CHINA WATER RISK

Water: The New Business Risk

Part I – Introduction

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1. Water Scarcity, an Emerging Business Risk

1.1 Exposure to water related risks

It goes without saying that industry sectors exposed to water risks are generally those that i) rely on large quantities of clean water to produce their product/services, either directly or through the supply chain, and/or ii) generate large quantities of contaminated waste water. This includes: thermal power generation; iron and steel; oil refining; petrochemical; chemical; paper mills; textiles; non-ferrous metals; food; and fermentation. Sectors where large quantities of water are used for low-value products are also vulnerable, such as the case for agriculture.

These risks and the impact to business vary greatly between companies and industry sectors and are strongly influenced by the local context in which companies and their suppliers operate, such as the sensitivity of local watersheds, ecosystems and communities. This in turn makes management, including measurement, monitoring and disclosure, more complex than for some other environmental issues.

1.2 Staying afloat

'Water is the new Carbon', this refrain is frequently heard in relation to the increasing awareness of emerging water crises, globally. For water intensive companies operating in a water-stressed environment, what this means is the immediate need to identify, map and manage water risks, from both a business and environmental perspective, much in the same way that companies are now responding to carbon.

Few corporate leaders strategically address water risks

Global management consultant McKinsey & Company recommends how companies can stay afloat1 by taking three steps to identify, quantify and manage water-related risks and opportunities:

- Firstly, understand exposure across geographies and along the value chain and product portfolios;
- Secondly, look for solutions in operations and products – pulling efficiency levers but also thinking boldly about new opportunities to help customers and other stakeholders use water wisely; and
- Thirdly, get involved in the wider debate to have a voice and help solve water challenges.

Yet, despite the increasing and varied risks facing companies that operate in water stressed environments such as China, few corporate leaders have emerged who systematically and strategically address the issue. There are

[1] The global corporate water footprint, Risks, opportunities and management options, McKinsey & Company, 2009

several reasons for this, not least the artificially low cost of water and thus lack of incentive to achieve efficiency.

Combined with a lack of awareness as to the severity and potential impacts of the crisis, companies have been slow to develop forward-looking strategies. For those willing to act, many are uncertain as to what approach and methodology to take in addressing a risk that is proving to be more complex to assess and manage than more familiar environmental concerns such as energy.

As the pressure on companies to address water risks gains momentum, a surprising number of initiatives, methodologies and tools are being developed by a variety of organisations including business, multilaterals and NGOs, often in collaboration. These initiatives cover a multitude of issues from water measurement and risk analysis to the development of strategic responses to risks and disclosure. While this is encouraging on a number of levels, it can be confusing for companies who want to start to address the issue in earnest. Recognising this, a number of expert groups have sought to distill the various initiatives and tools and provide guidance on how best to use them.

2. Industry Trends

2.1 Water Demand in China

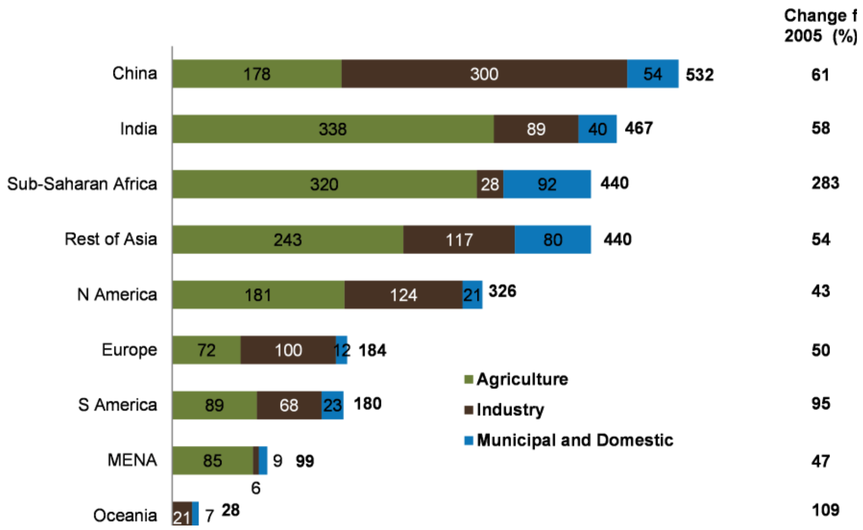
Companies have been slow to develop forward-looking water management strategies

In a recent report published by the 2030 Water Resources Group (WRG)[2] it is estimated that by 2030 under an average economic growth scenario and if no efficiency gains are assumed, global water requirements will grow by approximately 53%, from 4,500 billion m3 today to 6,900 billion m3. This is 40% above current accessible and reliable supply.

As might be expected, agriculture accounts for the majority of withdrawals (69%), with the remainder being split between industry (18%) and municipal and domestic demand (13%). Looking forward, WRG anticipates industrial withdrawals will increase to about 22% by 2030. This growth is in large part anticipated to be driven by China, which alone accounts for 40% of the additional industrial demand worldwide.

[2] Charting our Water Future, 2030 Water Resources Group, 2009

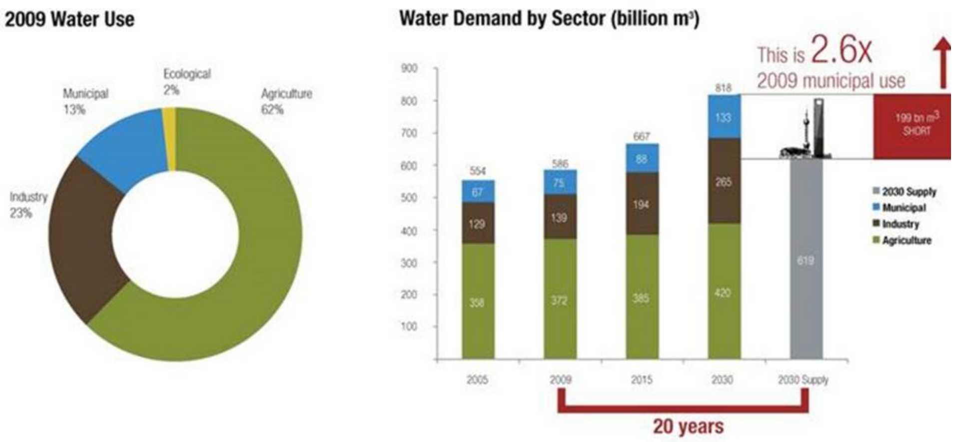
Figure 1: Increase in annual water demand 2005-2030 (billion m^3)



Source: 2030 Water Resources Group, Charting our Water Future, December 2009.

According to China's Ministry of Water Resources[3], in 2009 industrial water withdrawals accounted for about 23% of the country's total water withdrawal, in contrast to 10% in 1980[4]. Agriculture accounts for the lion's share of the nation's withdrawals at 62%.

Figure 2: Water Use in 2009 and Water Demand by Sector



Source: National Bureau of Statistics of China, China Statistical Yearbook 2010; 2030 Resources Group, "Charting Our Water Future", 2009

3 NSBC China Statistical Yearbook, 2010; 2030 Water Resources Group, 2009

4 China Water Conservation Technology Policy Outline, National Development and Reform Commission, 2005

Thermal power cooling is the single largest source of industrial demand

Industrial water consumption mainly includes cooling water, water for heating power and washing water[5]. Cooling water accounts for about 80% of total industrial consumption. Thermal power cooling in particular is estimated to be by far the single largest source of industrial demand – representing nearly one third of the total[6]. Thermal power generation is reported to be the largest industrial water user and as such is facing increasing limitations in China's rapidly urbanizing basins, despite the high penetration of water-efficient technology[7].

The volume of water withdrawals in nine industries: thermal power generation; iron and steel; oil refining; petrochemical; chemical; paper mills; textiles; non-ferrous metals; and food and fermentation accounts for over 65% of the national industrial water withdrawals (including direct cooling water for thermal power generation).

In 2009, the 2030 Water Group provided the following insights into projected industrial water demand and supply in China:

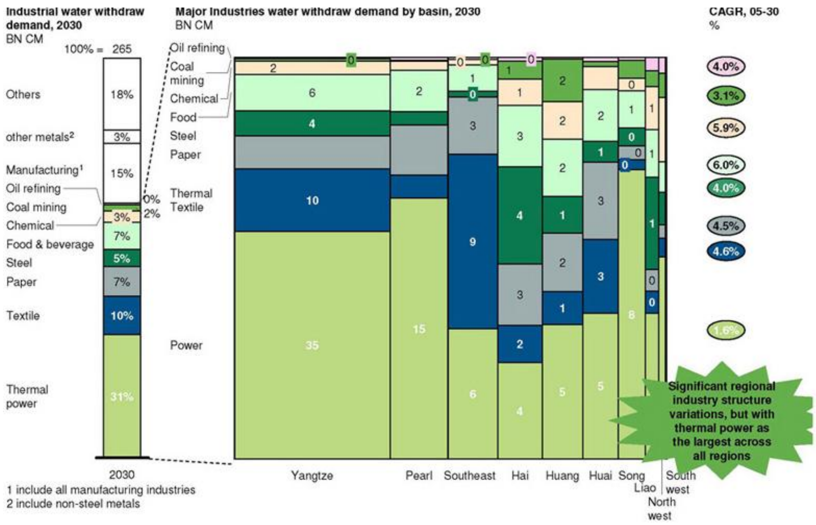
- If unconstrained, industrial water demand is expected to grow by 3% annually from 129 billion m^3 in 2005 reaching 265 billion m3 in 2030, with the highest growth within the next decade. Industry will then account for 33% of China's water demand.
- As demand outstrips supply, it is predicted that by 2030 China will experience a gap between demand and supply of 201 billion m^3.
- Heavy water-using industries, such as coal power, will come under pressure to save water or lose out to renewable energy sources. At the same time, urban utilities will be looking for more energy-efficient ways to treat, transport, and even desalinate their water.
- Industry structure varies significantly across the main ten river basins, leading to big differences in water withdrawals by industry and across basins. The one constant is thermal power, which accounts for 31% of total industrial demand across basins in 2030.

[5] China Water Conservation Technology Policy Outline, National Development and Reform Commission, 2005
[6] Charting our Water Future, 2030 Water Resources Group, 2009
[7] Ibid.

2.2 Industrial Water Use

The Water Resources Group predicts significant variation for industrial water withdrawal across China's basins, but thermal power remains the largest.

Figure 3: Industries water withdraw demand by basin, 2030



Adapted from Charting our Water Future, Water Resources Group, 2009

Additional sector information on China's industrial water use is provided in Responsible Research's report "Water in China"[8]. The report highlights water issues and practices facing the following industry sectors: bottlers; agriculture; banking; beverages; basic materials; metals and mining; paper and forest products; and the textiles, apparel and footwear industry.

[8] Water In China, Issues for Responsible Investors, Responsible Research, 2010

2.3 Industrial Wastewater Discharge

Wastewater discharges in 2007 were reported to be 75 billion tonnes[9], of this about two thirds were from industry. While estimates of industrial wastewater treatment vary, it is generally recognized to be in the region of 90%, though some figures (2006) have placed it in the range of 56%[10]. What is certain is that industrial contaminants are discharged into China's water supply in large quantities.

Two thirds of China's waste water discharges are from industry

As industrial water demand grows, inevitably so will wastewater and the need for necessary treatment of discharges. The 2030 Water Resources Group predicts that annual growth of 3 to 7% in industrial water demand will mean similar growth in the need for treatment, whether water is to be discharged or recycled.

Industry with the highest wastewater discharges are[11]:

- manufacture of paper and paper products
- manufacture of raw chemical materials and chemical products
- manufacture of textiles
- production and supply of electric power and heat power
- processing of food from agricultural products
- smelting and pressing of ferrous metals
- processing of petroleum, coking, processing of nuclear fuel
- mining and washing of coal
- manufacture of beverages

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[9] Ministry of Water Resources, "2007-2008 Annual Report," 2008. Note that other organisations may have conflicting figures. MEP in its 2007 State of the Environment Report refer to a figure of 55.6 billion tonnes.

[10] Addressing China's Water Scarcity, World Bank, 2009

[11] China Statistical Yearbook, 2008

Industry Examples and China Case Studies

In 2009, the Coalition of Environmentally Responsible Economies (CERES) and the Pacific Institute mapped the water use and discharges of water-exposed sectors in its report, *Water Scarcity and Climate Change: Growing Risks for Business and Investors.* An overview of water industry footprints is provided below.

FOOD

		Raw material production	Suppliers	Direct operations	Product use / end of life
Value chain segment		Food crop and livestock production	Container and packaging manufacturing; Ingredient suppliers	Meat and food processing; Distribution; Retail and marketing	Cooking and preparation of food products; Recycling and disposal of packaging and containers
	Intensity	High	Medium	High	Medium
Withdrawal	Description	Freshwater for crop irrigation; Freshwater for rinsing and cleaning crops; Freshwater requirements for livestock – drinking, sanitation, grazing	Freshwater to manufacture containers and packaging; Washing and cooling	Water as a product ingredient; Washing, cleaning, pasteurization (steam)	Water to wash and cook food products; Water to wash and recycle containers
	Intensity	High	Medium	High	Medium
Discharge	Description	Agricultural runoff, wastewater from food processing facilities containing fertilizer, pesticides, and herbicides; Feedlot runoff; Animal waste	Wastewater discharge containing toxic chemicals	Wastewater discharge from meat and food processing; Wastewater discharge from retail and commercial facilities (bathroom, kitchen, landscaping)	Wastewater discharge; Impact of discarded packaging on aquatic ecosystems

BEVERAGE

		Raw material production	Suppliers	Direct operations	Product use / end of life
Value chain segment		Food crop production, such as sugar cane, barley, fruits	Bottle, container and packaging manufacturing; Ingredient suppliers	Bottling; Distribution; Retail & marketing	Beverage consumption; Container recycling and disposal
	Intensity	High	Medium	High	Medium
Withdrawal	Description	Freshwater for crop irrigation; Freshwater for rinsing and cleaning crops	Freshwater to manufacture containers and packaging; Freshwater for washing and cooling	Water as a product ingredient; Water use in dispensing products; Water withdrawal for bottled water; Washing, cleaning, pasteurization (steam)	Water use to wash and recycle beverage containers
	Intensity	High	Low	High	Medium
Discharge	Description	Agricultural runoff; wastewater from food processing facilities containing fertilizer, pesticides, and herbicides	Wastewater discharge containing toxic chemicals	Wastewater discharge from meat and food processing; Wastewater discharge from retail and commercial facilities (bathroom, kitchen, landscaping)	Wastewater discharge; Impact of discarded packaging on aquatic ecosystems

APPAREL

		Raw material production	Suppliers	Direct operations	Product use / end of life
Value chain segment		Growing and harvesting cotton plants	Textile manufacturing; Garment manufacturing	Retail and marketing; Distribution	Consumer's garment use
	Intensity	High	Medium	Low	High
Withdrawal	Description	Freshwater withdrawal for cotton crop irrigation (22,000L/kg)	Freshwater for textile manufacturing, in particular for dyeing and bleaching (500L/kg)	Water use in retail and commercial facilities (bathroom, kitchen, landscaping)	Water use to wash garments (1,650L/kg)
	Intensity	Medium	High	Low	Medium
Discharge	Description	Agricultural runoff containing fertilizer, pesticides	Wastewater discharge containing dye, bleach, detergent and other processing chemicals	Wastewater discharge from retail and commercial facilities (bathroom, kitchen, landscaping)	Wastewater discharge containing detergent

ELECTRONICS/HIGH-TECH

		Raw material production	Suppliers	Direct operations	Product use / end of life
Value chain segment		Silicon extraction and production; Metal and plastic production	Silicon wafer/semiconductor and electronic parts manufacturing	Product assembly and manufacturing; Retail and marketing; Distribution	Consumer's garment use; Disposal
Withdrawal	Intensity	Medium	High	Medium/Low	Low
	Description	Freshwater for scrubbing and cooling; Freshwater for silicon extraction	Ultra-pure water for wafer manufacturing; Freshwater for scrubbing and cooling; A typical fab can use as much as 3 million gallons of water per day	Water use in assembly, retail and commercial facilities (bathroom, kitchen, landscaping)	Water use in electronics recycling process
Discharge	Intensity	High	High	Low	Medium
	Description	Wastewater containing heavy metal, acid and toxic chemicals	Wastewater containing heavy metal and toxic chemicals	Wastewater discharge from retail and commercial facilities (bathroom, kitchen, landscaping)	Electronic waste – leachate and runoff containing heavy metal and toxic chemicals from landfill

POWER

		Raw material production	Suppliers	Direct operations	Product use / end of life
Value chain segment		Extraction and refining of oil, natural gas and coal	Suppliers of power generation equipment	Power generation; Power distribution; Maintenance	Energy used for various purposes
Withdrawal	Intensity	High	Low	High	N/A
	Description	Water used for steam and water flooding of reservoirs, steam for oil extraction, cooling and steam generation for refining processes	Cooling water or steam generation in manufacturing facilities	Water use for cooling, steam generation, flue gas treatment; Hydropower generation requires reliable water flow	Water is not needed to use electricity. However, there is often a strong energywater connection – energy is required to heat or deliver water
Discharge	Intensity	High	Low	High	N/A
	Description	Wastewater containing metals and hydrocarbons	Wastewater containing heavy metals and other potentially toxic chemicals	Significant thermal discharge impacts on local ecosystems	No wastewater discharge associated with energy use

METALS & MINING

		Raw material production	Suppliers	Direct operations	Product use / end of life
Value chain segment		Mining and drilling	Suppliers of mining or manufacturing equipment	Manufacturing of steel and other metals	Recycling and disposal of metal products
Withdrawal	Intensity	High	Low	High	Medium
	Description	Water used for dust control, drilling and as slurry in product transportation	Cooling water or steam generation in manufacturing facilities	Freshwater use for cooling, boiler and rinsing	Freshwater use for boiler and rinsing
Discharge	Intensity	High	Low	High	Medium
	Description	Runoff and wastewater containing dust, sediments and metals and toxic chemicals; Drainage water from mines that require treatment to discharge	Wastewater containing heavy metals and other potentially toxic chemicals	Wastewater containing heavy metals and other potentially toxic chemicals	Wastewater containing heavy metals and other potentially toxic chemicals

FOREST PRODUCTS

		Raw material production	Suppliers	Direct operations	Product use / end of life
Value chain segment		Growing and maintenance of forests	Suppliers of logs, wood chips	Pulp and Paper manufacturing; Wood product manufacturing; Distribution; Retail and marketing	Recycling and disposal of paper and wood products
Withdrawal	Intensity	Medium	Low	High	Medium
	Description	Precipitation and irrigation requirements to grow and maintain forests; Water use to combat forest fire	Freshwater to manufacture containers and packaging; Washing and cooling	Freshwater use in pulp and paper-making process; Cooling water and steam generation	Water use to manufacture paper using recycled material
Discharge	Intensity	Low	Low	High	Medium
	Description	Agricultural runoff containing fertilizer, pesticides, and herbicides; Increased sediments from logging operations	Wastewater discharge from cleaning and cooling process	Wastewater discharge from pulp and paper-making process has high concentration of cleaning and bleaching chemicals, inks and oils; Wastewater discharge from retail and commercial facilities (bathroom, kitchen, landscaping)	No wastewater discharge associated with energy use

BIOTECH/PHARMA

		Raw material production	Suppliers	Direct operations	Product use / end of life
Value chain segment		Production of basic chemicals; Food and animal products	Container and packaging manufacturing	Pharmaceutical product manufacturing; R&D; Distribution; Retail and marketing	Disposal of unused products
Withdrawal	Intensity	Low	Low	Medium	Low
	Description	Freshwater for agricultural raw material (plants, animal)	Freshwater to manufacture containers and packaging; Washing and cooling	Water as a product ingredient; Washing, cleaning, pasteurization (steam)	Drinking and sanitation water for consumers
Discharge	Intensity	Low	Low	High	Medium
	Description	Agricultural runoff, wastewater from food processing facilities containing fertilizer, pesticides, and herbicides; Feedlot runoff; Animal waste	Wastewater discharge containing toxic chemicals	Wastewater discharge that contain high concentration of cehmicals and/or microbial organisms; Wastewater discharge from retail and commercial facilities (bathroom, kitchen, landscaping)	Disposal of unused products may release toxic chemicals and biological agents into the surrounding environment

Case Studies

The following two case studies are sourced from 'Water in China – Issues for Responsible Investors, Responsible Research, 2010.'

Pulp and paper mills: water intensive and polluting industries face closure in China

China is one of the world's largest producers of Paper and Forest Products. Its pulp production, for example, ranks third globally, producing almost 20 billion tonnes in 2007. Paper and board production in China surpassed 26 million tonnes in Q1 2009, growing over 2% year-on-year.

Pulp and paper mills use between 75-225 m³ of freshwater per tonne of paper manufactured. This does not include the cooling water used in their power plants. Hence, the 4.2MT capacity of Lee & Man Paper Manufacturing, a leading containerboard manufacturer, would require at least 840 million m³ of water per year. To put this in perspective, the total annual water resources of the Pearl River Basin are about 471,000 m³.

China's Department of Science and Technology Standards reported that 'the industry's waste water discharge accounts for 10-12% of China's total waste water discharge, ranking top among all industries. What's more, COD discharge in the industry accounts for up to 50% of the total in China.

Zhao Wei, Secretary-General of the China Paper Association, notes that of China's almost 3,500 paper mills in 2008, the number of small mills was around 3,100, with medium and large making up the remainder. These large mills account for 80% of the total production, but contribute less than one third of pollutant discharge in the industry. Although the China Paper Association does not have any water-related initiatives, industry and government officials stress that they are aggressively shutting down old, polluting mills. Progress is evident: The 11th Five-Year Plan (2006-2010) mandated that 6.5 million tonnes of capacity be closed. In May 2009, media reports indicate that that the goal now is to close an additional 7.5 million tonnes by 2011. The actual figure could be as high as 10 million tonnes.

Low profit margins incentivize pollution from untreated wastewater

The textile industry is not only one of the largest polluters in China, but is also one of the largest consumers of water and energy. It takes up to 40,000 litres to water the cotton to maturity and provide finishing for 1 kg of textile. It is also estimated that around 25% of chemical compounds produced worldwide are used in the textile industry, which has high levels of wastewater discharge at 600 litres per kg of textile on average.

Prices for clothing imported to the U.S. have fallen 25% in real terms since 1995, partly due to the pressure from discount retail chains that has led to artificially low pricing for textiles. This constant need to slash margins has led some Chinese factories to dump wastewater directly into rivers instead of treating it. Treating contaminated water costs around US$0.13/mt and factories can increase margins substantially by sending wastewater directly into rivers, violating China's water pollution laws. Substances found in high concentrations near textile plants include heavy metals, carcinogens, fabric fibres and many organic materials (for example the starch which is used to treat threads before they are woven). The oxygen required to breakdown large amounts of organic compounds can lead to a reduction in fish populations and stagnant water.