification treatment; rapidly growing urban centres in developing countries; new and tighter drinking water standards in Europe, especially Eastern Europe which has seen less previous investment in these systems; new standards for new pollutants in North America.

**Major risks:** Rapidly changing standards may affect project designs and development. Inconsistent standards from one region to another may increase costs in systems that cannot be easily standardised.

### Wastewater Treatment

**Global market for wastewater treatment is US$140 billion per year**

The global market for wastewater treatment totals about US$140 billion per year, with prospects for significant growth in some rapidly developing countries where water-quality problems are rapidly increasing.

**China targets increasing urban wastewater treatment from 45% to 60-70% by 2010**

The Chinese Ministry of Construction, for example, has set targets of increasing urban wastewater treatment from 45% to 60-70% of wastewater flows during the upcoming Eleventh Five Year Plan (2006-10). In a bid to attract foreign capital, advanced technology and management expertise, the central government was introducing more market-based mechanisms to the urban water industry.[39]

**Advanced systems are supplementing conventional ones**

Conventional water-treatment technologies are being supplemented in water-short areas by advanced systems capable of processing wastewater for reuse in certain applications. In Kuwait, **GE** (US) recently completed the world's largest membrane filtration water purification plant, which will treat up to 100 million gallons per day of wastewater for reuse by agriculture and industry.

**Leading providers:** Wastewater treatment: **Siemens** (Germany), **Suez** (France), **Veolia** (France), **RWE** (Germany) and **GE** (US). Membrane suppliers: **Asahi Kasei** (Japan), **Vontron Envirotech** (China) and **Saehan** (South Korea).

**Major drivers:** Severe river contamination in major developing countries like China and India, leading to pressures to implement new and strict wastewater discharge and treatment standards.

**Major risks:** High capital costs constrain rapid expansion of some of these markets. Currency fluctuations may affect investments.

### Industrial water treatment

**Industrial water treatment is a US$80-85 billion market per year**

Industrial water treatment is a highly differentiated US$80-85 billion market, including equipment, services and chemicals to meet the specialised water quality and water treatments needs of a various industrial sectors. Stringent water-quality standards for industries such as pharmaceuticals and electronics drive markets for water-treatment services tailored to the needs of these customers. Each 300mm-diameter silicon wafer chip produced by the high-tech industry requires 8,600 litres of deionised ultrapure freshwater.[40] Large-scale water users in other sectors such as pulp and paper, chemicals, food and petrochemicals require water-treatment services for a variety of needs, including prevention of corrosion and contamination.

**Leading providers: GE** (US), **Nalco** (US), **ITT** (US), **Veolia** (France), **RWE** (Germany), **3M/CUNO** (US), **Kurita** (Japan), **Organo** (Japan), **Zenon** (Canada) and **Amiad** (Israel).

**Major drivers:** Expansion of industries with special water requirements for either quality or reliability; the high value of such water (compared with its relatively low cost of production) is driving technological advances and market penetration.

**Major risks:** Competition from other users for water in water-scarce regions may lead to regional restrictions on water-intensive industries. Regions with severe water-quality problems may be passed over for investment if additional processing and treatment costs are lower elsewhere.

### Infrastructure for water distribution

**Infrastructure services and equipment is a US$50 billion marker per year**

This category includes equipment and services to build and maintain water distribution and sewage systems to serve residential, commercial and industrial markets, including pumps, valves, water testing and monitoring, and related engineering services. Altogether, these sectors represent a global market with total annual revenue of approximately US$50 billion, spread among thousands of manufacturing companies and service providers.

**Major drivers:** Unmet needs in many developing countries are driving rapid expansion of these markets; a shift from large-scale centralised infrastructure to community-scale systems will facilitate market expansion.

**Major risks:** Many players and many diverse technologies make more careful market analysis necessary.

### Demand-side efficiency

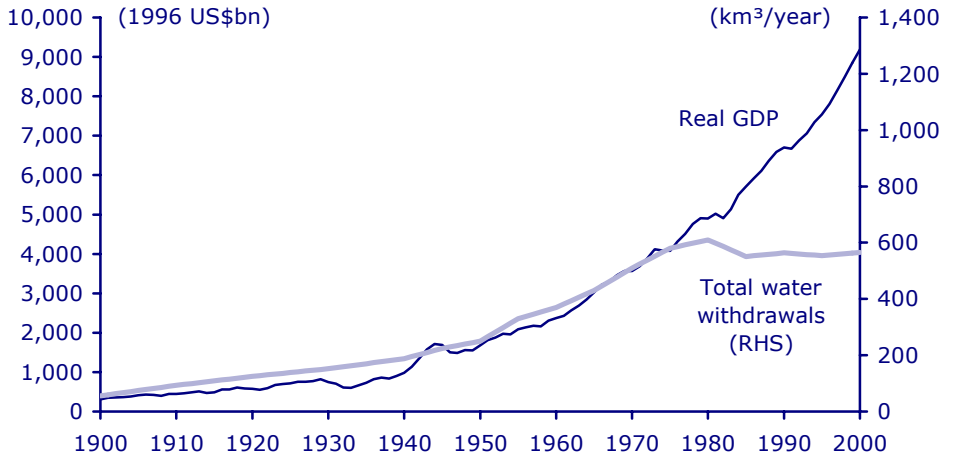
**Demand-side efficiency is an undervalued, but rapidly growing sector**

This is an underdeveloped, but rapidly growing sector, comprising companies that provide technology and services to improve "demand-side" or "end-use" efficiency for water users. It is increasingly apparent that effective management of existing water resources can reduce the need for expensive capital-intensive new water-supply systems. In many developed countries, actual demand for water is no longer growing with population and economic growth, as improvements are made in the efficient use of water. In the United States, for example, less water is now used for all purposes in 2000 than in 1980. Water use has also levelled off in places like Hong Kong, even while total economic productivity has continued to grow (see Figures 14 and 15).

Figure 14

**US gross national product (in 1996 dollars) and total water withdrawals**

**Rose in exponentially together until the mid-70s**




Source: Peter Gleick, Pacific Institute

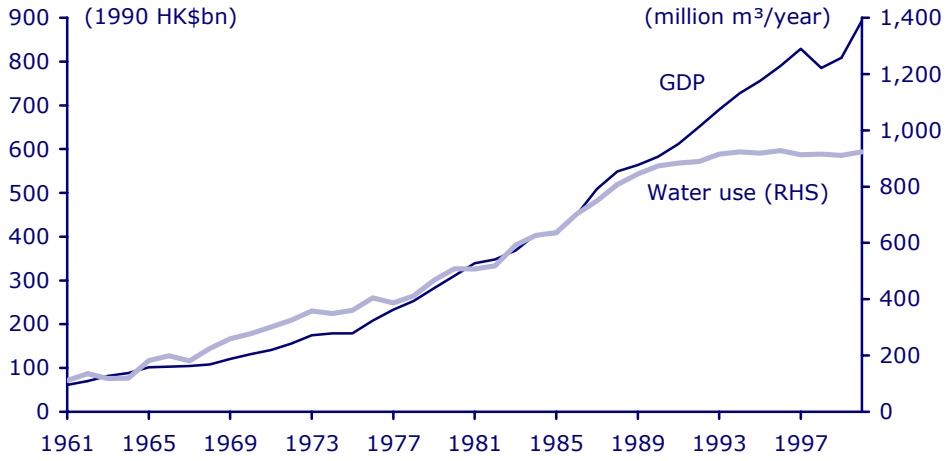
**Total US withdrawals began to level off and decline by the late 1970s**

As shown in Figure 14, until the mid-1970s, US GNP and total US water withdrawals rose exponentially together. By the late 1970s, however, total US water withdrawals began to level off and decline, while total economic productivity has continued to grow.

Figure 15

**Rose in exponentially together until the late 1980s**

**Hong Kong GDP and water use**




Source: Gleick et al, *The World's Water 2002-2003*

**Total water withdrawals in HK began to level off and decline by the early 1990s**

As shown in Figure 15, until the late 1980s, total water withdrawals for Hong Kong and gross domestic product (GDP) rose exponentially together. By the early 1990s, however, total water withdrawals in Hong Kong began to level off and then decline, even while total economic productivity grew.

**Opportunities for a wide range of companies**

Companies providing high-efficiency equipment, including showers, faucets, toilets, washing machines and other residential and commercial appliances may benefit as water prices rise, limits to economic supply are reached, new regulations are adopted and awareness of efficiency potential increases in certain markets. New technologies that reduce water use are appearing on the market regularly, such as digital X-ray machines for hospitals, commercial dishwashers and washing machines. In Europe and the United States, for example companies such as **Maytag** (US), **Geberit** (Switzerland), **Aqua Art AG** (Switzerland), as well as toilet and fixture manufacturers, have benefited from growing attention to efficient water use. Companies providing graywater recycling technologies, such as **Purecycle** (US) could also see significant growth opportunities. Moreover, integrated providers of water-efficiency technology and services may see increased opportunity in helping to address water supply crises faced by several major cities around the world.

**Major drivers:** Rising water costs, growing water scarcity and corporate water-efficiency performance objectives are all driving investment in water-use efficiency.

**Major risks:** The fragmentation of opportunities in this area makes it difficult for integrated providers of water-efficiency services and technologies to flourish. Water managers are rarely trained to address efficiency instead of expansion of supply.

## Irrigation

**Irrigation is the greatest human use of water**

The greatest human use of water worldwide is water for irrigation for food and fibre production. Growing populations, increased competition for water from urban centres and rising prices are all putting pressure on agricultural water allocations. As a result, efforts are expanding rapidly to improve the efficiency of irrigation water use to permit more food to be grown with less water.

**Growth opportunities for high-efficiency irrigation systems**

Providers of high-efficiency irrigation systems, such as precision sprinklers (including low-energy, precision application systems), drip irrigation and advanced monitoring and control systems for irrigation management are seeing growth opportunities. Drip irrigation can reduce water use by 30-70%, reduce risks of increased soil salinity and increase agricultural yields. Although drip irrigation currently accounts for only a few percentage points of the irrigation market, it is growing rapidly globally and is regionally significant. In 1970, no orchards in California were watered with drip/precision sprinklers, but by 2005 nearly 70% of these lands were watered with drip systems.[41]

**Leading providers: Rainbird** (US), **Toro** (US), **Hunter Industries** (US), **Eurodrip** (Greece) and **Netafim** (Israel).

**Major drivers:** Water efficiency initiatives by local governments as well as global food and agriculture companies are encouraging new investment in this area. Growing pressure for water transfers to cities are encouraging growers to improve yields with less water.

**Major risks:** Specialisation to match needs of many market niches, both geographically and sectorally, keeps this sector fragmented, though consolidation may occur.

## Water utilities

**Thousands of water utilities around the world**

There are thousands of large and small water utilities around the world, in many cases owned and operated by municipalities. In Switzerland alone there are still approximately 3,000 water utilities, while in Germany, there are 6,000 water utilities and 10,000 wastewater utilities. The US water industry is also highly fragmented, with more than 50,000 municipal water utilities, of which 84% serve fewer than 3,300 customers.

**Veolia and Suez are focussed on global expansion, including Asia**

The three largest private water utility companies in the world are **Veolia Environnement**, **Suez SA** and **RWE/Thames**. The first two are headquartered in France, with operations in water and energy, while RWE/Thames is based in Germany. Veolia is more exposed to the water business, which accounts for about 40% of its revenue compared with 28% for Suez. Both Veolia and Suez have high debt loads, but they continue to focus on global expansion, especially in Asia, Eastern Europe, North America and Africa. Both companies have seen strong financial performance and rising share prices in the past year, but some high-profile failures have taken a toll on this sector and slowed the push toward more private involvement in water management. RWE/Thames, after extensive acquisitions of smaller private water companies around the world, especially in the United States, is now considering divestiture of some of its holdings.

**Aqua America is an example of a large publicly-trade US-based water utility**

An example of a large publicly-traded US-based water utility is **Aqua America**, which serves more than 2.5 million people in 13 states. The company has achieved an annual customer growth rate of about 4% over the past decade based on a successful growth-through-acquisitions strategy while

keeping its operations and maintenance costs among the lowest in the industry. It also provides water and wastewater consulting and contract operations and management services. Over the past five years, Aqua America has completed an average of approximately 18 acquisitions per year, with 29 acquisitions in 2004 and a comparable pace in 2005. While this strategy requires significant cash, the company has sustained good debt ratings. Future performance will depend significantly on water rates for Aqua America's regulated utilities as determined by state regulatory bodies.

**Major drivers:** Globally, the organic growth potential for water utilities ranges widely with population and economic growth rates. Moreover, financial performance depends on regulatory factors as well as fundamental drivers of revenue and cost.

**Major risks:** Regulatory and legislative changes can shift the performance outlook for water utilities, although the sector in general offers stable returns.

## Bottled water

**Bottled water expenditure could be as high as US$100 billion per year**

Sales and consumption of bottled water have skyrocketed in recent years. From 1988 to 2004, global sales have more than quadrupled to over 154 million cubic meters annually.[42] Bottled water sales worldwide are increasing at 10% per year, while the volume of fruit drinks consumed is growing less than 2% annually and beer and soft drink sales are growing at less than 1% per year, though there was a slight slowdown in the rate of growth in 2004. More than 50% of Americans drink bottled water occasionally or as their major source of drinking water. Total consumer expenditures for bottled water could be as high as US$100 billion per year.

**Global consumption of bottled water is growing around 10% per year**

Global consumption of bottled water is growing around 10% per year with substantial growth in sales volume on every continent. The slowest growth is occurring in Europe, where bottled water has long had a commercial foothold, yet even there, growth rates of 5-10% per year are common.

In 2005, the Beverage Marketing Corporation estimated total consumption of bottled water at more than 154 billion litres, up from 72 billion litres in 1996. Figure 16 shows annual global consumption from 1996 to 2004 (estimated), along with the annual percent increase.

Figure 16

**Total global consumption of bottled water**

| Year | Thousands of cubic meters | % change |
|---|---|---|
| 1996 | 72,675.62 | - |
| 1997 | 80,649.10 | 11.00 |
| 1998 | 87,838.89 | 8.90 |
| 1999 | 97,848.00 | 11.40 |
| 2000 | 107,381.48 | 9.70 |
| 2001 | 117,876.24 | 9.80 |
| 2002 | 132,498.97 | 11.40 |
| 2003 | 144,924.78 | 9.40 |
| 2004 (preliminary) | 154,381.14 | 6.50 |

Source: Courtesy of the Beverage Marketing Corporation (2005)

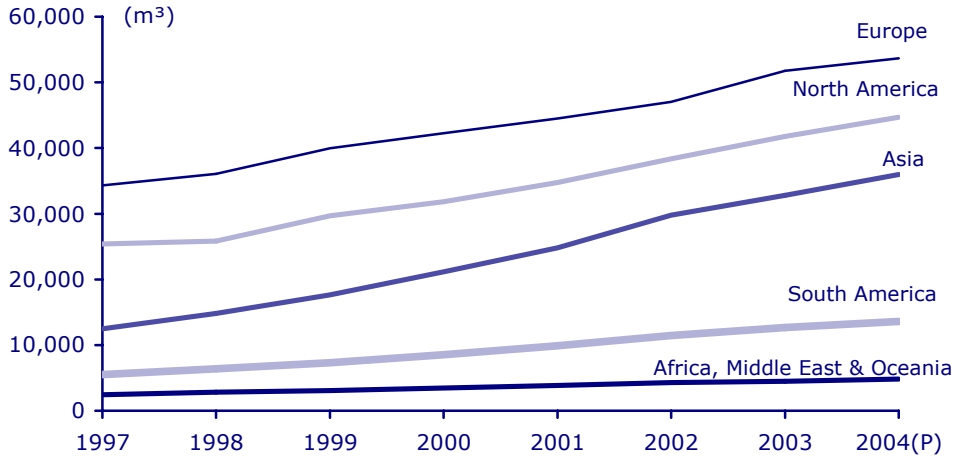
**The highest growth rates are occurring in Asia and South America**

The highest growth rates are occurring in Asia and South America, with annual increases in sales of 15% or more in places as diverse as Egypt, Kuwait, the United States and Vietnam. Figure 17 shows the trend in regional bottled water sales showing the especially rapid growth in Asia. Figure 18 shows the 2004 regional breakdown in sales.

**Growth in bottled water consumption is particularly rapid in Asia**

Figure 17

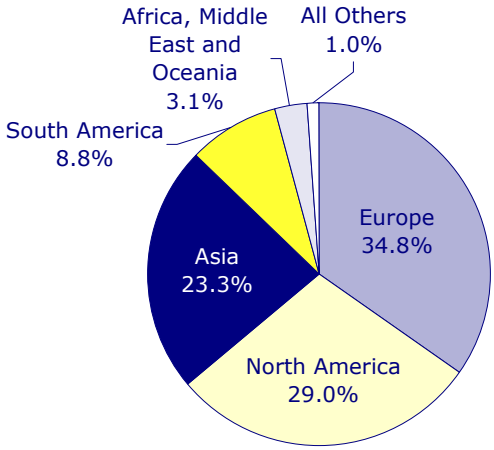
**Regional growth in bottled water consumption**




**Asia accounts for almost a quarter of bottled water sales globally**

Figure 18

**Regional breakdown in bottled water sales (2004)**




Source: Graph from the Pacific Institute, data from BMC 2005

**Many companies produce and sell bottled water, but a few major players dominate**

Many companies produce and sell bottled water, but a few major players dominate. Figure 19 shows the leading bottled water companies in the United States, though many of these have a global presence. One notable trend that may have long-term ramifications is the entry of two new companies that are committed to devoting a portion of profits from bottled water sales to water-development projects in poor countries.

**Ethos Water** in the United States has committed US$0.05 per bottle to such projects and was recently acquired by Starbucks Company, which aims to distribute Ethos Water in more than 5,000 coffee shops. A new Canadian bottled water company, **Earth Water**, has committed 100% of net profits to water programs around the world and has partnered with the UN Refugee Agency (UNHCR) to distribute these profits. Both companies are relatively small at this point, but are experiencing very rapid growth. Whether they can drive greater contributions to public water improvements from the other far larger bottled water companies remains to be seen.

Many companies produce and sell bottled water

Figure 19

**Leading US bottled water brands, 2001**

| | 2001 US market share (%) | 2001 volume growth (%) |
|---|---|---|
| Aquafina | 13.80 | 45.00 |
| Dasani | 12.00 | 95.50 |
| Poland Spring[1] | 11.20 | 29.00 |
| Arrowhead[1] | 6.60 | 50.00 |
| Aberfoyle | 5.60 | 33.00 |
| Crystal Geyser | 5.50 | 15.00 |
| Evian | 3.80 | (5.00) |

[1] Owned by Nestle SA. Source: Pacific Institute

**Major drivers:** Consumer demand is strong for this product because of concerns about water quality, image, convenience and taste. High profit margins for some bottlers.

**Major risks:** Bottled water is expensive, compared to a high-quality public supply. There are also inconsistent regulatory requirements in different regions, rising concern about plastic packaging, many players and growing community concerns about the impact of bottling plants on local water supply.

## Regional details

Regional markets differ significantly

Regional markets differ significantly in terms of freshwater availability, demographics, regulation and growth prospects. In this section, we highlight a few key characteristics of selected national and regional water economies.

### China

China is regarded as one of the most highly prospective markets

China is widely and justifiably regarded as one of the most highly prospective markets over the next two decades for companies providing water technologies and services. With relatively limited water resources, severe distribution problems and soaring demand from industrial users and rapidly growing cities, China's water infrastructure needs are vast. While it has 22% of the world's population, the country has only 7% of the world's freshwater resources and this water is unevenly distributed around the country.

Heavy groundwater reliance is already taking its toll

The rapid growth of China's mega-cities is putting serious strains on the ability of water and wastewater infrastructures to keep up. As one example of the water problems now emerging, heavy reliance on groundwater to meet soaring water demand in and around Beijing has led to water tables in the area falling at a rate of nearly two meters a year. This, in turn, is already constraining corporate development in the Beijing region.

Global and Asian companies will square off for a piece of China's pie

Business opportunities in China's water sector have shifted significantly as the Chinese government has opened the door to build-operate-transfer (BOT) and transfer-operate-transfer (TOT) deals with private companies. Increasingly, global companies such as **GE** (US), **Siemens** (Germany) and **ITT** (US) will come into competition with Asian regional players such as **Hyflux**, **BioTreat**, **United Envirotech**, and **Sinomem**, all listed in Singapore.

Environmental regulation is a new major driving force in the China market

Another major driving force in China, along with economic growth and population shifts to the cities, is new environmental regulation. China's water pollution control law is forcing cities to build sewage-treatment plants and requiring industrial companies to restrict water use and comply with new water-pollution laws. In January 2005, China's Ministry of Water Resources released a report stating that more than 53% of the water in major river systems is undrinkable, with half the water in 52 lakes surveyed and 35% of groundwater deemed too polluted to drink.[43]

**China will need to double its urban sewage disposal capacity in the next five years**

According to China's Ministry of Construction, China will need to double its urban sewage disposal capacity in the next five years, requiring investment of Rmb300 billion.[44] By 2010, 90% of all Chinese cities must have sewage-treatment plants capable of processing 60% of all waste, a huge leap from current capacity. Just to meet 2005 targets, which now appears unlikely, China would need to build 2,000 wastewater treatment plants, according to an estimate by the US Department of Commerce.

**Substantial opportunities for international firms**

The Chinese market is likely to provide substantial opportunities for international companies providing water and wastewater treatment and industrial water treatment technology and services in the decade ahead.

### India

**India will feel severe water-related pressure**

While the World Bank recently pledged to increase its water sector loans to India from US$200 to US$900 million per year over the next four years, India will be under severe pressure to revamp its water policies, improve water management and renew ageing infrastructure.[45] Water-sector opportunities in India are most likely to fall in areas of metering, desalination, improving irrigation efficiency and sewage treatment.

**May need to accelerate installation of water-metering systems**

Only a few of India's major cities, including Bangalore and Mumbai, have achieved comprehensive water metering coverage. As a result, water usage in many areas is rationed physically rather than by price. Changes in India's water economy could bring stronger pressures to accelerate the installation of water-metering systems in other major cities.

**A number of desalination projects in recent years**

A number of desalination projects have gone forward in recent years using low-cost technologies adapted for use in a power-starved country like India. A first-of-a-kind low-temperature thermal desalination plant was completed in Kavaratti, one of the Indian Lakshadweep islands.[46] The Indian government is considering larger scale commercialisation and development of the technology along India's coast. Other technologies being explored include reverse-osmosis-membrane desalination units that are run with the help of a pair of oxen or camels. Meanwhile, **IVRCL Infrastructure** has secured a contract to build a large-scale desalination plant for drinking water in Chennai.[47]

**Groundwater pumping is unsustainable in areas**

Nearly 80% of India's water resources are used in irrigation, largely from groundwater. Farmers and entrepreneurs have invested an estimated US$12 billion in groundwater pump structures. Nearly one in four of India's 100 million farmers own a pump set and well. This investment has, however, greatly accelerated the unsustainable pumping of groundwater in some parts of India, suggesting a serious risk of growing costs to farmers from energy needs to pump from greater depths, as well as major losses in agricultural production if wells go out of service. According to a recent World Bank study, India produces 15% of its food and meets 80% of its household needs by "mining" rapidly depleting groundwater resources. The World Bank estimates that by 2050 water demand in India will exceed all available supplies.[48] Upgrades to improve the energy and water efficiency of this widely dispersed rural infrastructure will come slowly, constrained by farmer's limited cash-flows and government policies that subsidise groundwater use.

**Pressure to fund sewage-treatment projects**

Finally, India's government is under pressure to find ways to fund sewage-treatment projects for increasing sewage generated by rapidly growing cities. The country only has capacity to treat about 10% of the 30 billion litres of sewage generated every day by urban areas. India's leading engineering and construction firms are likely to vie for project work in this area.

## Latin America

**Controversy over water-privatisation programs**

Controversy over water-privatisation programs in Latin American countries will remain a central factor affecting investment in water infrastructure in the region. Latin America is relatively well endowed with water: the four largest rivers there have combined runoff of almost 5,500 cubic miles, nearly as much as the 21 other largest rivers in the world put together. Brazil alone accounts for one-fifth of the world's freshwater resources. But serious water-management problems plague Latin America's largest cities, many of which lose more than 50% of water supplies through infrastructure leakage.

**Strong resistance to privatisation in much of Latin America**

Water-supply problems are particularly grave in relatively dry Mexico. In the past decade, 20% of Mexico's water system has been privatised, and the Mexican government's initiative to support privatisation and investment in water, known as PROMAGUA, has received strong support from the World Bank and other international financial institutions. Still, resistance to privatisation remains strong across much of Latin America. The balance of political and economic forces on this issue will have major implications for global water companies, such as **Suez** and **Veolia**, which hope to find new opportunities in the region.

## Europe

**Droughts and ageing water infrastructure are major challenges**

Europe's water industry faces the task of maintaining and replacing ageing water infrastructure, while addressing water problems related to frequent droughts in countries such as Cyprus, Spain, Italy and Greece. Cyprus and Spain have already installed sizeable desalination plants. The Spanish government announced plans to build up 20 desalination plants along the country's Mediterranean coast at a total cost of more than US$2 billion.[49]

**Some of Europe's largest cities may be under pressure**

Some of Europe's largest cities may also be under pressure to meet growing water needs, while simultaneously upgrading decades-old water infrastructure. In Greater London, for example, the population is expected to grow by more than 800,000 people by 2016 from the current 7 million according to Thames Water. A proposal to build a desalination plant to serve Northeast London was rejected by London's Mayor, Ken Livingstone, who urged city residents to save water as a lower-cost alternative. London has faced drought conditions in recent years and some climate experts project a drier climate for southern England in the decade ahead.

**Investment needed to meet standards by 2015 in the European Water Framework Directive**

At the same time, the European Water Framework Directive requires EU member countries to meet strict water-quality standards by 2015. Significant investment will be needed in Eastern Europe in particular to meet the new standards. Funding for projects in Eastern Europe will likely come in part in the form of grants from the European Commission, which provided almost US$3 billion to these countries from 2000-2003, most of which was directed toward water and wastewater projects.[50] Meanwhile, in the industrial sector, outsourcing of water and wastewater treatment facilities is gaining ground in Europe and expected to grow from US$620 million in 2004 to reach close to US$1 billion by 2011.[51]

## Africa

**Local distribution remains a major problem in parts of sub-Saharan Africa**

A combination of large- and small-scale water projects and technologies are likely to continue to be the most practical solutions to the serious water problems facing parts of sub-Saharan Africa where local water distribution remains a major problem. Efforts to stimulate large-scale international investment in water projects in Africa have met with little success in recent decades.

**Foreign water investment remains urgently needed**

Africa is also seriously underrepresented in international aid. Between 1990 and 1997, according to World Bank figures, sun-Saharan Africa received less than 0.001% of international private-sector water investment; from 1998 to 2001, Africa as a whole received a very small fraction of overseas development assistance.[52] Over the past decade, only modest progress has been made toward higher investment levels. Until political and regulatory changes can be brought into place to strengthen Africa's water utilities, foreign investment in this region remains urgently needed, but difficult to find and apply.

## Israel

**Israel is a key place to watch for water-technology startups**

Israel is a key place to watch for emerging water-technology startups. As the country faces severe water and water-security problems, both the government and Israel's water utility, **Mekorot**, have taken steps to foster innovation in water technology. As more and more regions of the world faces water problems, Israeli companies may find wider markets for their products and services. Mekorot is offering 3,000 sites in Israel to startups for beta testing of water-related technologies.[53] One Israeli startup, **Atlantium**, is testing a new UV-based water-disinfection technology that can treat water at high flow rates to destroy pathogens that cannot be eliminated by conventional water treatment methods. The Israeli government has set up two technology incubators to support water-related technology development, and has launched a project to explore nanotechnology applications in the water industry.

# Appendix: Water-related stocks listed in Asia

| | Code | Market cap (US$m) | Current year PE (x) | 12-month div yield (%) | Net debt to equity (%) | PB (x) | Operating margin (%) | ROE (%) | Earnings yield (%) |
|---|---|---|---|---|---|---|---|---|---|
| **Australia** | | | | | | | | | |
| Transpacific Industries | TPI AU | 836.1 | 23.6 | 0.0 | 105.7 | 9.3 | 10.6 | 22.4 | 2.0 |
| **China** | | | | | | | | | |
| Fujian Kongking-A | 600388 CH | 141.0 | - | 1.8 | (13.1) | 1.6 | 6.8 | 6.9 | 4.1 |
| Wuhan Kaidi Electric-A | 000939 CH | 244.3 | - | 1.4 | 27.1 | 2.8 | 9.9 | 15.1 | 5.1 |
| **Japan** | | | | | | | | | |
| Airtech Japan | 6291 JP | 90.2 | 18.0 | 1.2 | (53.6) | 1.3 | 13.4 | 9.7 | 6.6 |
| Asahi Pretec | 5855 JP | 608.9 | 35.3 | 1.0 | 3.8 | 2.8 | 7.0 | 8.2 | 3.2 |
| Ataka Construct & Engineer | 1978 JP | 127.0 | 26.8 | 1.8 | (26.1) | 1.4 | 6.1 | 6.5 | 3.2 |
| Daiki Engineering | 5102 JP | 24.1 | 39.9 | 1.1 | 206.9 | 1.9 | 1.9 | 2.5 | 1.2 |
| Ebara Jitsugyo | 6328 JP | 146.1 | 25.3 | 1.5 | (11.4) | 2.4 | (8.8) | (8.2) | 2.1 |
| Fujikoh | 2405 JP | 23.0 | 18.7 | 0.4 | 56.8 | 2.7 | 19.4 | 19.6 | 5.3 |
| Hitachi Plant | 1751 JP | 55.3 | 14.2 | 1.5 | (2.8) | 1.7 | 4.5 | 11.0 | 5.8 |
| Kobelco Eco-Solutions | 6299 JP | 207.9 | 40.4 | 1.3 | 11.9 | 1.8 | 3.1 | 8.1 | 5.4 |
| Kurita Water (U-PF) | 6370 JP | 2,652.5 | 38.5 | 0.9 | (22.8) | 2.4 | 8.4 | 6.2 | 2.2 |
| Metocean Environment | 9768 JP | 69.7 | 20.2 | 1.0 | 10.8 | 0.6 | 4.3 | 1.3 | 5.4 |
| NS Environmental Science | 4675 JP | 33.1 | 21.4 | 1.0 | (34.3) | 1.3 | 5.6 | 5.6 | 2.4 |
| Original Engineering | 4642 JP | 48.0 | nm | 1.7 | (42.6) | 0.8 | (3.2) | (6.7) | - |
| Oyo Corp | 9755 JP | 360.4 | nm | 0.8 | (30.8) | 0.7 | (1.6) | 0.2 | 1.5 |
| PREC Institute | 4701 JP | 17.2 | 15.4 | 2.1 | (19.7) | 0.8 | 10.6 | 5.3 | 6.5 |
| Suido Kiko Kaisha | 6403 JP | 72.3 | nm | 0.6 | (29.6) | 1.1 | 0.6 | 1.3 | - |
| **Korea** | | | | | | | | | |
| Cesnet | 065180 KS | 16.9 | - | 0.0 | (8.1) | 1.2 | 8.0 | 6.5 | - |
| Cheil Entech | 053330 KS | 21.8 | - | 0.0 | 48.5 | 0.6 | (49.3) | (29.8) | - |
| Clean Air Tech | 064060 KS | 55.4 | - | 0.0 | 123.1 | 1.5 | 10.4 | 10.5 | 2.6 |
| Dongjin Ecotech | 054250 KS | 14.7 | - | 0.0 | 38.3 | 0.4 | 11.5 | 1.1 | 3.0 |
| Eco Solutions | 052510 KS | 33.3 | - | 0.0 | 17.4 | 1.8 | 3.7 | 1.9 | - |
| Insun Ent | 060150 KS | 157.9 | 12.3 | 0.0 | (5.5) | 2.7 | 25.3 | 22.2 | 7.5 |
| Kael | 082270 KS | 49.4 | - | 0.0 | (17.4) | 3.4 | 40.5 | 43.8 | 10.7 |
| Koentec | 029960 KS | 71.9 | - | 0.0 | 32.7 | 1.7 | 30.9 | 18.3 | 10.1 |
| Korea Cottrell | 009440 KS | 42.0 | - | 0.0 | 16.5 | 1.6 | (3.9) | (8.9) | - |
| MAT | 080440 KS | 73.6 | - | 0.0 | 17.9 | 5.3 | 18.4 | 38.0 | 6.0 |
| Nature & Environment | 043910 KS | 27.4 | - | 0.0 | (6.5) | 2.4 | 19.4 | 23.7 | 8.8 |
| Sungkwang | 041140 KS | 11.5 | - | 0.0 | - | - | (27.2) | - | - |
| Y-Entec | 067900 KS | 47.9 | - | 0.0 | 8.4 | 2.2 | 13.9 | 33.0 | 12.7 |
| **Malaysia** | | | | | | | | | |
| Puncak Niaga (BUY) | PNH MK | 1.2 | 12.1 | 2.0 | 106.5 | 0.9 | 54.8 | 4.0 | 5.1 |
| **Philippines** | | | | | | | | | |
| Manila Water (BUY) | MWC PS | 244.9 | 8.7 | 4.1 | 33.8 | 1.5 | 39.5 | 18.0 | 11.5 |
| **Singapore** | | | | | | | | | |
| Bio-Treat Tech | BIOT SP | 1.0 | 11.7 | 2.1 | (29.7) | 3.3 | 30.3 | 29.6 | 7.1 |
| Hyflux (SELL) | HYF SP | 1.5 | 29.9 | 0.3 | 69.0 | 8.4 | 33.7 | 27.0 | 3.3 |
| **Taiwan** | | | | | | | | | |
| China Ecotek | 1535 TT | 31.4 | - | 5.4 | (44.7) | 1.0 | 3.7 | 6.2 | 6.4 |
| Super Dragon Tech | 9955 TT | 70.4 | - | 0.0 | 4.9 | 3.4 | 10.9 | 17.9 | 4.8 |

Source: Bloomberg, CLSA Asia-Pacific Markets

# Some useful resources

Budds, J and G McGranahan, "Are the debates on water privatization missing the point? Experiences from Africa, Asia and Latin America." Environment & Urbanization Vol 15 No 2 October 2003 (www.iied.org).

Business for Social Responsibility. Issue Brief - Water Issues (www.bsr.org).

Global Environmental Management Initiative. Connecting the Drops Toward Creative Water Strategies: A Water Sustainability Tool (www.gemi.org).

Global Reporting Initiative Water Protocol (with the GRI 2002 Sustainability Reporting Guidelines), February 2003 (www.globalreporting.org).

The Pacific Institute. This group publishes a wide range of water-related publications, including assessments of water privatization and globalization, environmental management standards, community participation in environmental assessment, and global water threats (www.pacinst.org).

United Nations Educational, Scientific and Cultural Organization (Unesco). World Water Assessment Programme (www.unesco.org).

United Nations Food and Agriculture Organization. Aquastat, for data on water availability and use by country and sector (www.fao.org).

The World Bank, Public-Private Investment Database (ppi.worldbank.org).

*The World's Water: The Biennial Report on Freshwater Resources*. Island Press, Washington, DC. This book is published every two years, starting in 1998. See also, *The World's Water: Information on the World's Freshwater Resources* (www.worldwater.org).

# Endnotes

[1] See, for example Raskin, P, P Gleick, P Kirshen, G Pontius and K Strzepek. "Water Futures: Assessment of Long-Range Patterns and Problems." Comprehensive Assessment of the Freshwater Resources of the World. Stockholm Environment Institute, Stockholm, Sweden. 1997.

[2] *Threats to the World's Freshwater Resources*, Gleick, P, A Singh and H Shi. Pacific Institute and United Nation Environment Programme, November 2001.

[3] "Securing Food for a Growing World Population." (Chapter 8). In UN World Water Development Report – *Water for People, Water for Life* (www.unesco.org).

[4] As cited in Business for Social Responsibility. Issue Brief – Water Issues (www.bsr.org)

[5] The International Conference on Water and Environment, held in Dublin, Ireland in January 1992, included the following principle among the four so-called "Dublin Principles:" "Water has an economic value in all its competing uses and should be recognized as an economic good."

[6] United Nations General Comment 15, Economic and Social Council, Committee on Economic, Social and Cultural Rights, E/C.12/2002/11. November 2002. New York.

[7] "A fragile cornucopia assessing the status of US biodiversity." Stein, B A *Environment* Vol. 43, pp. 11-22. 2001. and Riccardi, A and J Rasmussen. 1999. "Extinction rates of North American freshwater fauna." Conservation Biology Vol.13, No. 5. October 1999.

[8] Zheng Caixiong and Wang Zhuoqiong, "Salt Tides, Drought Blight South," *China Daily*, 1 November 2005.

[9] Intergovernmental Panel on Climate Change (IPCC). 2001. *Climate Change 2001: Impacts, Adaptation and Vulnerability* (www.grida.no). See also the Water Sector Report of the US National Assessment, *Water: The Potential Consequences of Climate Variability and Change*. US Global Change Research Program, Washington DC (www.gcrio.org).

[10] "Water Crisis Looms as Himalayan Glaciers Melt." *Reuters*, 9 September 2005.

[11] World Wildlife Fund.

[12] "Asia's Water Security Under Threat." UNEP press release, 6 September 2005.

[13] "Group doesn't want Perrier bottling Michigan water". US Water News, March 2001 (www.uswaternews.com).

[14] A comprehensive study of this issue, "The New Economy of Water" is available online from the Pacific Institute (www.pacinst.org).

[15] Private Participation in Infrastructure Database. World Bank, 2005 (ppi.worldbank.org).

[16] "No smooth passage to India." *World Water and Environmental Engineering*. April 1997, p10.

[17] "Kerala Govt undecided on Coke plant's future". Sun Network (www.sunnetwork.org).

[18] "Why are IT firms fleeing Bangalore?." *The Economic Times*, 29 July 2004 (economictimes.indiatimes.com).

[19] "Grasim's VSF plant closure hits textile units in MP." Bharat Textile (www.bharattextile.com).

[20] Environmental News Network, 11 March 2004 (www.enn.com).

[21] "Gunnamatta priority in push to end ocean outfalls." *The Age*, 13 August 2004 (www.theage.com.au).

[22] Comprehensive Assessment of the Freshwater Resources of the World. World Meteorological Organization and Stockholm Environment Institute. Stockholm, Sweden. 1997. As cited in *Earth Trends,* World Resources Institute, 2001.

[23] "China's water crisis said to be severe and urgent", United Press International, 1 November 2005 (www.wpherald.com)

[24] "China must abandon its growth-at-any-cost model." *Shanghai Daily* (www.shanghaidaily.com).

[25] Environmental reports from Unilever (www.unilever.com).

[26] A more detailed description of this case study can be found in "Challenges of Water Scarcity: A Business Case for Financial Institutions," UNEP Finance Initiative, p 9.

[27] Challenges of Water Scarcity: A Business Case for Financial Institutions, UNEP Finance Initiative, p9.

[28] We note, for example, that in the recent review by the Pacific Institute on "Corporate Water Reporting," no Chinese companies published environmental-sustainability reports.

[29] Business for Social Responsibility. Issue Brief – Water Issues (www.bsr.org).

[30] ISO 14001:1996(E) Environmental Management Systems – Specification with Guidance for Use. Geneva, Switzerland.

[31] *Corporate Water Reporting Industry Summary*. Pacific Institute internal report, 14 September 2005 (M Morikawa).

[32] More information on the Facility Reporting Project can be found at www.facilityreporting.org.

[33] P H Gleick, *The World's Water 2004-2005*. Island Press, Washington DC, 2004. See especially Chapter 2: "The Myth and Reality of Bottled Water."

[34] Girish Kuber, "India's on the brink of a water crisis." *The Economic Times*, 12 October 2005.

[35] "GE's Water Financing Strategy," The Wall Street Transcript, 7 June 2005.

[36] Helmut Kaiser, "Water Desalination Worldwide for Seawater and Brackish Water, 2005-2015.

[37] See, for example, *General Comment 15* of the United Nations Committee on Economic, Social and Cultural Rights. November 2002, cited above.

[38] We note that desalination of brackish water (water with slightly elevated salt content) is far more economic than desalination of ocean water. The earliest and largest expansions of desalination technologies may occur in areas with such brackish waters.

[39] "China's water crisis said to be severe and urgent", United Press International, 1 November 2005 (www.wpherald.com)

[40] Challenges of Water Scarcity: A Business Case for Financial Institutions, UNEP Finance Initiative, p9.

[41] Peter Gleick, Heather Cooley and David Groves, *California Water 2030: An Efficient Future.* Pacific Institute (www.pacinst.org) This report has detailed information on irrigation technologies in California, the largest agricultural producer in the United States.

[42] P H Gleick, *The World's Water 2004-2005*. Island Press, Washington, DC. See Chapter 2: "Bottled Water: Myth and Reality".

[43] "Water: The New Oil - China," Red Herring, 15 August 2005.

[44] "China Welcomes Investment in Water Sector," China Knowledge Press, 1 November 2005.

[45] Gargi Parsai, "Manage Water Resources: Expert," *The Hindu*, 6 October 2005.

[46] "Water: The New Oil - China," Red Herring, 15 August 2005.

[47] "IVRCL to Set Up Desalination Plant Near Chennai," The Hindu Daily Business Line, 11 August 2005.

[48] Andy Mukerjee, "Forget Oil: India's Bigger Problem is Water," Bloomberg, 27 October 2005.

[49] "Water: The New Oil—Europe," Red Herring, August 15, 2005.

[50] "Water—The New Oil: Europe," *Red Herring*, August 15, 2005.

[51] "EU Industrial Outsourcing Market," Frost & Sullivan, PR Newswire, September 12, 2005.

[52] "Creditor reporting system, aid activities in the water sector 1997-2002. Organisation for Economic Co-operation and Development (OECD), Paris. 2002. Also "Water: The New Oil - Africa," Red Herring, 15 August 2005.

[53] "Mekorot Establishes WaTech," Mekorot press release, 25 September 2005.

# Table of figures

# Research & sales offices

www.clsa.com

## Operational hubs


**Hong Kong**
CLSA Hong Kong
18/F, One Pacific Place
88 Queensway
Hong Kong
Tel : (852) 2600 8888
Fax : (852) 2868 0189

**Singapore**
CLSA Singapore
9 Raffles Place #19-20/21
Republic Plaza II
Singapore 048619
Tel : (65) 6416 7888
Fax : (65) 6533 8922

**USA**
Calyon Securities (USA) Inc
Calyon Building
1301 Avenue of The Americas
New York, New York 10019
Tel : (1) 212 408 5888
Fax : (1) 212 261 2502

**United Kingdom**
CLSA (UK)
122 Leadenhall Street
London EC3V 4QH
Tel : (44) 207 696 9190
Fax : (44) 207 214 5401


## Asia-Pacific Markets


**China – Beijing**
CLSA Beijing
Unit 10-12, Level 25
China World Trade Centre Tower 2
1 Jian Guo Men Wai Ave
Beijing 100004, P.R.C.
Tel : (86 10) 6505 0248
Fax : (86 10) 6505 2209

**India**
CLSA India
8/F Dalamal House
Nariman Point
Mumbai 400 021
Tel : (91) 22 5650 5050
Fax : (91) 22 2284 0271

**Korea**
CLSA Korea
15th Floor Sean Building
116, 1-Ka, Shinmun-Ro
Chongro-Ku
Seoul, 110-061
Tel : (82) 2 397 8400
Fax : (82) 2 771 8583

**Taiwan**
CLSA Taiwan
6/F, No. 117, Sec. 3
Min-sheng E. Road
Taipei
Tel : (886) 2 2717 0737
Fax : (886) 2 2717 0738

**China – Shanghai**
CLSA Shanghai
Suites 305-310, 3/F
One Corporate Avenue
No.222 Hubin Road
Luwan District, Shanghai PRC 200021
Tel : (8621) 2306 6000
Fax : (8621) 6340 6640

**Indonesia**
CLSA Indonesia
WISMA GKBI Suite 1501
Jl. Jendral Sudirman No.28
Jakarta 10210
Tel : (62) 21 574 2626/2323
Fax : (62) 21 574 6920

**Malaysia**
CLSA Securities Malaysia Sdn. Bhd.
Menara Dion, #20-01
27 Jalan Sultan Ismail
50250 Kuala Lumpur
(Company No. 690921-X)
Tel : (603) 2056 7888
Fax : (603) 2056 7988

**Thailand**
CLSA Securities (Thailand) Ltd
16th Floor, M. Thai Tower
All Seasons Place
87 Wireless Road, Lumpini
Pathumwan, Bangkok 10330
Tel : (662) 257 4600
Fax : (662) 253 0532

**China – Shenzhen**
CLSA Shenzhen
Room 3111, Shun Hing Square
Di Wang Commercial Centre
333 Shennan Road East
Shenzhen 518008
Tel : (86) 755 8246 1755
Fax : (86) 755 8246 1754

**Japan**
Calyon Securities
Shiodome Sumitomo Building 15F
1-9-2, Higashi-Shimbashi
Minato-ku, Tokyo 105-0021
Tel : (81) 3 4580 5533 (General)
(81) 3 4580 8722 (Trading)
Fax : (81) 3 4580 5896

**Philippines**
CLSA Philippines
18th Floor, Tower One
The Enterprise Center
6766 Ayala Avenue
Makati City
Tel : (63) 2 886 5637-46
Fax : (63) 2 886 5692


**Key to investment rankings: BUY** = Expected total return greater than >10%; **O-PF** = Expected to outperform the local market by 0-10%; **U-PF** = Expected to underperform the local market by 0-10%; **SELL** = Expected to underperform the local market by >10%. Performance is defined as 12-month total return (including dividends).




03/01/2006