07 June 2007
Global
Equity Research

Water

The New Perspectives Series

Credit Suisse realizes that in the current geopolitical environment, investing opportunities are not always easily categorized by industry sectors. Emerging issues and macroeconomic trends often involve companies across sectors and regions of the world. In this "New Perspectives" Series, research analysts join together, often times with the help of our equity strategists, to craft in-depth thematic analysis highlighting the issues at hand and the companies poised to benefit.

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STRATEGY

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Water use is rising at double the rate of global population growth owing to urbanisation, more water-intensive agricultural products, growing industrialisation of emerging markets and the impact of climate change.

The supply of fresh water is relatively static. Hence, the rapid rate of demand growth is, not surprisingly, causing some stress.

An estimated third of the world's population currently lives in water-stressed or water-scarce countries. On the current trajectory, we estimate that by 2025, based on the most recent UN population projections, 18 countries will have water demand in excess of supply and 58 countries (or 64% of the global population) will be under significant pressure.

In this report, we have drawn together material across sectors and regions in order to analyse the investment implications of this important topic. We focus on the potential solutions to the water shortage. Essentially, we organise the discussion into three sections: (1) water supply (encompassing recycling, pollution, desalination and infrastructure); (2) water management (utilities, operators and consultants); and (3) water demand (efficiency potential in agriculture, industry and at home).

The capex required to mitigate the problem is significant. Our top-down estimates suggest real growth in water infrastructure expenditure of 6.7% per annum out to 2025.

To play this theme, we present the *Credit Suisse Water 20,* which includes Suez, Pennon, ITT Corp, Cardno, Coffey, Kurita Water Industries, Bunge, Ricoh, Halma, Danaher and Nestlé.

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Executive summary

Warren Buffett wrote, “It doesn’t count to predict rain, what counts is building the ark”. That is the focus of this report. We accept the issue that there are global water shortages and they will get worse. However, our focus is on building the ark: specifically, which companies are taking charge of dealing with this shortage and which, from an investment perspective, offer the most potential.

Overall water use is rising at double the rate of global population growth owing to urbanisation, more water-intensive agricultural products, growing industrialisation of emerging markets and the impact of climate change. The supply of fresh water is relatively static. Hence, the rapid rate of demand growth is, not surprisingly, causing some stress. Just over a fifth of water use is from groundwater and these reserves are being used faster than they can be replenished in China, India, the US and Australia. For example, total depletion to date of North America’s biggest aquifer is equivalent to the annual flow of 18 Colorado rivers.

An estimated third of the world’s population currently lives in water-stressed or water-scarce countries (largely in the Middle East). By 2025, we estimate, based on the most recent UN population data, that 18 countries will have water demand in excess of supply and 58 countries (representing a total of 64% of the global population) to suffer high or medium-high relative water stress.

In this report, we look in more detail at the current and prospective problems of the water supply (pages 12–14). We briefly describe the cycle for collecting and processing water (pages 56–57). The publication of this report coincides with the Asian Water report, written by Angello Chan, which looks in more detail at the problems and solutions to the water issue across Asia, particularly China.

We have drawn together material across sectors and regions in order to analyse the investment implications of this important topic. The bulk of the report focuses on the potential solutions to the water shortage. We organise the discussion into three sections: (1) water supply (encompassing recycling, pollution, desalination and infrastructure); (2) water management (utilities, operators and consultants); and (3) water demand (efficiencies in agriculture, industry and at home).

Water is growth: GE has publicly stated that it forecasts its water-related activities to grow by a CAGR of 35% (up to 2009) in developing markets. Dow Chemical similarly states that it is looking to triple water exposure over the next four years. Nitto Denko’s targets are to triple sales of membrane filters over the next three years.

The capex required to mitigate the problem is significant. Our top-down estimates suggest real growth in water infrastructure expenditure of 6.7% pa out to 2025. Growth in India, China and Russia is likely to be particularly strong at 15.4%, 12.6% and 16.7%, respectively, pa to 2025. Many of the major capital equipment and chemical companies (such as GE and DOW) are sensitive to this theme, although often it is a small part of the business. Hence, we have examined over 200 companies in an attempt to highlight where stocks offer greater exposure to water. Wherever possible we have calculated the proportion of sales derived from water-related business from the accounts of the last reported financial year for each stock.

Despite the growth potential, the stocks do not appear to be expensive. We find that our basket of 232 water-related stocks trade on a prospective P/E of 16x, a 14% premium to global equities, with strongly positive earning momentum.

Key issues

(1) Water supply

Recycling and pollution

Water recycling makes up just 4% of global supply (according to the World Bank). The potential is much larger: in Israel, the government plans are in place for recycling to deliver 25% of water supply, and in Australia 11%. On the pollution front, there is increasing legislation to force a cleanup. China's Construction Ministry estimates that Rmb 1trn (US$130bn) will need to be invested in water between 2006 and 2010, increasing the proportion of sewage that is treated from 34% to 40% by 2010. *Water treatment technology is shifting away from the traditional sand-filtering processes to membrane processing*. **GE** and **Dow** are major players in this industry, but their water businesses both represent less than 1% of group sales. Interestingly, however, water is an area where they have both publicly stated that they are looking to expand. Direct exposure to water treatment (and, in particular, the fast-growing membrane filtration and UV disinfection parts of the chain) can be gained through **ITT, Danaher, Halma, Pentair and Pall**. **ITT** is a multi-faceted water provider (39% of 2006 sales were water-related), their services and product range from pumps and valves to desalination equipment. **Danaher and Halma** (9% and 12% of sales, respectively, related to water) offer exposure to UV treatment. **Pentair and Pall** (68% and 17% of sales, respectively, are water-related) concentrate on membrane filtration.

Desalination

Desalination is the easiest answer for those countries (mainly in the Middle East) where water stress is greatest. The key is the huge fall in the cost of desalination. On some estimates (Johns Hopkins University), this was down 80% over the last three years. At the Askelon plant in Israel, costs are US$0.5/1,000 gallons—in line with the normal cost of water in Israel. Total global desalination capacity has grown by 47% over the last five years. There are total global government plans to boost production by nearly 50% over the next 5–8 years. Current market sales are approximately US$5bn and are forecast to grow to US$70bn by 2020, according to the International Desalination Association. Direct exposure to the desalination theme can be accessed via **Kurita Water Industries** (100%), **Doosan** (23% of sales from water, with 40% market share in MSF technology), **Tetra Tech** (85%), **Acciona** (15%) and **Hyflux** (30%).

Water infrastructure

We consider two areas of water infrastructure: dams and reservoirs and pipelines and leaks.

Growth in dams and reservoirs looks likely to be concentrated in Asia and Europe (where the ratio of reservoir capacity/water supply (16% in Europe, 11% in Asia) is so much lower than in the US (33%)). **Alstom** (6% of sales is hydro-related) is the largest provider of hydro-electric power generation equipment and, despite fierce competition from **Harbin,** has managed to maintain its market share in China.

Ageing infrastructure as well as dwindling groundwater supplies, growth in desalination and water recycling are boosting demand for new and replacement water pipelines and related products, such as pumps and valves. In Spain, the government has said it is planning to build a 900km pipeline. In China, the government plans seven pipelines and seven more are under consideration. Some of the smaller caps offer direct exposure (**Kurimoto**, **Nippon Chutetsukan**, **Northwest Pipe Co**). We can also consider **Georg Fischer** (15% of revenue from pipes). Leakage rates have fallen in response to higher water prices and a rising tide of public sentiment against waste. There is still a huge variation in leakage (from just 5% in Holland, 23% in the UK, 25% in the US and 33% in Czech Republic). AWWA forecasts a three-fold increase in repair costs by 2030, which

translates into annual average expenditure on leaks running at 4.7% growth pa. Exposure is via **Halma** (the global leader in leak detection technology with 12% of sales from water), **Homeserve** and **Insituform**.

Virtual water

The alternative to pipelines is the so-called 'virtual' water trade, where water-rich regions supply water-intensive agricultural products to water-poor areas. Rising demand for meat and vegetable oils from developing countries is likely to necessitate this trend regardless of trade barriers. Brazil, with 15% of the world's fresh water supply, is the obvious beneficiary. **Bunge** (an integrated oilseed processor in Brazil) offers exposure.

Packaged water

The packaged water industry is worth roughly US$85bn in annual sales and has been growing strongly (8% by volume pa) over the last decade. The penetration rate of bottled water is mixed: in China, the consumption per capita is 10% that of Italy; US consumption is nearly 30% lower than Europe. We expect the growth in bottled water to continue to be strong for the health benefits of drinking spring water for developed market consumers and to avoid ill-health for emerging market consumers. **Danone** (20% water sales) and **Nestle** (10%) offer exposure to the theme.

(2) Water management

In order to finance and manage the required capex, both the price and the private provisioning of water are likely to rise substantially. The need to contract out water supply is huge: in Europe only 35% of supply is provided by the private sector; 15% in the US; and just 5% in Asia. Clearly the price of water has to rise. Over the past five years, municipal water rates have increased by a global average of 2.7% pa in excess of inflation. In the UK, where the water sector is largely privately-owned and prices are probably a more accurate reflection of costs, prices rank as the third-highest in the world. They are, for example, 66% and 189% above Italian or US levels. In addition, there are huge price anomalies that seem unlikely to be able to last (e.g. within Spain the price of water in Barcelona, where water is plentiful, is 90% higher than in water-scarce Valencia). Required investment is greatest in China, India, Russia and other emerging markets, but this is where the regulatory risk is also greatest.

We prefer utilities that offer a balance of growth against regulatory risk (either because they operate in a stable regulatory environment or because that risk is mitigated through contracting). **Veolia** (34% of revenue from water) and **Suez** (15% of revenue from water) offer exposure to the theme. In addition, **Hong Kong and China Gas** (2% water sales) and **NWS Holdings** (4% water sales) could be considered for their growth potential.

(3) Water demand

Water demand per capita in the US is 70% greater than in Europe and 87% greater than in Japan. The scope for savings is huge. We break it down into three areas: agricultural, industrial and domestic efficiencies.

Agricultural efficiencies

Cutting agricultural demand for water (70% of world water usage) is possible through the following: (a) The introduction of drought-resistant plants (**Monsanto, DuPont** and **Syngenta**). Drought-resistant corn could be commercially available by 2012–15. Monsanto estimates that this could deliver incremental revenues of US$1bn–5bn (compared to current sales of US$7.3bn). (b) More efficient irrigation techniques, such as drip irrigation. Only 2.8% of arable land in China and 1.6% in India uses efficient irrigation compared to 100% of arable land in Germany and Israel. **Jain Irrigation** in India and **Xinjiang Tianye Water Saving Systems** in China are potential beneficiaries.

Industrial efficiencies

Industry accounts for 22% of end water demand. Following major growth between 1960 and 1980, global water withdrawal for industrial use has pretty much stabilised despite continued growth in manufacturing production. In Europe, the Best Available Technology (BAT), part of the Integrated Pollution Prevention and Control Directive of 1996, is already mandatory for all new installations in industrial processes, but comes into force for all existing installations from the end of October this year. According to the UN, industry could cut 40–90% from industrial water usage with existing technology. Indeed, Japan has cut industrial water demand by 25% since 1970. Lower growth numbers are reflected in the forecasts of the companies providing product and services in industrial water use. **Alfa Laval** (10% water-related sales), **Hercules** (6%), **Nalco** (the largest player in industrial water treatment with 100% sales in water products), **Ciba (24%)** and **Ashland** (9%) offer exposure. **Badger Meter, Flowserve** and **ITT** all provide flow equipment to monitor and regulate the flow of water.

Domestic efficiencies

Domestic water use accounts for 8% of the total, but the proportion wasted is a staggering 85%. Water metering is universal except in the UK. Currently, 25% of UK households are metered, DEFRA is targeting 75% of households by 2025. Legislation is slowly catching up to force the adoption of water-efficient devices and practices. The US DOE predict that by 2026, water use for the average American family should be reduced by up to a half, compared to pre-1994 (when Congress passed the Energy Policy Act). In the UK, the consultation period on mandating water efficiency in new buildings finished in March this year with legislation due to be discussed later this year.

Solutions include metering (**Itron, Badger Meter**), better household plumbing (**GWA International, Watts Water Technologies,** with 75% and 100% of revenue from water, respectively) and more efficient appliances (e.g. the latest washing machine technology is twice as efficient as the installed base; potential beneficiaries are **LG Electronics** and **Whirlpool**).

Stock-picks

The Credit Suisse Water top 20

We are highlighting 20 stocks that (a) play a role in the water process and are exposed to growth in the chain, (b) screen well on Credit Suisse HOLT and our composite valuation screen and (c) are recommended by our analysts.

The 20 stocks are presented in Figure 1. The list is sorted by the final column (the aggregate score), which combines the results of the most attractive valuations (based on P/E, P/BV, yield and Credit Suisse HOLT), the best momentum (on CFROI, earnings and sales) and the most *negative* sentiment (i.e. stocks with a greater number of broker sell recommendations rank more highly).

Figure 1: Credit Suisse Water 20

				-----P/E (12m fwd) ------			------ P/B -------		Yield (06e)		HOLT			----- Momentum --------							
Name	Water exposure	% of sales related to water	Main listing	Abs	rel to Industry	rel to mkt % above/below average	Abs	rel to mkt % above/below average	FCY	DY	Implied CFROI less 5-year average	Price, % change to best	Valuation score	CFROI	1m EPS	3m EPS	3m Sales	Momentum score	Consensus (buy less holds & sells)	Overall score	Credit Suisse rating
Shanghai Electric	Wastewater treatment equipment, water project engineering and construction	4%	HKG	15.4	86%	-1%	2.3	-10%	-2.9%	1.9%	-2.1	45.9	6.0	2.2	0.6	-1.5	3.4	1.5	-37.5	8.5	Outperform
Northumbrian Wtr G	Water utility	96%	GBR	14.1	75%	n/a	n/a	n/a	-0.9%	3.3%	n/a	57.7	5.0	0.4	0.4	3.2	0.5	2.0	-11.1	8.0	Neutral
Cardno Limited	Consultant engineers	10%	AUS	15.3	80%	n/a	n/a	n/a	5.1%	n/a	n/a	2.8	7.0	-0.3	1.3	-1.4	-3.6	0.5	14.3	7.5	Outperform
Ricoh Co	Water meters	28%	JAP	15.2	91%	-44%	1.9	-10%	5.7%	1.1%	-3.3	32.0	6.0	-0.2	-0.8	2.1	2.4	1.0	41.2	7.0	Outperform
Halma	Water treatment, UV disinfection, water leak detection	12%	GBR	17.0	95%	15%	n/a	n/a	5.2%	3.2%	1.1	-8.1	4.0	0.5	0.0	0.1	0.3	1.5	-80.0	6.5	Neutral
Coffey Intl	Consultant engineers (dam construction)	10%	AUS	14.3	77%	n/a	n/a	n/a	2.3%	n/a	n/a	-2.8	5.0	14.1	-0.3	-3.8	0.8	1.0	60.0	6.0	Outperform
George Fischer Ag	Water piping systems	15%	CHE	14.1	87%	26%	2.6	99%	5.8%	2.0%	0.9	24.9	4.0	1.0	0.4	5.0	3.6	2.0	11.1	6.0	Outperform
Chiyoda Corp	Water treatment	NA	JAP	18.3	96%	-57%	7.3	48%	4.7%	0.6%	-3.1	18.6	4.0	-5.1	-2.5	-0.8	4.4	0.5	-20.0	5.5	Neutral
Kubota Corp	Filtration products, water tanks, pipes	11%	JAP	15.1	93%	-63%	2.0	-26%	5.4%	1.2%	1.1	-6.0	4.0	0.2	-5.1	-7.0	-0.6	0.5	-28.6	5.5	Neutral
Nestle Sa	Packaged water	10%	CHE	17.1	97%	25%	3.7	-5%	4.7%	2.0%	-2.3	3.3	4.0	-0.4	0.4	1.3	0.9	1.5	51.7	5.5	Outperform
Danaher Corp	Water testing and treatment	8%	USA	18.4	113%	16%	3.4	-19%	5.3%	0.1%	-8.9	87.0	4.0	-2.8	0.0	0.4	1.1	1.0	39.1	5.0	Outperform
Hercules Inc	Scaling/corrosion/microbial control chemical production	6%	USA	12.1	75%	-4%	27.7	517%	6.7%	0.0%	1.2	-5.9	3.0	0.2	1.9	2.5	NM	2.0	100.0	5.0	Outperform
Hongkong&China Gas	Water supply and wastewater treatment	2%	HKG	18.2	100%	16%	4.8	-14%	4.3%	2.0%	-0.5	-6.4	3.0	1.0	2.1	13.5	4.8	2.0	33.3	5.0	Outperform
Bunge Ltd	Agricultural products	NM*	BRA	16.6	95%	49%	1.9	5%	3.0%	0.8%	-1.8	-0.2	3.0	0.3	-0.3	-2.8	7.2	1.0	-40.0	5.0	Outperform
Nitto Denko Corp	Membrane filtration products	3%	JAP	21.4	133%	-21%	2.9	9%	0.5%	1.2%	-3.5	9.4	3.0	-1.4	-2.0	-11	-2.4	0.0	-36.8	4.0	Outperform
Toray Inds Inc	Membrane filtration products	2%	JAP	19.0	118%	-38%	1.9	-15%	1.4%	1.2%	2.8	-12.5	2.0	0.4	-5.3	-5.6	2.6	1.0	-11.1	4.0	Neutral
Kurita Water Inds	Wastewater and sewage treatment systems, plus desalination	100%	JAP	26.6	164%	25%	2.9	-1%	0.6%	0.8%	3.3	-34.1	1.0	0.8	3.1	4.7	0.6	2.0	-66.7	4.0	Neutral
ITT Corp	Wastewater and advanced water treatment, flow control, pumps	39%	USA	17.8	110%	36%	4.3	-1%	4.5%	0.8%	1.1	-5.1	1.0	0.4	1.2	3.7	2.0	2.0	0.0	3.0	Neutral
Suez	Water Treatment, water supply management	13%	FRA	16.5	105%	18%	2.4	-7%	3.6%	2.7%	2.6	-14.4	1.0	0.5	1.8	4.0	0.4	2.0	50.0	3.0	Outperform
Pennon Group	Water utility	50%	GBR	19.2	101%	n/a	4.2	n/a	-0.8%	2.7%	2.0	-1.4	0.0	1.1	-0.5	-0.4	0.1	1.0	-57.1	2.0	Outperform

Source: Company data, Credit Suisse estimates

Other water-related stocks that screen highly:

We have also run our entire universe of water-related stocks (232 companies) through our composite valuation and earnings momentum scorecard (which is based entirely on consensus data). Below, we show the water-related stocks that are not covered by Credit Suisse analysts that screen highly on valuation and earnings momentum scores.

Figure 2: Water stocks: other interesting ideas

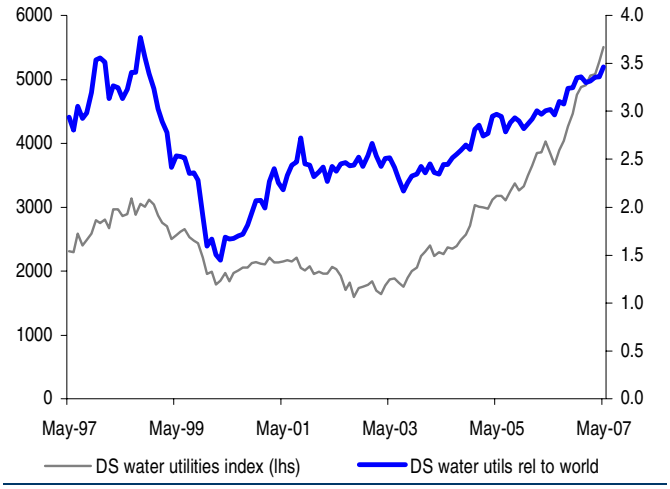
Name	Water exposure	Main listing	-----P/E (12m fwd) ------			------ P/B -------		Yield (06e)		HOLT		Valuation score	-------- Momentum ----------				Momentum score	Consensus (buy less holds & sells)	Overall score	Credit Suisse rating
			Abs	rel to Industry	rel to mkt % above/below average	Abs	rel to mkt % above/below average	FCY	DY	Implied CFROI less 5-year average	Price, % change to best		CFROI	1m EPS	3m EPS	3m Sales				
Hopewell Highway	Infrastructure in China	HKG	16.1	62%	n/a	n/a	n/a	6.0%	n/a	n/a	31.4	7.0	2.9	-1.2	2.6	1.7	1.5	-71.4	9.5	NR
Harbin Power Eqpmt	Hydro turbines	HKG	10.2	63%	n/a	n/a	n/a	6.9%	1.7%	n/a	28.3	7.0	2.4	-0.6	-3.3	6.9	1.0	-27.3	9.0	NR
Coca-Cola	Water bottling	USA	17.7	93%	-48%	2.4	-15%	18.0%	1.0%	0.3	2.4	5.0	-0.4	0.2	1.5	0.3	1.5	-71.4	7.5	NR
Pepsiamericas Inc	Water bottling	USA	17.0	89%	n/a	n/a	n/a	6.4%	n/a	n/a	-25.0	5.0	-0.2	0.0	2.5	0.4	1.0	-100.0	7.0	NR
Bio-Rad Labs	Water testing	USA	21.5	n/a	n/a	n/a	n/a	5.3%	n/a	n/a	2.8	7.0	-1.6	NM	NM	NM	0.0	n/a	7.0	NR
Watts Water Technologies Inc	Instruments for water regulation and control	USA	15.3	94%	n/a	n/a	n/a	4.6%	n/a	n/a	13.5	5.0	0.6	-3.9	-5.6	5.8	1.0	-20.0	7.0	NR
WS Atkins	Engineering and advanced technology consultancy	GBR	17.6	95%	30%	n/a	n/a	5.5%	1.7%	-1.2	-10.0	5.0	-1.0	3.9	9.3	0.8	1.5	6.7	6.5	NR
Ciba Spezialitaten	Scaling/corrosion/microbial control chemical production	USA	14.1	86%	13%	1.7	-10%	8.6%	2.9%	0.9	8.1	5.0	0.0	-1.1	0.2	-0.3	0.5	-66.7	6.5	NR
Pentair Inc	Membrane water filtration systems	USA	17.2	106%	33%	2.2	-14%	5.5%	1.6%	-1.8	19.6	5.0	-0.5	0.0	-1.2	1.3	0.5	-50.0	6.5	NR
Bio-Treat Tech	Water treatment	SGP	10.8	58%	n/a	n/a	n/a	5.4%	n/a	n/a	-16.9	5.0	-1.4	NM	NM	1.2	1.0	n/a	6.0	NR
Lotte Chilsung Bev	Soft drinks	KOR	18.2	95%	68%	0.9	-42%	8.6%	0.2%	-2.6	-10.6	4.0	0.7	NM	NM	NM	2.0	n/a	6.0	NR
Rohm And Haas Co	Scaling/corrosion/microbial control chemical production	USA	14.4	88%	4%	2.8	-9%	7.3%	2.5%	0.6	5.8	5.0	-0.1	0.3	-0.1	0.3	1.0	0.0	6.0	NR
Inversiones Aguas	Water Utility	CHL	12.8	67%	-29%	1.5	25%	5.3%	7.1%	-3.0	23.3	6.0	-0.8	NM	NM	NM	0.0	60.0	6.0	NR
Beckman Coulter Inc	Water testing	USA	19.5	89%	47%	3.5	9%	1.6%	0.8%	-0.2	8.9	4.0	1.4	0.8	0.3	0.0	1.5	0.0	5.5	NR
Guangdong Invest	Water distribution	HKG	15.5	81%	36%	2.1	58%	7.2%	2.1%	-1.2	23.0	4.0	0.4	-1.1	0.7	1.4	1.5	40.0	5.5	NR
Cott Corp Que	Soft drinks	CAN	29.1	152%	50%	2.3	-43%	7.4%	0.0%	-7.3	23.5	4.0	-0.7	0.0	1.4	-0.9	0.5	-42.9	5.5	NR
Shanghai Ind Hldgs	Industrial Conglomerates	HKG	15.7	98%	29%	1.3	21%	2.0%	2.1%	-3.6	42.1	3.0	0.4	1.1	-0.8	1.7	1.5	-9.1	5.5	NR
Toyobo Co	Textiles Apparel & Luxury Goods	JPN	16.8	90%	-57%	1.8	-35%	9.0%	1.5%	2.4	-23.4	5.0	0.0	NM	NM	NM	0.0	n/a	5.0	NR
Coca-Cola Femsa S.	Beverages	MEX	13.6	71%	8%	2.0	-45%	6.1%	1.0%	-5.0	-8.0	4.0	-0.9	NM	NM	NM	0.0	-33.3	5.0	NR
Pepsico Inc	Beverages	USA	19.5	102%	8%	7.3	-6%	3.9%	1.8%	-0.6	-5.2	3.0	3.0	0.1	0.6	1.0	2.0	87.5	5.0	NR
Fugro Nv	Energy Equipment & Services	NTH	15.2	112%	51%	6.1	47%	0.0%	1.9%	-0.9	16.0	3.0	2.0	4.6	8.3	1.0	2.0	42.9	5.0	NR
Woong Jin Coway	Household Durables	SKR	17.1	98%	76%	5.4	5%	-0.2%	1.3%	-2.6	17.3	3.0	2.7	1.3	9.1	1.3	2.0	71.4	5.0	NR
Trimble Navigation Ltd	Electronic Equipment & Instruments	USA	23.5	118%	-2%	4.6	12%	3.5%	0.0%	-3.4	47.0	3.0	1.8	3.9	4.0	1.1	2.0	33.3	5.0	NR

Source: Company data, IBES Global estimates, Credit Suisse HOLT estimates

Valuations

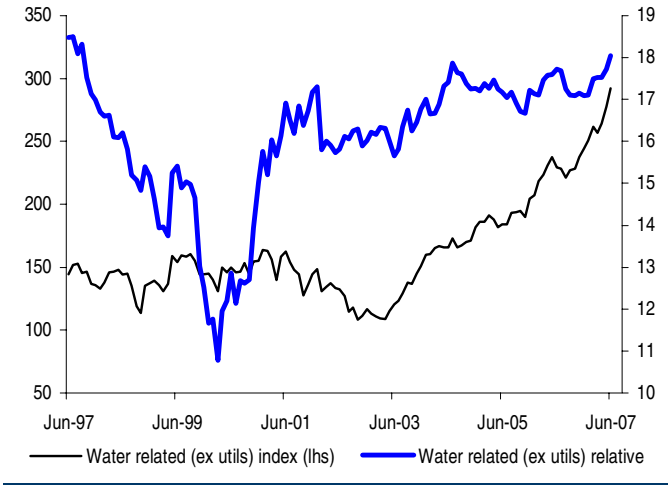
Water utilities and stocks with a high exposure to the water industry have outperformed over the last couple of years. The Datastream water utility index has outperformed the global index by 80% over the last four years. Our index of water-related companies (ex utilities) has outperformed by 28% over the same period.

Figure 3: Water utilities price performance



Source: Datastream, Credit Suisse estimates

Figure 4: Non-utility water stocks price performance

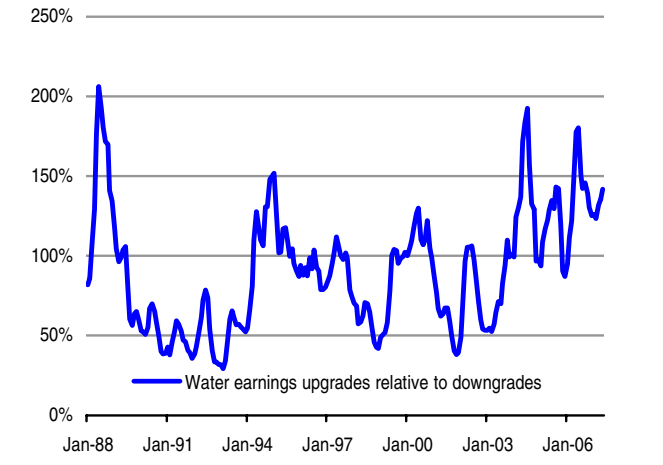


Source: Datastream, Credit Suisse estimates

Will the outperformance continue? We note the following:

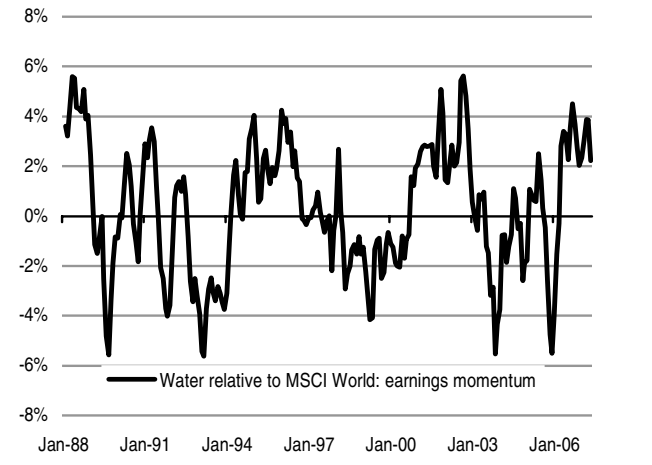
(a) Earnings surprises for our water index (comprising a total of 232 stocks with varying degrees of exposure to the water industry) have been better than average, suggesting the market has, so far at least, under-estimated the growth in capex and water prices.

Figure 5: Water basket: Upward relative to downward earnings revisions



Source: Datastream, IBES, Credit Suisse estimates

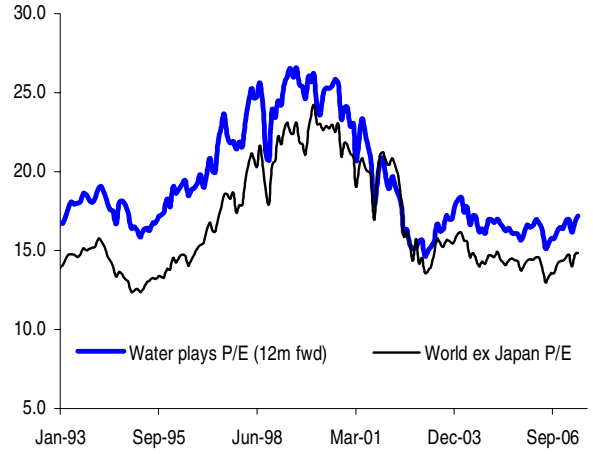
Figure 6: Water vs MSCI World: Relative earnings momentum



Source: Datastream, IBES, Credit Suisse estimates

(b) Multiples have re-rated for the water utilities (off a low base), but for our aggregate water index, forward P/Es have stayed relatively constant for the last few years. The aggregate 12-month forward P/E for our water index is running at 18x (the MSCI world ex Japan is trading on 15x).

Figure 7: Water basket and DS World Index: 12-month forward P/Es



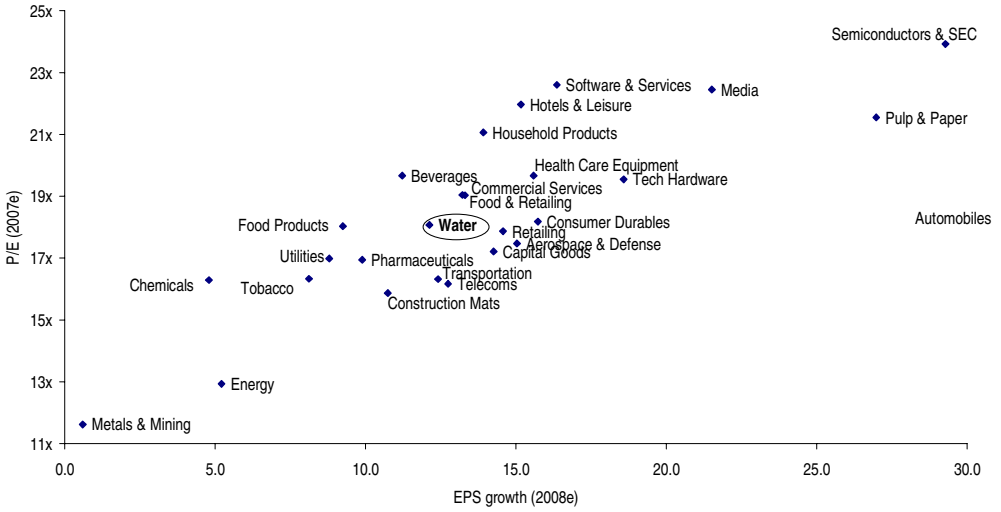
Source: Datastream, IBES, Credit Suisse estimates

Figure 8: Water basket vs DS World Index: 12-month forward P/E relative

Source: Datastream, IBES, Credit Suisse estimates

(c) Mapped against current growth expectations, our basket of water and water-related stocks still looks very reasonable.

Figure 9: Global sectors: 2007E P/E vs 2008E earnings growth



Source: IBES, Credit Suisse estimates

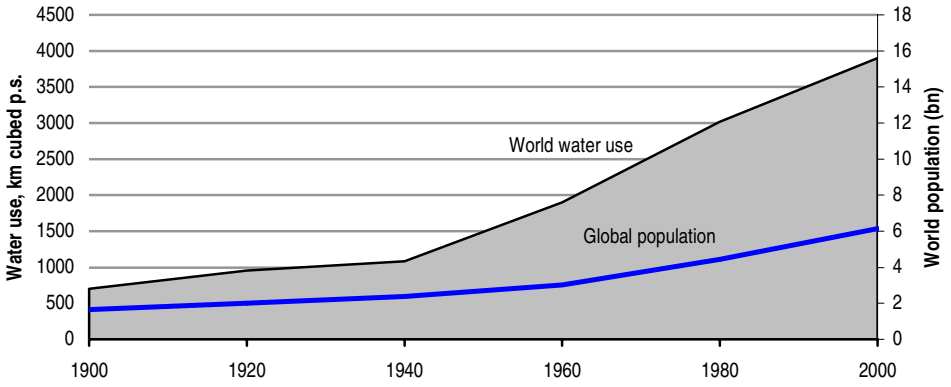
These bottom-up forecasts appear to be somewhat conservative, given our top-down view on the outlook for the industry: Top-down, we expect real growth in the water industry and water inflation to continue to beat global averages. It seems odd, then, that bottom-up forecasts (IBES) for water sector earnings are only in line with the average and that the valuation implies long-run expectations are similarly neutral. Conclusion: There appears to be plenty of scope for continued outperformance of the sector if, as we expect, bottom-up earnings forecasts converge with the more positive top-down view and multiples see a commensurate re-rating. As a ball-park target, if the water sector P/E moved up to 20x and earnings growth were 15% in the next year, the sector would be up 27% on an absolute basis.

Water: Setting the scene

Significant growth in water demand

Annual world water use is up sixfold over the last century, more than double the rate of population growth, according to FAO Aquastat.

Figure 10: Global water use and population



Source: FAO Aquastat, UN

Rising real incomes, more convenient water supply and industrial and agricultural developments have meant water demand has significantly outstripped population growth

Growth in water usage has significantly outstripped population growth for three broad reasons:

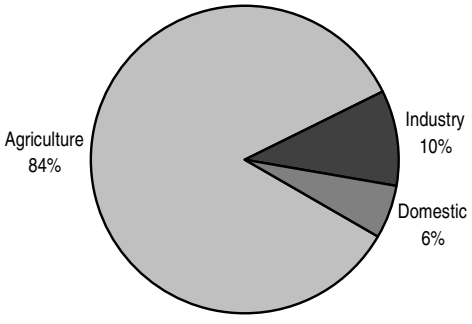
(i) Rising real incomes have increased the demand for more expensive (and water-intensive) food groups;

(ii) Advances in technology (water networks, pipelines) have brought water and sanitation into the home, making it more convenient to use in greater quantity;

(iii) Growth in industrial processes and agriculture has added to greater demand for water.

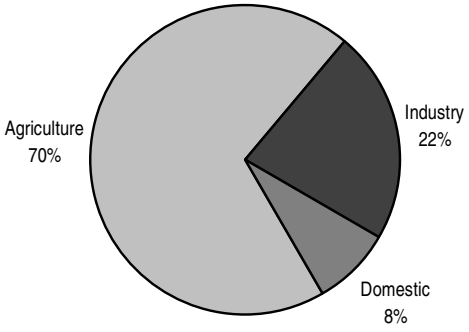
70% of water is used in agricultural processes, 22% is accounted for in industrial processes and domestic use accounts for 8%.

Figure 11: Estimated annual world water use (1940)



Source: FAO Aquastat

Figure 12: Estimated annual world water use (2000)

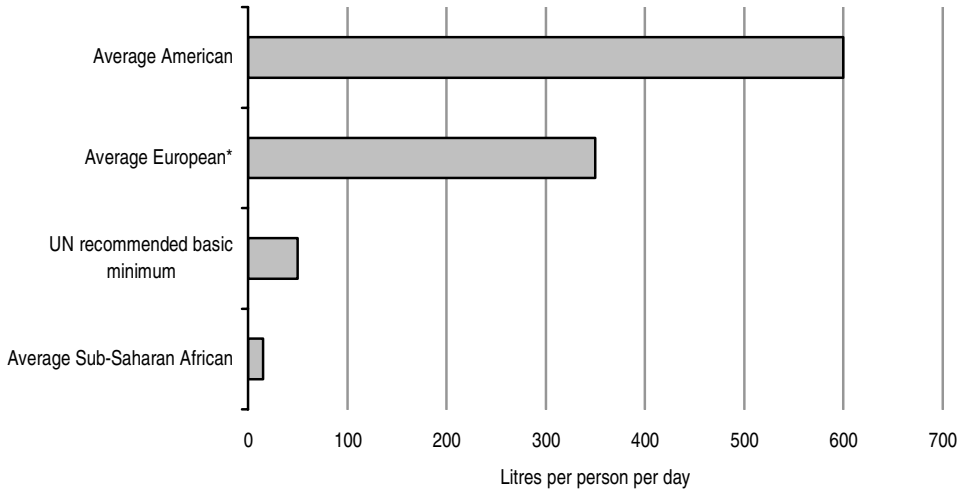


Source: FAO Aquastat

At the regional level, water demand reflects relative incomes. With better diet and water network in the US, for instance, consumers account for nearly 40 times the quantity of water per person as in Africa.

Figure 13: Water use around the world

American water consumption is 70% greater than European consumption



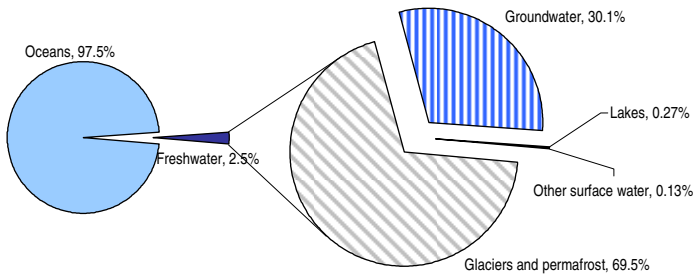
Source: World Water Council

Water supply is relatively static

The absolute quantity of water supply is the same now as it was 10,000 years ago. There is roughly 1.4bn cubic kilometres of water on the earth, but 97.5% of that is saltwater. Of the 2.5% that is freshwater, less than a third is easily accessible in groundwater, lakes and rivers. Glaciers and permafrost make up 69.5% of the freshwater.

Figure 14: Global distribution of the world's water

Only 2.5% of the world's water is fresh water and most of that is frozen

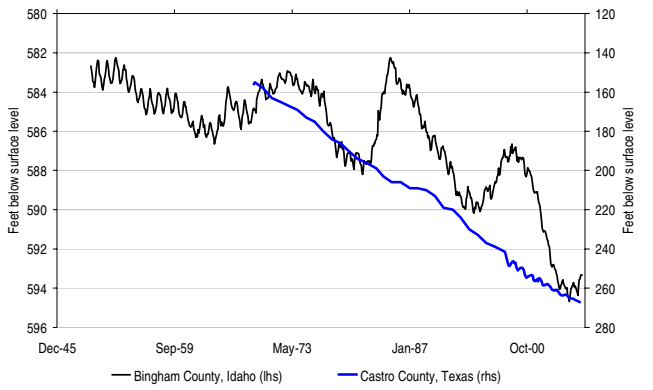


Source: Shiklomanov and Rodda, 2003

We can divide the problems with the water supply/demand balance into five broad categories. We run through these in more detail in Appendix 1, but in summary:

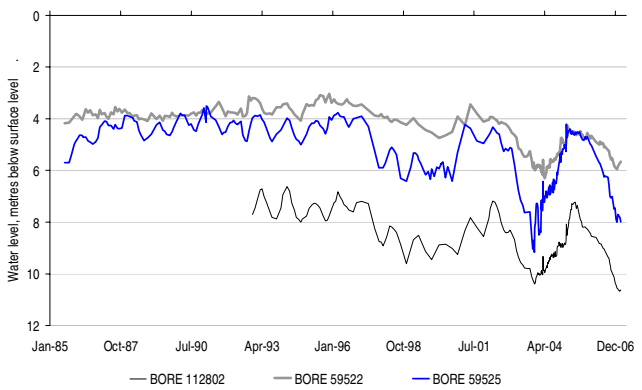
(i) The current mismatch. Groundwater levels are declining as the rate of demand has outstripped the rate of replenishment. An estimated third of the world's population currently lives in water-stressed or water-scarce countries.

Figure 15: US ground water levels



Source: US Geological Survey

Figure 16: Victoria, Australia: ground water levels



Source: Victorian water resources

(ii) Continued strong demand growth. World population growth is projected at some 30% over the next 20 years (from just over 6bn people today to just less than 8bn). Along with a forecast rise in real incomes (and hence demand) in developing markets this makes the supply/demand situation significantly worse. On our estimates, by 2025, this means that 64% of the global population will be living in countries suffering high or medium-high relative water stress.

(iii) Shifting patterns of demand. Rural/urban migration is increasing the stress on the supply/demand balance for most utilities and particularly water as it places increased pressure on neighbouring water resources (i.e. local water tables). Currently, half the world's population lives in urban centres, compared to less than 15% in 1900. By 2030, the UN forecasts that 60% of the world's population will live in urban areas.

(iv) Global warming effects. There are two factors: (a) glacial river flow is set to be negatively affected. If the glacier disappears then so does the river (this is the main threat to the Indus, fed by the Himalayan glacier and providing the main water source for approximately 250m people). (b) The IPCC warned that a temperature increase of more than 2.5°C could affect global food supply and contribute to higher food prices. Heat stress, shifting monsoons and drier conditions can reduce yields by as much as one-third in the tropics and subtropics. Dry continental areas, such as central Asia and the African Sahel, would be expected to experience drier and hotter climates, whereas longer growing seasons and increased rains might boost productivity in temperate regions.

(v) Pollution. Water pollution is derived from a wide variety of sources: failure to clean industrial waste, surface water run-off from agriculture, inappropriate discharge of sewage and over extraction of groundwater to depths whereby naturally occurring poisons (such as arsenic) fatally contaminate supplies (which is a well documented problem in India). Levels of pollution are arguably worse in developing markets where preventative legislation is not yet in place to (for example, in China, where the World Health Organisation claim that 90% of the rivers are polluted).

Combatting the water problem

(1) Water supply

In this section, we consider four avenues of augmenting the water supply: recycling water and removing pollutants, desalination, water infrastructure (dams and reservoirs, pipes and leakages), and finally, packaged water.

Recycling and pollution

Key points: Water recycling makes up just 4% of global supply. The potential is much larger: in Israel, plans are in place for recycling to deliver 25% of water supply and 11% in Australia. Several Middle Eastern countries are aiming for 50–70% reuse of wastewater. On the pollution front, there is increasing legislation to force a cleanup. China estimates that Rmb 1trn will need to be invested in water (US$130bn) between 2006 and 2010, increasing the proportion of sewage that is treated from 34% to 40% by 2010.

Stocks: GE and **Dow** are major players in this industry, but their water businesses both represent less than 1% of group sales. Interestingly, however, water is an area that they have both publicly stated they are looking to expand. More direct exposure to water treatment (and, in particular, the fast-growing membrane filtration and UV disinfection parts of the chain) can be gained through **ITT, Danaher, Halma, Pentair** and **Pall.**

Recycling

The annual reclaimed water volumes total about 2.2bn cubic metres, or 4% of global supply

The annual reclaimed water volumes total about 2.2bn cubic metres (4% of global supply), according to figures from the World Bank. Recent projections indicate that Israel, Australia and Tunisia will use reclaimed water to satisfy 25%, 11% and 10%, respectively, of their total water demand within the next few years. By 2012, Spain will need to increase its reclaimed water use by 150% and, by 2025, Egypt will need to increase its usage by more than ten times. A number of Middle Eastern countries are planning significant increases in water reuse to meet an ultimate objective of 50–70% reuse of total wastewater volume. The growing trend of water reuse is not only occurring in water-deficient areas (Mediterranean region, Middle East and Latin America), but also in highly populated countries in temperate regions (Japan, Australia, Canada, north China, Belgium, England and Germany). This method of augmenting natural water sources is becoming an integral component to many water resources management plans and future use policies. San Diego gets 90% of its current municipal water supply from a wholesale water provider but in future that amount is planned to decrease to 60% with the supplementary supply coming from reclaimed water and desalination.

Pollution

On the pollution front, legislation in the US, Europe and other developed markets has long been in place to limit pollution of the water supply. Major pieces of legislation have been:

- The UK Control of Pollution Act 1984. It is a criminal offence to either pollute a lake, river, groundwater or the sea or to discharge any liquid into such water bodies without proper authority.
- The US Clean Water Act of 1977. This established the basic mechanisms for regulating contaminant discharge. It established the authority for EPA to implement wastewater standards for industry. The Clean Water Act also continued requirements to set water quality standards for all contaminants in surface waters.
- The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. This provides an international mechanism for addressing issues of waste generation, movement, management and disposal.

- The Stockholm Convention on Persistent Organic Pollutants (POPs). It governs the production, handling, transport and use of certain highly toxic organic chemicals that remain intact in the environment for long periods, and become widely distributed geographically.
- The EU Water Framework Directive on Integrated River Basin Management for Europe. This coordinates the objectives of European water policy in order to protect all waters, including surface water and groundwater.

More interesting developments are in the emerging markets, where pollution is significant (the WHO estimate that 90% of China's rivers are polluted) and pressure to change due to public demand and economic necessity is increasing.

In China, the government is finally starting to take measures to control water pollution

In China, the government is finally starting to take measures to control water pollution. According to the Construction Ministry, between 2006 and 2010, the total investment in water supply, treatment and other related measures in China by both public and private bodies will be more than Rmb 1trn (around US$130bn). The ministry has established the creation of an urban water supply network as a priority project, and says it aims to maximise its use of overseas capital and technological know-how. One of the stated aims is to observe WHO standards on drinking water supply by 2010, driving the need for improved water supply systems and more sewage treatment (China's target is from 34.3% treated effluent to 40% by 2010).

There has been an exponential increase in the number of companies seeking ISO 14001 certification

Efforts to control industrial pollution are emerging from within the sector. There has been an exponential increase over the past decade in the number of industrial companies seeking certification with ISO 14001, the international environmental standard. As of 2006 c.104,000 companies worldwide had attained ISO 14001 certification compared to just 4,400 in 1997.

Water treatment technology

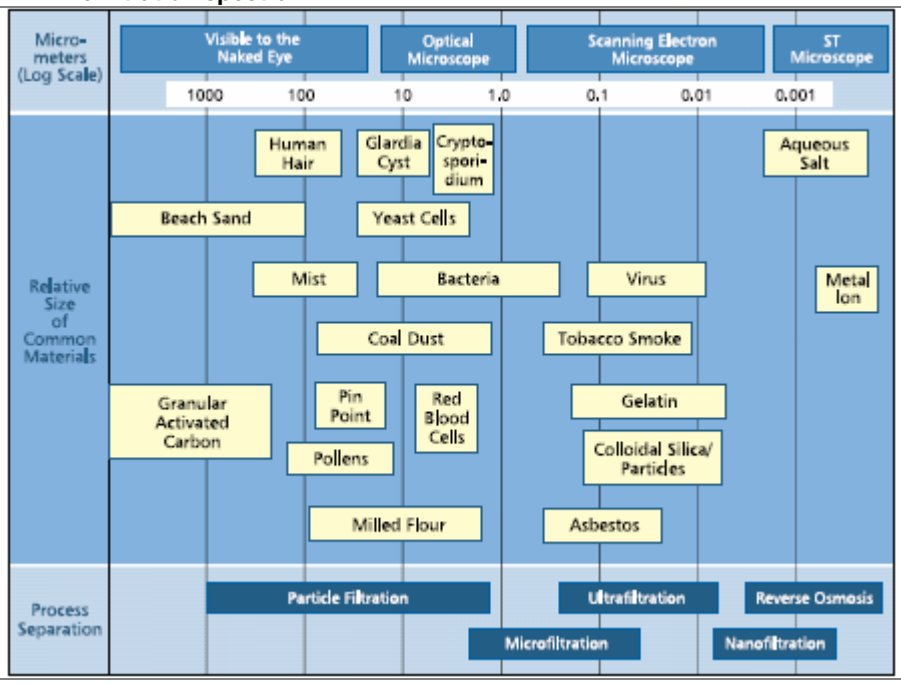
Water treatment technology is gradually shifting from the traditional processes of high-speed filtration using sand and other filter media to membrane processing.

Traditionally, sand has been used to purify water. Recent technology focuses on membrane filtration

Traditional processes have cleaned water by using beds of sand through which the water is allowed to percolate, usually preceded by coagulation, flocculation and settlement stages to reduce the load of impurities requiring filtration and to enhance the removal of very fine particles. Other types of media can be used in place of (or in combination with) sand to address specific impurities, an example being the use of activated carbon to adsorb chemical contaminants.

Water processing membranes are resin membranes perforated with tiny holes that range in size between micrometres (or millionths of a metre) to nanometres (billionths of a metre). The dimensions of the holes allow them to filter out impurities under pressure, and increase the purity of the water. There are four main types of membrane, RO (reverse osmosis, used in the desalination process), NF (nano filtration), UF (ultra filtration) and MF (microporous filtration), which are used in response to different applications.

Figure 17: **The filtration spectrum**



Source: ITT

After potable water has been filtered (either via the traditional sand processing or membrane technology), it then typically goes through a stage of disinfection.

After filtering, water (for potable use) requires disinfection

There are three methods of disinfection within the potable water industry, namely ozonation, ultraviolet and chlorination:

Ozonation is a water disinfection method first used in Nice, France, in the early 20th century to improve drinking water taste and odour. Ozonation is literally a process of adding ozone to the water supply. In the processes, disease-causing microbes, including Giardia and Cryptosporidium, are inactivated.

Ultraviolet disinfection is a very effective method of eradicating the effects of micro-organisms. The process takes place as water flows through an irradiation chamber. Micro-organisms in the water are inactivated when the UV light is absorbed. This damages their nucleic acid, thereby preventing the microbe from replicating and infecting a host.

Chlorine is a disinfectant added to drinking water to reduce or eliminate micro-organisms, such as bacteria and viruses. Chlorine, like ozone, is an oxidant that kills the micro-organisms or renders them incapable of reproduction. Chlorine remains the most commonly used drinking water disinfectant, used on more than 90% of the world's drinking water either as the primary source of disinfection or as a secondary disinfection to leave a residual after an ozone or ultraviolet primary disinfection.

In Figure 18, we present some of the larger companies within each region offering exposure to wastewater treatment including the membrane industry and the disinfection process.

Figure 18: Waste water treatment and recycling

	Description	Main listing	Sales (2006, US$)	% related to water	Rec
G.U.D. Holdings	Pumps, purification	AUS	462	30%	N
United Group	Project design, construction management and maintenance	AUS	2,232	13%	N
Beijing Capital	Urban water supply, wastewater treatment	CHN	138	75%	N/A
Tianjin Capital Environmental Protection	Wastewater treatment and reclamation, tap water supply	CHN	101	92%	N/A
Halma	Water treatment, UV disinfection, water leak detection	GBR	615	12%	N
RWE	Water treatment	GER	86,775	4%	N
Kemira Oyj	Municipal Waste Water Treatment (Coagulant/Flocculant)	GER	2,523	36%	N/A
Shanghai Industrial Holdings	Raw water and tap water supply, wastewater treatment	HKG	882	4%	N/A
Asahi Kasei	Membrane water filtration systems	JAP	13,235	1%	N
Chiyoda Corporation	Water treatment	JAP	3,452	NA	N
Ebara	Wastewater treatment facilities and desalination	JAP	4,548	34%	N/A
Kubota	Filtration products, water tanks, pipes	JAP	9,282	11%	N
Kurita Water Industries	Wastewater treatment systems plus desal	JAP	1,534	100%	N
Meidensha	Water treatment systems, sewage systems	JAP	1,623	NA	N/A
Shimadzu	Water quality analyzers	JAP	2,143	NA	N/A
Toray	Filtration products	JAP	12,607	2%	N
Puncak Niaga Holdings	Water supply and distribution	MYS	301	94%	N/A
Bio-Treat Technology	Water treatment	SGP	196	100%	N/A
Hyflux	Seawater desalination, wastewater treatment, membrane technology	SGP	84	30%	N/A
3M	Membrane water filtration systems	USA	22,923	2%	N/A
Ashland	Scaling/corrosion/microbial control chemical production	USA	9,285	9%	N/A
Ciba Specialty Chemicals	Scaling/corrosion/microbial control chemical production	USA	5,212	24%	N/A
Danaher Corp	Water testing and treatment	USA	10,545	8%	O
DOW	Membrane water filtration systems	USA	49,124	<1%	O
Ecolab Inc	Boiling/Cooling Tower Maintenance Services	USA	2,563	2%	N
General Electric	Water treatment, filtration products	USA	160,854	<1%	O
Hercules Inc	Scaling/corrosion/microbial control chemical production	USA	2,036	6%	O
ITT Corp	Wastewater and advanced water treatment, flow control, pumps	USA	8,607	39%	N
Millipore	Membrane water filtration systems	USA	1,255	15%	N/A
Nalco Holding	Scaling/corrosion/microbial control chemical production	USA	3,603	100%	N
Pall Corp	Membrane water filtration systems	USA	2,017	17%	N/A
Pentair	Membrane water filtration systems	USA	3,155	68%	N/A
Rohm & Haas	Scaling/corrosion/microbial control chemical production	USA	8,230	6%	N/A
Tetra Tech Inc	Consulting, resource management	USA	1,300	85%	N/A
Valhi Inc	Water treatment	USA	1,481	1%	N/A

Source: Company data, Credit Suisse estimates

For many of the largest players in the water value chain (Dow or GE, for instance), water represents only a small proportion of their overall sales. There are a few companies that offer 100% exposure to water processes (Nalco, Bio-treat, Kurita).

Most companies offer services and products in several areas of the industry, hence classification is difficult.

GE and ITT are multi-facetted water players.

GE's water business is very small as a proportion of total sales, but the company is specifically looking to gain scale

GE's Water & Process Technologies business is a US$2bn-in-sales global supplier of water and wastewater treatment and process systems solutions. More recently, GE has been bulking up its portfolio to address issues of water scarcity (including desalination) and water quality, and is also moving into water quality analysis (microbiological control systems to fast, on-site pathogen detection). GE is forecasting a ~35% CAGR (2003-2009) in water-related revenue from developing countries, which should contribute meaningfully to the bottom line as margins expand over the upcoming years. GE Vice

Chairman, John Rice, expects the company's water business to double from its current US$2.3bn in revenues; the only question is whether this takes three or five years. While the business is currently too small to move the needle at the company level (less than 1% of group sales), GE is looking to gain scale in water. Mr Rice forecasts equipment, filters and membrane products will be the main growth areas.

ITT's installed base consists of more than 13m pumps worldwide, which bodes well for increased service revenues in the future

ITT offers much more direct exposure to the water industry (an estimated 39% of revenue is derived from its Fluid Technology business). This segment is primarily involved in the production of pumps, valves, and water treatment equipment for the Wastewater, Residential & Commercial, Industrial & BioPharm and Advanced Water treatment markets. Through a series of acquisitions and organic growth initiatives, ITT's water portfolio has evolved from a product provider into a total solutions provider within the global water space (e.g. 2006 acquisition of F.B. Leopold gave ITT access to desalination pre-treatment processes adding further to its presence in the desalination and filtration industry). ITT's installed base consists of more than 13m pumps worldwide, a number that continues to expand, which bodes well for increased service revenues in the future. ITT's Fluid Technology division has been growing its top-line at c.10% CAGR since 2000 with operating margins currently in the mid-teens. The bulk of ITT's R&D spending is attributed to its Fluid Technology business, driven by investments in new facilities in Asia and Eastern Europe.

Several companies (Pentair, Dow, Millipore, 3M, Pall, Toray, Toyobo, Asahi Kasei) have focused their efforts on membrane filtration products. As with GE, company forecasts put growth ahead of long-term trend GDP, courtesy of the growth in wastewater treatment as well as the very strong growth in desalination (see point 3 below). Specifically, Pentair (68% of sales exposed to water) sees long term growth prospects of 5–8% for its water division, Pall (17% of sales) has said it expects growth to better GDP, Millipore (20% of sales) is forecasting growth in the high single digits, 3M (2% of sales) expects growth of 8–10% in its water division. Dow is looking to triple its exposure (currently less than 1% of total sales) to water over the next four years through organic growth and acquisitions.

Toray (2% sales in water) has said it plans to take its sales of water treatment equipment to more than ¥100bn in 2015, from a projected ¥35bn in FY3/07 (i.e. average annualised growth of 14%). Toray is developing membranes specifically designed to cope with the local water conditions at its new water-related R&D centre in Shanghai.

Asahi Kasei (1% sales in water) has also received orders for micro-porous filters for use in two major new water treatment plants in China. These will be supplied to a new water treatment plant on the outskirts of Beijing with production capacity of 35,000 tons per day, and to a desalination plant in Zhejiang Province with a capacity of 50,000 tons per day. Orders from China grew 50% yoy in 2006, and the company's Hangzhou plant, which began local production of water treatment equipment last summer, is now operating at full capacity.

Danaher focuses on water quality analysis and treatment

Danaher and Halma (among other things) offer exposure to the fast-growing UV treatment industry. Tighter regulatory standards on the quality of drinking water has led to increased demand for UV processes.

The water platform at Danaher (Outperform-rated) is a US$1.15bn-in-sales business (9% of total sales) centred on water quality analysis and treatment. This segment provides instrumentation and disinfection systems (a world leader in UV treatment) to both municipal and national governments for use in residential, commercial, and industrial wastewater applications. Most recently, DHR acquired ChemTreat, an industrial water treatment and engineered products provider. The company continues to accelerate growth in developing regions (particularly Asia and Eastern Europe). 20% of revenues now come from products introduced in the past three years.

Halma's water business (12% of group sales) manufactures ultraviolet sensors/monitors that sterilise water, produces water treatment equipment that measures the quality of water and stops clean water being lost in distribution networks. Halma is the global leader in water leak detection and one of the largest suppliers of UV disinfection selling to customers such as GE, Veolia and Nalco. Halma believes it is the first company with medium-pressure UV technology that complies with the new European testing criteria. The company believes that the CAGR over 2000–10 for UV sensor/monitoring is 5–15% and 7% for water treatment equipment.

Halma is the global leader in water leak detection and one of the largest five suppliers of UV disinfection

Companies concentrating on water treatment (particularly for use in industrial processes) include Nalco, Ciba, Ashland, Hercules and Rohm & Haas. We discuss these in more detail in section 3 (on industrial efficiencies) below.

Desalination

Key points: Desalination costs have fallen significantly in recent years (at the Askelon plant in Israel, costs are US$0.5 per 1,000 gallons compared to typical Israeli costs of US$0.45). Total global desalination capacity has grown by 47% over the last five years. Nine plants (with 727,000 cubic metres of capacity) are currently under construction. A further 214 plants (providing 24.4m cubic metres per day) are under consideration, with plans to build over the next 5–8 years.

Stocks: Dow and **GE** are again major players, but the contribution to their overall sales is tiny. More direct exposure can be accessed via **Ebara** (34% of revenue from water-related areas), **Kurita Water Industries** (100% of revenue from water-related areas), **Sasakura Engineering** (57% of revenue from water-related areas), **Doosan** (23%), **Tetra tech** (85%), **Alfa Laval** (10% of sales), **Toray** (2%) and **Hyflux** (30%).

According to the World Bank, of all the water on the earth's surface, only 3% is fresh and less than 1% is suitable for human consumption, with the rest being too polluted or frozen in polar ice caps. Using the remaining 97% of the earth's water requires desalination. The cost of desalinating seawater has long made it too prohibitive to be feasible on a wide-scale, but costs have been falling dramatically with advances in technology and processing. At the end of 2004, it cost between US$5 and US$16 to desalinate 1,000 gallons of seawater, but recently completed plants have brought costs down to below US$1 per 1,000 gallons (US$0.5 at the Askelon plant in Israel, compared to typical water costs of US$0.45).

The cost of desalination has fallen dramatically

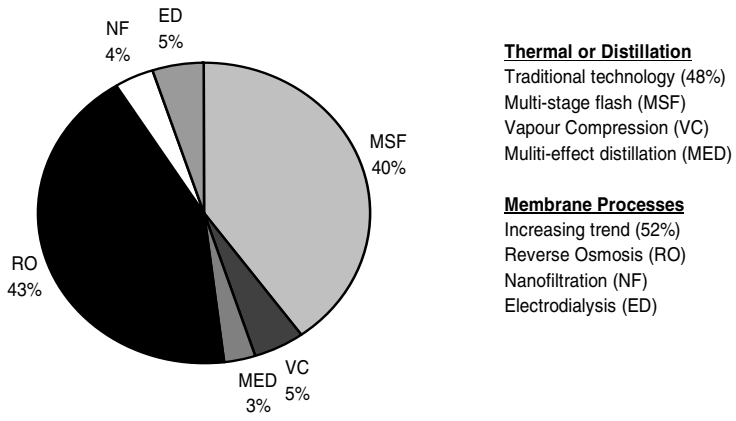
Traditionally, thermal desalination or distillation has been the most commonly used technology for producing large quantities of freshwater from seawater. Historically, this has been an expensive process given the significant required energy input. The economic efficiency of desalination plants has improved by combining the purposes of power and water production. Most of the desalination plants operating in the Middle East and elsewhere are dual-purpose multi-stage flash distillation plants that produce both water and electricity, using oil as the energy source. However, oil price rises undermine the economic performance of these plants, even in the Arabian Gulf region. As a result, nuclear power is increasingly being considered as a viable energy source for thermal desalination plants.

Desalination has traditionally been a thermally driven process but the trend now is towards reverse osmosis (or membrane desalination)

Reverse osmosis (membrane desalination) is an electrically driven process that uses special membranes through which water molecules may pass under pressure, leaving behind larger molecules, including salt. The capital cost of reverse osmosis units is dropping, and they are now the most common choice for new desalination plants. Over the last 20 years there has been an 86% decline in membrane costs and a 94% increase in membrane productivity (according to research undertaken by the John Hopkins University).

Membrane processing now accounts for more than half of the desalination industry

Figure 19: Desalination market revenues by process technology (2005)



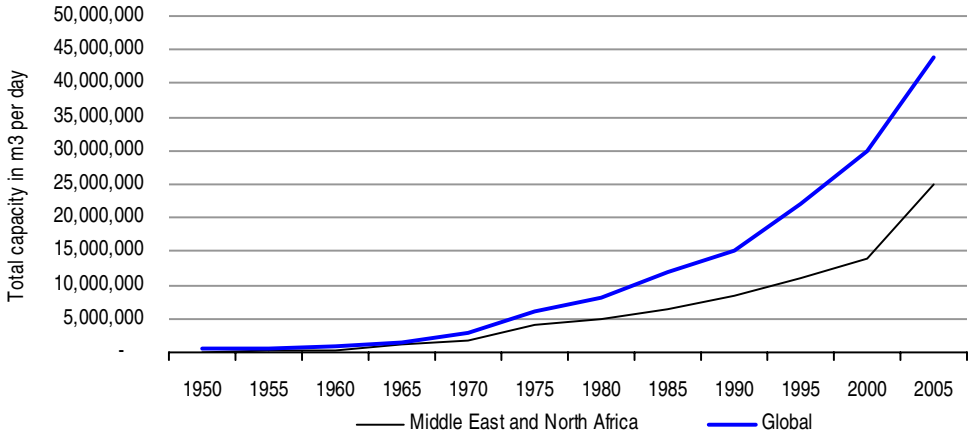
Source: Aqua Resources International

The challenge of what to do with the brine waste by-product remains. Currently, it is disposed of by discharge into the ocean or surface waters, sewage treatment plants, deep-well injection, land application or further evaporation in ponds. Each of these methods has potentially adverse environmental impacts.

There are currently over 13,000 desalination plants in operation in 120 countries, removing salt from roughly 45m cubic metres of water every day. Some 55% of the world's desalination plants are located in the Arabian Gulf countries.

Total global desalination capacity has grown by 47% over the last five years. The market, currently worth approximately US$5bn, is forecast to grow to US$70bn by 2020, according to the International Desalination Association.

Figure 20: Growth in desalination



Source: www.ewatermark.org

Figure 21 illustrates the point. There are nine desalination plants currently under construction, with a total expected combined capacity of 726,605 cubic metres of water per day. However, there are 214 more plants under consideration (with plans to build over the next 5–8 years) with a total combined capacity of 24m cubic metres per day. The largest expansion is planned for Israel (4.2m cubic metres per day), China (nearly 3.3m) and the UAE (3.1m).

Figure 21: Global desalination plants: under construction and in the planning phase

	Under construction		Planned	
	Number	Size (cubic m of Water per day)	Number	Size (cubic m of Water per day)
Algeria	-	-	11	2,256,000
Australia	1	125,000	8	931,300
Bahamas	-	-	2	22,710
Bahrain	-	-	2	152,500
Bermuda	1	2,275	-	-
Cayman Islands	1	3,030	-	-
China	2	280,000	25	3,270,000
Cyprus	-	-	3	63,290
Djibouti	-	-	1	20,000
Greece	-	-	8	NA
India	-	-	5	369,000
Israel	1	82,200	8	4,226,791
Kuwait	-	-	4	709,251
Libya	-	-	8	921,000
Mexico	-	-	1	21,600
Morocco	-	-	3	69,200
Namibia	-	-	1	32,877
Oman	1	6,900	7	327,733
Pakistan	-	-	4	558,327
Philippines	-	-	1	100,000
Qatar	1	7,200	2	454,600
Saudi Arabia	-	-	9	2,739,000
South Africa	-	-	2	113,500
Spain	1	220,000	30	1,351,815
Taiwan	-	-	1	30,000
Tunisia	-	-	11	402,000
UAE	-	-	26	3,143,805
UK	-	-	1	150,000
USA	-	-	28	1,859,369
Venezuela	-	-	1	70,000
West Indies	-	-	1	13,000
Total	**9**	**726,605**	**214**	**24,378,668**

Source: Global Water Intelligence, Credit Suisse estimates

There are nine desalination plants currently under construction with a total combined capacity of 726,605 cubic metres of water per day

There are 214 more plants under consideration with a total combined capacity of 24 million cubic metres per day.

Projected costs of construction are not readily available for all projects but very roughly: the mean average size of plant is c.120,000 cubic metres of water per day, 214 plants are planned, 120,000 cubic metres plant costs c.US$800m to build (note: this amount is an average of the cost of recently built plants of this size), which means total capex of c.US$170bn. This expenditure will obviously be spread over many years (the next 5–10 years) but nevertheless is a significant investment.

Figure 22 highlights many of the listed companies exposed to the growth in desalination. There are several overlaps here with stocks also operating in wastewater treatment (see above) but given the high growth forecast in the desalination market we thought it worth highlighting as a separate point.

Figure 22: Companies exposed to Desalination

	Description	Main listing	Sales (2006, US$)	% related to water	Rec
Leighton Holdings	Engineering & construction	AUS	8,503	10%	N/A
Multiplex	Engineering & construction (Perth desal)	AUS	3,074	5%	N/A
Acciona	Construction and plant machinery	ESP	8,467	c15%	N/A
WS Atkins	Engineering and advanced technology consultancy	GBR	2,053	5%	N/A
Asahi Kasei	Membrane filtration products	JAP	13,235	1%	N
Ebara	Wastewater treatment facilities and desalination	JAP	4,548	34%	N/A
Hitachi Zosen	Seawater desalination plant	JAP	2,949	NA	N/A
Ishikawajima-Harima Heavy Industries	Dam and desalination construction	JAP	9,954	NA	O
Kurita Water Industries	Wastewater and sewage treatment, plus desal	JAP	1,534	100%	N
Mitsubishi Heavy Industries	Dam and desalination construction	JAP	24,659	NA	N
Mitsui Engineering & Shipbuilding	Dam constructor, plus water treatment and desal	JAP	5,021	NA	N/A
Nitto Denko	Membrane filtration products	JAP	5,531	3%	O
Sasakura Engineering	Desalination plants	JAP	138	57%	N/A
Suido Kiko	Membrane filtration products	JAP	162	100%	N/A
Toray	Membrane filtration products	JAP	12,607	2%	N
Torishima Pump Mfg.	Seawater pump	JAP	277	35%	N/A
Toyobo	Membrane filtration products	JAP	3,550	NA	N/A
Doosan Heavy Industries and Construction	Desalination plant construction	KOR	11,493	23%	N/A
Oman National Electric Co	Water treatment	OMA	39	N/A	N/A
Qatar Electricity & Water	Water treatment	QTR	472	N/A	N/A
Saudi Industrial Services	Construction and plant machinery	SAU	20	N/A	N/A
Hyflux	Seawater desalination, wastewater recycling	SGP	84	30%	N/A
Alfa Laval	Construction and plant machinery	SWE	2,912	10%	U
DOW	Membrane water filtration systems	USA	49,124	<1%	O
General Electric	Water treatment, filtration products	USA	160,854	<1%	O
ITT Corp	Water treatment, flow control, pumps	USA	8,607	39%	N
Tetra Tech Inc	Consulting, resource management	USA	1,300	85%	N/A

Source: Company data, Credit Suisse estimates

We highlight the following issues.

Doosan is one of the few companies in the world that has proprietary technologies covering all desalination methods

Doosan has sizeable exposure to desalination facility construction and is currently the biggest in the field of MSF (Multi Stage Flash) desalination with a share in the global market of some 40%. Doosan was responsible for the construction of one of the world's largest plants (Shuaibah Desalination Plant Phase 3 in Saudi Arabia) with a daily desalination capacity of 880,000 tons as well as the world's first hybrid desalination plant (combining MSF and RO systems) in Fujairah, UAE. Doosan is one of the few companies in the world that has proprietary technologies for all three desalination methods (MSF, MED and RO).

The membrane providers are typically enjoying above-average growth rates. Dow (the largest global provider of RO membranes) is specifically targeting this area of the industry because of the strong growth outlook. The company announced in September last year that it was launching Dow Water Solutions, a business unit focused on the filtration of waste water and drinking water. Sales for this unit could amount to around US$350m pa, or 1% of total revenue. Dow Water Solutions offers membrane filtration products that are used in micro filtration, reverse osmosis and ion exchange, as well as handles aftermarket service for these products. Dow has set a sales target of US$1bn for Dow Water Systems within four years through a combination of organic growth and future acquisitions.

Nitto Denko is another significant supplier of RO membranes and processes. Membrane sales in the last fiscal year totaled ¥17.7bn. The company is targeting ¥50bn in sales in the next five years.

Toray has received orders for RO filters for seawater desalination plants in countries around the Mediterranean, such as Algeria and Israel. Toray is the third-biggest supplier of RO membranes in the world (behind Dow and Nitto Denko). Toyobo is a major producer of seawater desalination equipment, with orders received to date almost matching Toray's, and has a 60% market share in the Persian Gulf and the Middle East. Sumitomo Chemical has ordered a desalination plant from Toyobo as part of its Rabigh petrochemical plant project in Saudi Arabia.

Toray is the third-biggest supplier of RO membranes in the world

Toyobo is a major producer of seawater desalination equipment

Hyflux (30% of sales related to water) also specialises in membrane technologies, mainly for wastewater but also in desalination. Hyflux operates 17 wastewater treatment plant projects, 7 water treatment plant projects and one seawater desalination plant in China.

Alfa Laval provides products and services used in desalination and waste treatment. In aggregate, these two activities account for c.10% of group sales. Within desalination, Alfa Laval is involved in both the multi-effect (thermally driven and used where low cost of free thermal energy is available) and mechanical vacuum vapour compression processes (electrically driven). Alfa Laval has designed desalination units since the 1950s with more than 30,000 units in the field. Their products and systems have four main applications: the requirement for fresh water in the power generation industry (Alfa Laval converts sea water into high purity water for process and drinking purposes); for industrial purposes (treatment of complex physico-chemical composition of the saline raw waters); desalination units for the oil & gas industry (generally for small capacities); and in marine applications (seawater distillers powered by waste heat from main and auxiliary engines on board). In wastewater sludge Alfa Laval provides centrifuges, drum thickeners, spiral heat exchanger, modular treatment systems and total plant solutions for sludge disposal. Essentially, this equipment reduces sludge volumes so that they can be managed in a cost-efficient manner. The company's main customers include Thames Water and the City of Chicago.

Water infrastructure

We consider two areas of water infrastructure: dams and reservoirs and pipelines and leaks.

Key points: The growth in dams looks likely to be concentrated in Asia and Europe, where the ratio of reservoir capacity to the supply of water—16% in Europe and just 10% in Asia—is so much lower than in the US (33% capacity/supply ratio). If Asian dam capacity rose to European levels, then there would need to be some US$92bn of spending on dams.

Ageing infrastructure, dwindling groundwater supplies, growth in desalination and water recycling is boosting demand for water pipelines and related products. In Spain, the government has said it plans to build a 900km pipeline. In China, seven pipelines are planned and seven more are under consideration. AWWA forecasts a three-fold increase in the pipe network repair costs by 2030, which translates into annual average expenditure on leaks running at 4.7% growth pa.

Stocks: Alstom is the largest provider of hydro-electric power generation equipment and services. **Dongfang** and **Harbin** are two other players. Pipeline providers include **Kurimoto, Nippon Chutetsukan, Northwest Pipe Co.** Leak detection and remedy is provided by **Halma, Homeserve and Insituform.**

Dams and reservoirs

The world has around 55,000 large dams, most of them registered by the International Commission on Large Dams (ICOLD). About half of them are used solely for supplying water for irrigation purposes and roughly one-third are multi-purpose. No reliable data exist on the total number of 'small' dams, i.e. those not meeting the ICOLD criteria. A very indicative figure is 800,000, almost all of them used for irrigation and water supply.

The World Commission on Dams estimated that US$2trn had been spent building some 45,000 dams in the 20th century (WCD, 2000) and that prevailing (the year 2000) investment was running at US$40bn .

Asia and the Pacific, led by China and India, have a total of about 36,000 large dams, with plans to significantly increase this number.

Growth is likely to be greatest in Asia

A major indicator of water resources development is the ratio between the available storage reservoir capacity and the volume of the annual renewable water resources. The ratio in the Asian and Pacific region is only 11%, less than the global average of 14% and far behind North America (33%) and Europe (16%).

Thus, if, for example, the capacity of dams relative to water resources in Asia were to rise to European levels, then that would need to increase reservoir capacity by 45%, resulting in c.US$92bn of incremental investment. If the capacity of dams in the rest of the world were to rise to US levels, then that would mean tripling Asian capacity, doubling European capacity and result in a stellar US$1.3trn of building. We are certainly not suggesting that this will happen but storage capacity probably has to rise to help manage the resource more effectively and which ever way you cut it the costs involved are significant.

Figure 23: Water resources and reservoir storage by region

	Population	Internal renewable water resources	IRWR per capita	Total reservoir storage	Total reservoir storage/IRWR	Total reservoir storage per capita
	m, 2004	Km3/year	M3/year	Km3	%	M3 per person
Asia	3,574	11,117	3,111	1,262	11	353
Europe	729	6,592	9,043	1,083	16	1,486
Middle East and North Africa	435	517	1,189	392	76	901
Sub-Saharan Africa	714	3,887	5,444	388	10	543
North America	326	5,650	17,331	1,845	33	5,660
Central America and Caribbean	177	1,211	6,842	148	12	836
South America	367	12,246	33,368	891	7	2,428
Oceania	31	1,694	54,645	107	6	3,452
WORLD	6,353	42,914	6,755	6,116	14	963

Source: www.fwr.org

The world's largest dam (set for completion in probably in 2008) is China's Three Gorges dam, located on the River Yangtze in Hubei Province. Once completed, the project will have generating capacity of 18.2GW (or 3% of Chinese electricity capacity) and a reservoir approximately 630km long, 2.3km wide and 148m deep. The China Three Gorges Project Corporation (CTGPC) expect the capital outlay to build the dam to be recovered (through the sale of electricity) by around 2016.

China is developing major reservoirs and dams in the form of the Three Gorges…

Other hydro schemes under construction in China are the Yellow River Hydroelectric Development Corporation's scheme. When completed (scheduled for 2010), this will become the world's second-biggest hydro scheme, with capacity of 15.8GW. Construction work on the 12.6GW Xiluodu project on the Jianshajiang River began in December 2005. Development costs are expected by the authorities at 50.34B yuan (US$6.2bn), with the first turbine due to be installed by June 2012 and the entire project completed by 2015. Another major hydro project is the 6GW Xiangjiaba venture again on the Jianshajiang (construction commenced last November). Xiangjiaba, which is also being developed by CTGPC, is scheduled for completion in 2015 and production is expected by the authorities to reach 31BkWh pa. CTGPC's planning and development department indicate that 12 other hydro schemes (with generating capacity of 58GW) are planned for the middle and upper reaches of the Jianshajiang before 2020.

…and along the Yellow River

In India, there are plans in Arunachal Pradesh to build 89 dams and hydro projects using the fast flowing rivers coming off the Himalayan mountains. The projects could generate

around 60,000 MW of power,- which is double India's current hydro output and more than half of the current total generating capacity.

In 2001, Spain proposed the highly controversial National Hydroelectric Plan (NHP). The plan includes the construction of up to 120 new dams and more than 900km of new pipeline to transfer water from the Ebro River to south-east Spain. The plan envisages an all-in cost of €23bn, part of which would be funded by the EU.

Plans to develop a dam along the upper Tigris River in Turkey have re-surfaced in the last eight months (having previously been shelved when the major backers pulled out). The Ilisu Dam project envisages annual energy generation 3.833bn kWh and a reservoir covering 313 sq km. Projected completion date is set for 2013.

In the Sudan, a US$2bn hydro-electric dam is under construction on the fourth cataract of the Nile. The project is the largest of its kind under way in Africa and, when completed in 2008 or 2009, should produce 1,250 megawatts, doubling Sudan's electricity generation.

In the UK, there are plans to build three new reservoirs and extend five existing reservoirs to help solve the water shortage problems of the South-east. Costs are estimated by the UK government to be in the region of £2.3bn (US$4.6bn).

Figure 24: Dam builders

	Description	Main listing	Sales (2006, US$)	% related to water	Rec
Cardno	Consultant engineers	AUS	186	10%	O
Coffey International	Consultant engineers	AUS	251	10%	O
Alstom	Hydro turbines	FRA	18,020	5-6%	O
Alfred McAlpine Plc	Building water infrastructure	GBR	2,190	<5%	N/A
AMEC P.L.C.	Building water infrastructure	GBR	6,297	<5%	N/A
Balfour Beatty Plc	Building water infrastructure	GBR	8,750	<5%	N/A
Carillion Plc	Building water infrastructure	GBR	5,977	<5%	N/A
Costain Group Plc	Building water infrastructure	GBR	1,459	<5%	N/A
Siemens	Hydro turbines	GER	117,321	1%	O
Harbin Power Equipment Co	Hydro turbines	HKG	3,804	22%	N/A
Guangdong Investment	Water distribution	HKG	415	53%	N/A
Impregilo SpA	Hydroelectric plants	ITL	3,368	NA	N/A
Hazama	Dam constructor	JAP	2,035	NA	N/A
Kawasaki Heavy Industries	Dam constructor	JAP	11,680	NA	N
Sasebo Heavy Industries	Dam constructor	JAP	454	NA	N/A
Mitsubishi Heavy Industries	Dam and desalination construction	JAP	24,659	NA	N
Ishikawajima-Harima Heavy Industries	Dam and desalination construction	JAP	9,954	NA	O
Mitsui Engineering & Shipbuilding	Dam constructor, plus water treatment and desalination	JAP	5,021	NA	N/A
Kurimoto	Steel pipe, ductile iron pipe and dam construction	JAP	1,474	28%	N/A
Heijmans NV	Infrastructure incl bridges and floodgates	NLD	3,958	NA	N/A
ABB	Hydroelectric turbines	SWI	19,910	NA	O

Source: Company data, Credit Suisse estimates

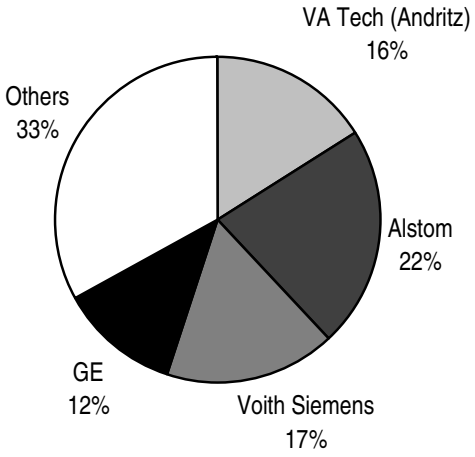
Alstom is the global leader in hydro-electric power generation equipment and services, with annual sales we estimate of around €0.8bn (5–6% of group sales). The business was placed into a joint venture with Bouygues last year, as part of the EU agreement regarding the French government's financial assistance provided to the company a few years ago. Products include turbines, pumps, valves, control systems, hydro-mechanical equipment and generators.

Despite fierce local competition (from Dongfang and Harbin), Alstom has managed to retain its market share within the successive upgrades to the Three Gorges Dam, which we believes underlines its leading technology in this area. The company won eight of 14 turbine set contracts for the Left Bank in 1998, and won around one-third of the Right Bank

contracts in 2003. We believe it is well-placed to win a decent share of the remaining six 700MW turbines yet to be tendered for the underground power house, having signed an MOU for ongoing co-operation with the operator of the Three Gorges project. The company is investing significantly in its hydro power plant capacity, and doubled capacity at its Tianjin facility in China in 2006.

Siemens (through its JV with Voith) is the second-largest global provider of hydro-power equipment. In its most recent fiscal year (2005/06), the business reported sales of €614m and orders of €721m (up 5% yoy). Products include turbines, pumps, generators, shut-off valves and power plant automation systems. Siemens also provides other services within the water industry (equipment systems, electrical systems and automation) but annual sales (c.€1bn) still only account for 1% of group sales. Nevertheless, water is recognised as a growth area: in 2004, Siemens acquired US Filter (from Veolia Environment, for US$993m); earlier this year, Siemens announced the acquisition of four companies (Envirotrol, CEC, Ultrapure Solutions and Sunlight Systems, with total sales of US$25m) in order to increase its service portfolio for activated carbon water treatment.

Figure 25: Hydro power equipment market shares



Source: Andritz

Pipelines and leakages

Ageing infrastructure as well as dwindling groundwater supplies, growth in desalination and water recycling schemes is boosting demand for new and replacement water pipelines and related products, such as pumps, valves and automation and control instruments.

Major long-distance pipelines exist in many nations and new ones are in development.

Linking the Ganga-Brahmaputra-Meghna system with other rivers in India is part of the solution being offered to counteract extensive recurring droughts and floods.

In China, there are seven existing major transfers and seven more planned or under consideration. A major potential project is a large-scale south-to-north basin transfer that, if completed, would divert 450km in three years. The project would involve building an extensive pipeline and canal network. Three options are in contention: (a) pump water from the lower Yangtze River uphill for hundreds of miles, (b) use canals and pipeline to channel water from the Han River, (c) divert water from the 'western line' of the Yangtze and possibly the upper Mekong and Irrawaddy Rivers. Chinese authorities estimate the cost of the project at US$64bn.

In China, there are seven existing major transfers and seven more planned or under consideration

In Australia, the Queensland Government is planning a pipeline network that will aim to fix the south-east's water shortage. In mid-April, the Water Resources Minister released a report outlining plans to pipe water from rivers in Northern New South Wales to South-East Queensland.

Proposals in the UK to build a major water pipeline from the Pennines in the north to London in the south have been discarded on the back of DEFRA's conclusion that the cost (£9bn–15bn) would be at least four times more than the new and enlarged reservoirs planned for the South-east.

Figure 26: Pipeline construction and maintenance

	Description	Main listing	Sales (2006, US$)	% related to water	Rec
AJ Lucas	Directional drilling, pipe-laying	AUS	171	15%	N/A
Crane Group	PVC pipes	AUS	2,039	35%	N/A
Hills Industries	Pipe and water tanks	AUS	932	30%	U
Leighton Holdings	Engineering construction	AUS	8,503	10%	N/A
MacMahon Holdings	Earthmoving, civil works	AUS	804	5%	N/A
Onesteel Ltd	Steel and tube pipes	AUS	4,005	5%	N
Walter Diversified	Pipe-laying	AUS	221	13%	N/A
Georg Fischer AG	Piping systems	CHE	3,252	15%	O
Qianjiang Water Resources	Water supply and pipeline construction	CHN	46	44%	N/A
Shanghai Municipal Raw Water	Raw water and tap water supply, wastewater transfer and pipeline construction	CHN	150	100%	N/A
Shanghai Electric Group Co	Wastewater treatment equipment, project engineering and construction	HKG	5,353	4%	O
Kurimoto	Steel pipe, ductile iron pipe and dam construction	JAP	1,474	28%	N/A
Nippon Chutetsukan	Steel pipe, ductile iron pipe	JAP	161	70%	N/A
Engtex Group Berhad	Water piping systems	MYS	119	N.A.	N/A
JAKS Resources Berhad	Water piping systems	MYS	77	N.A.	N/A
YLI Holdings Berhad	Water piping systems, treatment equipment	MYS	26	N.A.	N/A
Pan Asian Water Solutions	Water piping systems	SGP	22	95%	N/A
Crane Co	Valves, pumps	USA	2,257	44%	N/A
Idex Corp	Pump products	USA	1,155	38%	N/A
Mueller Water Products	Valves, pipes	USA	1,933	100%	N/A
Northwest Pipe Co	Steel pipes used primarily in water infrastructure	USA	347	71%	N/A

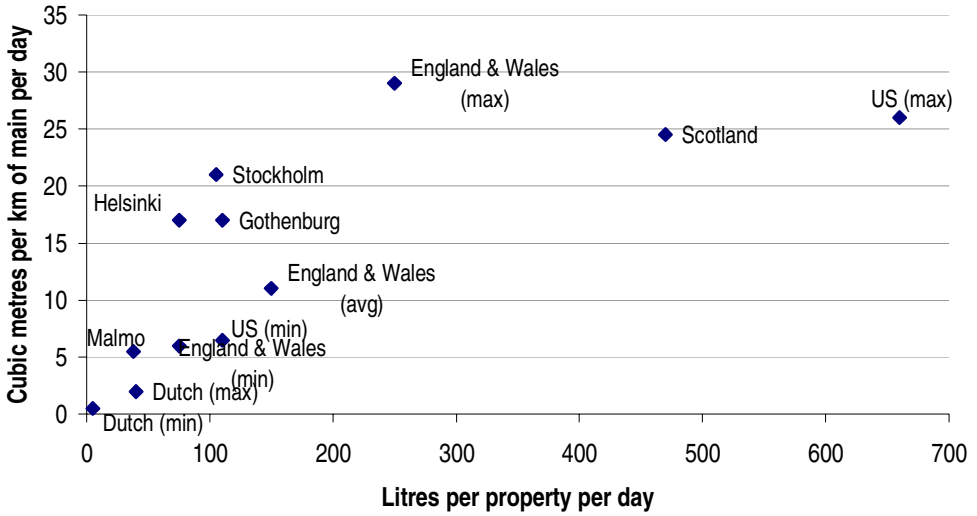
Source: Company data, Credit Suisse estimates

A significant percentage of distributed water never reaches the final user but is lost due to leakage. Average leakage rates for Public Water Supply (PWS) range from 0–5% in the Netherlands, 10% in Austria and Denmark, 18% in urban Australia, and 33% in Czech Republic. In the UK, leakage rates have been falling (from 30% in the 1980s) but are still running at 23%. Such problems are most acute in long-established urban areas with ageing assets. Water infrastructure, such as pipes, can be expected to last for between 50 and 100 years depending on conditions, implying replacement rates of 2% pa. Most systems in urban areas were laid at the beginning of the 20th century, but replacement work has often been neglected.

As the American Water Works Association (AWWA) observed, "we can expect to see significant increases in break rates and therefore repair costs over the coming decades. In the utilities studied by AWWA, there will be a three-fold increase in repair costs by the year 2030".

According to AWWA, there will be a three-fold increase in repair costs by the year 2030

Figure 27: Estimates of water leakage



Source: Ofwat

A major difficulty is in defining what levels of leakage may be acceptable from 'public' mains. In England and Wales, Economic Level of Leakage (ELL) is used to specify targets for the water companies. ELL represents an agreed leakage rate above which it is believed economic to tackle the problem and below which it would supposedly cost more to deal with than it would save. ELL suffers from the notorious difficulty of assigning economic and marginal costs and is a highly contested concept. As recent capital investment has lowered the age (and leakage) of networks, as water supplies become more scarce and as above-inflation price rises have increased the opportunity cost, the economic level of leakage has fallen over time. Typical agreed ELL is now on the order of 20%.

Much of the leakage reduction comes about through mains refurbishment and renewals. We see the main beneficiaries of these projects as the UK water companies, who get the extra capital expenditure into their asset bases, upon which they earn a return (Pennon is top of the list), and the construction companies who benefit from capex.

Halma is the market leader in water leak detection systems

Halma plc (12% of revenue is water-related) is the market leader in water leak detection systems in the UK and also has significant market share in Europe and the US. It is a typically defensive stock, but with solid overall growth prospects and relatively attractive valuations (a 6% discount to the European Capital goods universe on 2008 P/E). Other listed plays on leak detection and pipe maintenance include Homeserve (7% of sales) and Insituform (100% of sales).

Pipeline alternative? Virtual water flows

Since water is an integral part of the make-up and production of many agricultural (and some industrial) commodities, the trade in these commodities implies trade in water. This is the so-called trade in 'virtual water'. Virtual water flows between nations can be estimated from statistics on international product trade. The global volume of virtual water flows related to the international trade in commodities is 1.6trn m3/yr. About 80% of these virtual water flows relate to the trade in agricultural products, and the remainder industrial products.

At present, if importing countries produced all imported agricultural products domestically, they would require 1.6trn m3 of water pa; however, the products are being produced with only 1.2trn m3/yr in the exporting countries, saving water resources of 352bn m3/yr.

As a rule of thumb, a grain crop transpires about 1 cubic metre of water in order to produce 1 kilogram of grain. Producing 1 kilogram of meat requires a much greater quantity of water.

Figure 28: Water requirement equivalent of main food products

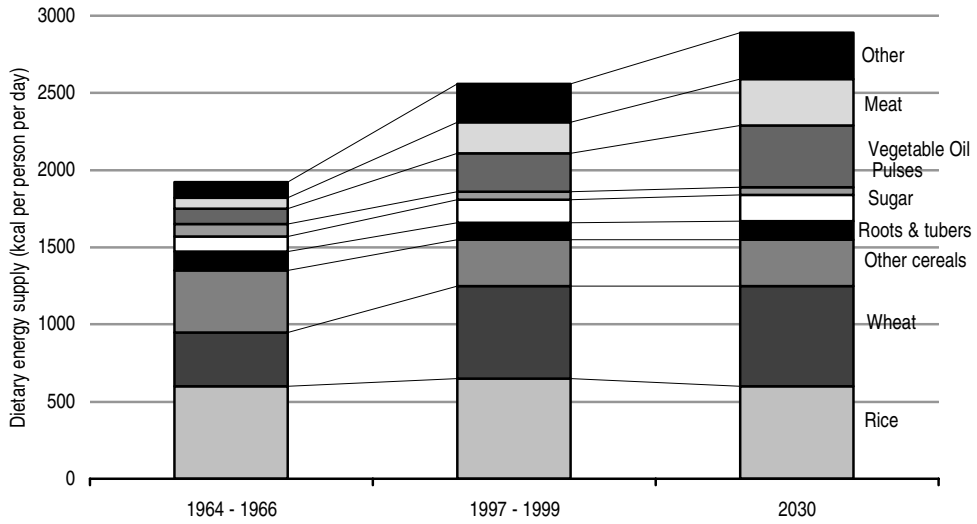
Product	Unit	Equivalent water in M^3 per unit
Cattle	Head	4,000
Sheep and goats	Head	500
Fresh beef	Kg	15
Fresh lamb	Kg	10
Fresh poultry	Kg	6
Cereals	Kg	1.5
Citrus fruits	Kg	1
Palm oil	Kg	2
Puls, roots and tubers	Kg	1

Source: UNEP, Extracted from the Executive Summary of the 1st World Water Development Report

Producing a kilogram of beef requires 10 times the water input as a kilogram of cereals

Over the past few decades, consumption of meat in developing countries has grown at a rate of 5–6% pa; consumption of milk and dairy products at 3–4%. Poultry is the fastest-growing sector worldwide: it represented 13% of the meat production in the 1960s, compared to 28% currently.

Figure 29: Dietary changes in developing countries (1965–2030)



Source: FAQ 2003

While rice, wheat and other cereals remain the main component of the human diet, their relative weight tends to decline as income rises, compensated by a rise in consumption of meat and vegetable oils

As trade barriers are gradually reduced, water supply problems become more acute and the developing market demand for better nutrition continues, the trade in virtual water looks set to increase. This must surely present an advantage to the water-rich nations with large agricultural areas. Brazil (with 15% of the world's freshwater supply) is the obvious winner. As this is a longer-term trend, pinpointing immediate equity market beneficiaries is not easy but as Robert Moskow, our US food analyst, points out, Bunge (a vertically integrated oilseed processor in Brazil) looks well best positioned to capitalise on this growth.

Packaged water

Key points: The packaged water industry is worth roughly US$85bn in annual sales and has been growing strongly (average 8% by volume pa) over the last decade. The penetration rate of bottled water is very mixed: in China, the consumption per capita is 10% that of Italy. US consumption is nearly 30% lower than Europe. We expect the growth to continue to be strong for several more years for two reasons: i) for the health benefits of drinking spring water for developed market consumers and ii) to avoid ill-health for the emerging market consumers.

Stocks: Danone (c.20% water sales) and **Nestle** (10% water sales) are two opportunities to play the theme. We prefer **Nestle.**

Packaged water can come in all shapes and sizes, sparkling or still, sourced, refined or spring water. We suggest there are two principal ways to segment the market: by source and by packaging.

By source, the market can be divided into three distinct sub-groups:

(a) source water, where the water comes from a specific spring or source, such as Evian, Vittel, Volvic;

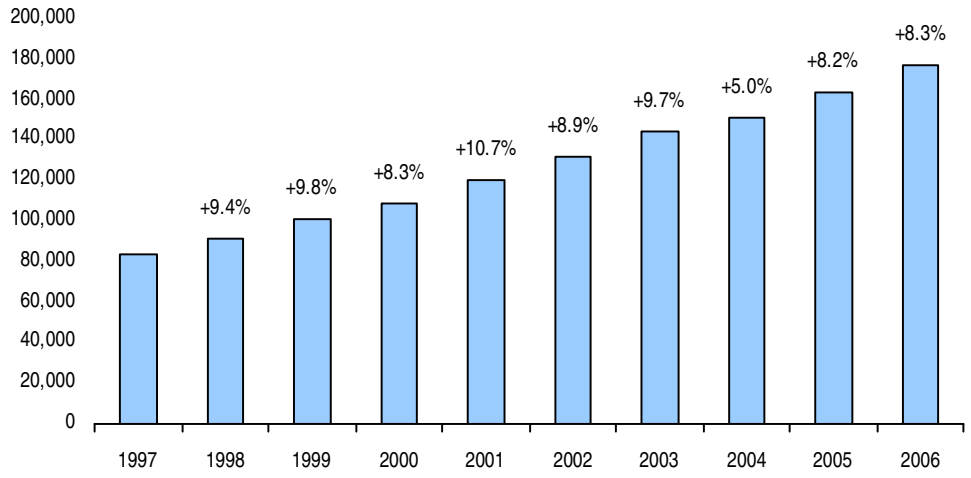
(b) spring water, where the water comes from a spring, but not a specific or identified spring. Examples here are Danone in the US or Nestlé's Aquarel; and

(c) refined water, where municipal water is refined/processed possibly with minerals added. Examples here include Dasani, Aquafina and Nestlé Pure Life.

By packaging there are two principal markets, being HOD (home and office delivery), where water is supplied in large 10 gallon drums and consumers tap the water from it. The rest of the market is principally bottled water, in all shapes and sizes.

So much for defining the market. What is clear is that growth in this industry has been very strong for many years now, averaging 8% by volume pa for the last decade. Our expectations, and those of the industry, are that these growth rates will continue for several years and, more importantly, remain non-cyclical (note: 2004 weakness reflected poor weather in Europe).

Figure 30: Global packaged water market (million litres pa)



Source: Zenith International

Growth in this industry has been very strong for many years now, averaging 8% by volume pa for the last decade

The drivers of the market are different according to each region, with growth in the developed market driven by health issues, and the benefits that spring water brings (together with the minerals it contains). The developed world market is dominated by spring water.

The packaged water industry has benefited from the desire to improve health in developed markets…

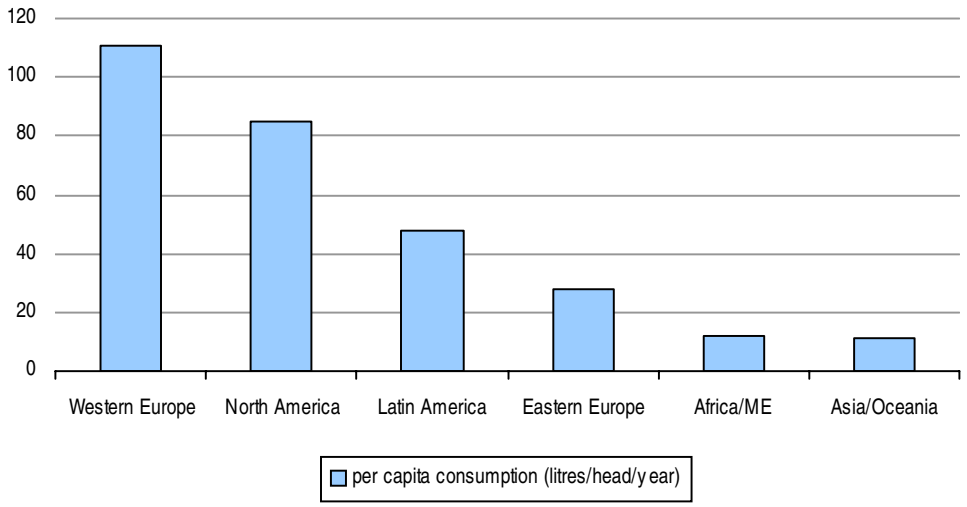
By contrast, the emerging or developing world has increasingly sought to buy water to avoid ill-health as local municipal supplies have fallen short of the quality required. These markets predominantly buy refined water, where it is cleanliness of the water that is paramount rather than the source.

…and the desire to avoid ill-health in the developing markets

Consumption levels also vary markedly from region to region with the more affluent developed world able to afford to pay for water, and willing to pay the premium prices for source water.

Figure 31: Per capita consumption of packaged water 2006 (litres per head pa)

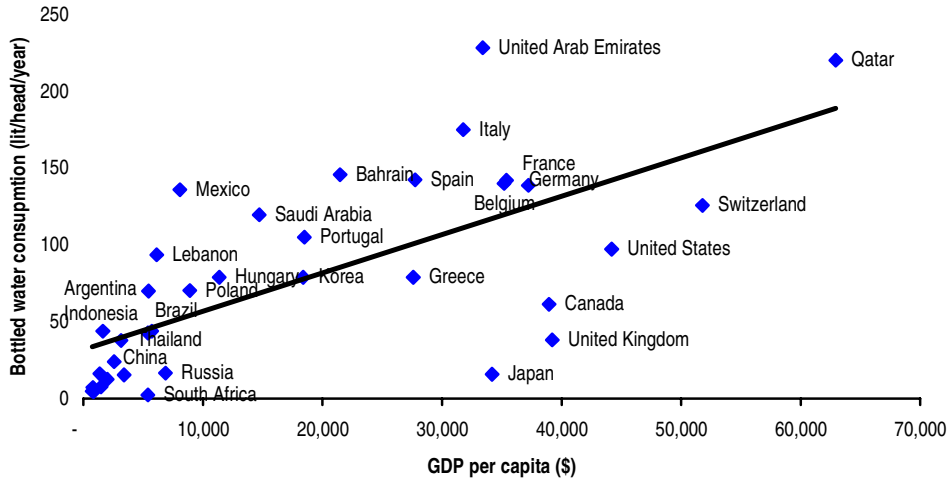
Western Europe consumes by far the greatest quantity of packaged water per head



Source: Credit Suisse research based on Nestlé Waters data

Even in the developed and developing world consumption varies markedly from country to country. Italy, France and Spain, for instance, consume significantly more bottled water than the UK, US, Canada or Switzerland.

Figure 32: Per capita consumption of packaged water 2006 (litres per head pa)



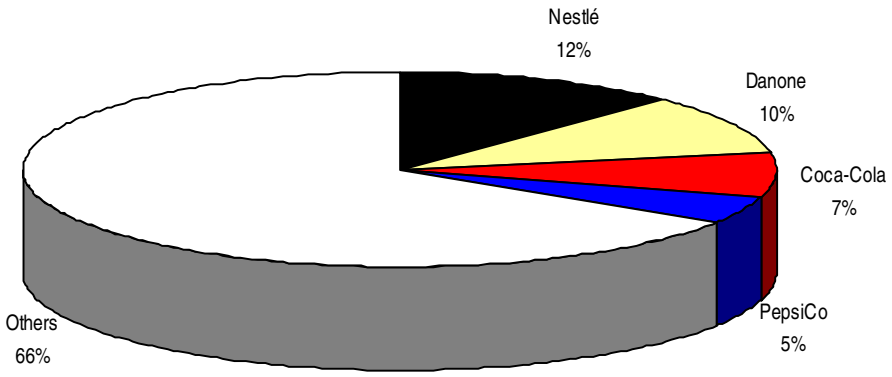
Source: Credit Suisse research based on Nestlé Waters data

The main growth is understandably coming from those countries where per capita consumption is very low, notably the emerging markets, where pollution is such a problem, but also several of the developed markets (e.g. the US, the UK). If US and UK consumption were to increase to Italian levels (in terms of per capita consumption) then sales would have to rise by 80% and 358%, respectively, in each country. Since the US is a large market this would imply net growth in global sales of 21%. The net addition to global sales from the growth potential in China is equally significant. Chinese GDP per capita of US$4,000 per head (rather than US$2,000) would imply sales growth in packaged water of 229% in China and net growth in global sales of 25%.

Main growth from here is expected to come from the emerging markets and a few of the developed where consumption per head is still relatively low

Although there are numerous brands globally, there are four companies that dominate this industry that between them account for around a third of the market.

Figure 33: Global market share of packaged water (by volume, 2006)



Source: Zenith International

Given these companies by and large have premium brands, their combined share of the market by *value* is rather larger at 42%.

Four companies dominate this industry: Nestlé, Danone, Coca-Cola and PepsiCo

The major brands of these companies are:

- Nestlé: Perrier, Vittel, Poland Spring, Deer Park, Arrowhead, Ozarka, Zephyrhills, Acqua Panna, San Pellegrino, Perrier, Contrex;
- Danone: Evian, Volvic, Aqua, Wahaha, Robust, Naya, Bonafont, Fontvella;
- Coca-Cola: Dasani, Bonaqa, Viva, Ciel, Wilkins, Spring; and
- PepsiCo: Aquafina, Propel,

Not all these companies break out the contribution to their respective profits of water, although Figure 34 identifies what information is released. Note that in Danone's case we are including the performance of its 'Beverages' division, which includes non-waters (probably around a third of the division).

Figure 34: Leading global water companies sales (US$m, unless otherwise stated, 2006)

	Group sales	Water sales	water as % of total sales
Nestlé	80165	7830	10%
Danone *	18998	5322	28%
Coca-Cola	24088		under 5%
Pepsico	35137		under 5%

** Includes non-waters. Water around two-thirds of total Beverages*

Source: Company data, Credit Suisse estimates

In conclusion, packaged water has been, and looks set to continue to be, one of the most attractive long-term growth industries in the consumer staples market. We believe Danone and Nestlé remain the best way to play this industry.

Our key Outperform rating is Nestlé

Our key Outperform rating, and indeed the only food company in Europe on which we have an Outperform, is Nestlé. The main drivers to this are:

- The group's superior top-line growth, driven by the portfolio that has been positioned for health, wellness and nutrition. Water forms a key part of this, with the group having averaged over 8% pa organic growth in water over the last six years (versus group growth of 5.5% pa).
- The group's valuation remains compelling versus its peers. Stripping out Nestlé's stakes in Alcon and L'Oréal, the food business trades on an implied P/E of 14.6x versus its peers, such as Danone on 19x.

(2) Water management

Key points: In order to finance and manage the required capex, both the price and the private provisioning of water are likely to rise substantially. The need to contract out water supply is huge: in Europe only 35% of supply is provided by the private sector, 15% in the US and just 5% in Asia. Over the past five years, municipal water rates have increased by an average 2.7% pa in excess of inflation. In the UK, where the water sector is largely privately owned and prices are a more accurate reflection of cost, prices rank the third highest in the world. There are also wide price anomalies that seem unlikely to be able to last (e.g. Germany and Denmark charge five times the price for water than in the US; in Spain, the price of water in Barcelona, where water is plentiful, is 90% higher than in water-scarce Valencia).

Required investment is arguably greatest in China, India, Russia and other emerging markets but this is where the regulatory risk is also greatest.

Stocks: We prefer utilities that offer a balance of growth against regulatory risk (either because they operate in a stable regulatory environment or because the regulatory risk is mitigated through contracting). **Veolia** (34% of revenue from water) and **Suez** (15% of revenue from water) offer exposure to the industry. **Hong Kong and China Gas** (2% water sales) and **NWS Holdings** (4% water sales) could be considered for their growth potential. In the UK, we continue to prefer **Pennon** (50% water sales).

We are confident of the growth potential in the water sector. While global water-related capex in 2006 amounted to US$355bn, we estimate that it could reach US$1,200bn (in real terms) by 2025, implying real growth of 6.7% pa.

We expect capex to be strong

Figure 35: Projected expenditure on water infrastructure, 2006

	Current exp on water infrastructure (US$bn)	Current exp on water infrastructure (% GDP)	Projected exp on water infrastructure as % GDP by 2025	Average annual investment (US$bn) by 2025	Annual avg real growth rate (2006–25) by 2025
North America	**109.6**	**0.75**	**1.08**	**246.4**	**4.4%**
US	99.3	0.75	1.10	229.6	4.5%
South America	**18.0**	**0.94**	**1.52**	**61.6**	**6.7%**
Europe	**135.5**	**0.83**	**0.94**	**284.2**	**4.0%**
Netherlands	8.0	1.20	1.50	15.7	3.6%
Russia	3.1	0.32	1.00	58.5	16.7%
Spain	13.5	1.10	1.30	23.9	3.1%
UK	17.1	0.72	0.86	32.2	3.4%
Asia	**85.2**	**0.97**	**2.06**	**606.1**	**10.9%**
China	39.5	1.50	2.50	378.7	12.6%
India	6.3	0.71	2.50	95.8	15.4%
Japan	32.8	0.75	1.26	99.1	6.0%
Australasia	**7.3**	**0.85**	**1.10**	**14.8**	**3.8%**
Total	**355.6**	**0.84**	**1.38**	**1,213.0**	**6.7%**

Source: OECD, IMF, Credit Suisse estimates

A key—and complex—question is how the required capital expenditure can be financed.

One issue is pricing. In most countries, water infrastructures have been ill-managed, ill-governed and under-priced. In some cases, water is free. This limits the involvement of private companies because the pricing mechanisms ignore the huge cost of collecting, distributing and treating water. We think it would be best dealt with along the same lines as electricity and gas. Price should reflect the cost of the service as well as its marginal utility. The water business is highly capital intensive.

In most countries, the price of water fails to reflect adequately the cost of supply

Another issue is governance. Some argue that private companies are not more efficient than the public sector and point to the Atlanta, Manila, Puerto Rico or Buenos Aires contracts as examples of private sector failures. However, most of these examples are in emerging markets where water is heavily politicised and pricing more difficult. In our view, failures do not have much to do with privatisation: they are more to do with the perception consumers and politicians have of water and the fact that water has been mis-priced for a long time and that municipalities have been under-investing in infrastructure. The most important factor in establishing a successful relationship between municipalities and private operators is governance, an institutional framework and effective regulation. The Camdessus report (2003) provides some good ideas on financing public/private partnership in water.

We address three main subjects in this section: (a) water pricing, (b) the participation of the private sector and (c) how to play the water theme in the utilities sector. In our view, these themes are all linked in the sense that the price of water is dependent on who manages the infrastructure and under which contractual or ownership terms.

(a) Water pricing

The price of water has increased substantially over recent years and, in our view, this trend is set to continue. The need to upgrade or build installations is rapidly unfolding at the same time as demand for higher water standards has intensified. Significant capital expenditure, while central government subsidies are less readily available, implies higher prices. According to the survey published by the NUS Consulting Group (International Report and Cost Survey, July 2006), over the past five years, municipal water rates have increased by an average 2.7% per annum in excess of inflation.

The price of water has increased substantially in recent years and looks set to continue

Figure 36: 2006 water cost comparison

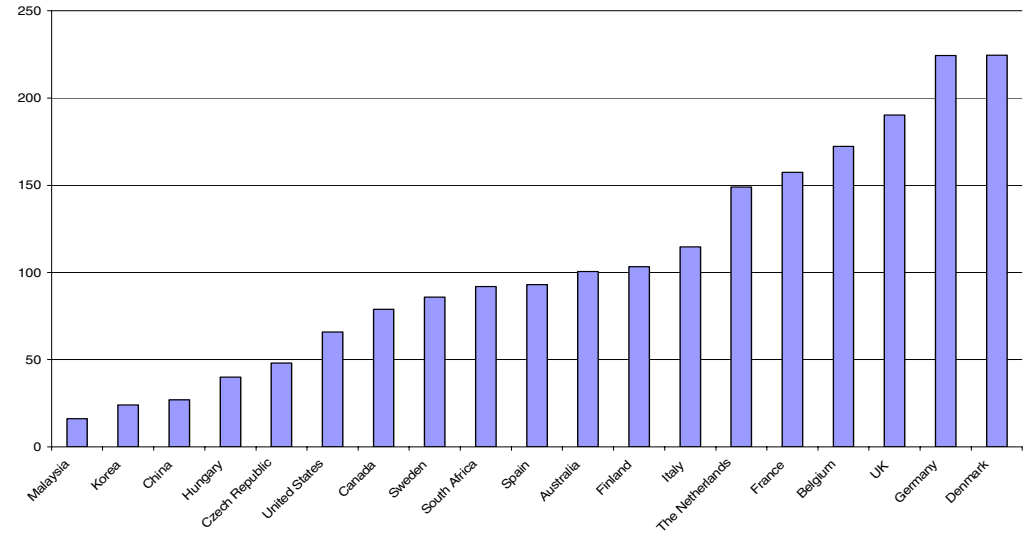
Country	Cost (US¢)/m³	2005/2006 chg %	5 yr avg water rate	5 yr avg CPI rate
Denmark	224.6	- 4.6	0.4	1.7
Germany	224.5	1.6	- 0.5	1.6
UK	190.3	7.8	6.5	1.9
Belgium	172.3	1.9	10.2	2.0
France	157.5	3.5	2.4	1.9
The Netherlands	149	1.0	0.1	2.0
Italy	114.7	2.0	4.6	2.2
Finland	103.3	9.7	6.0	1.1
Australia	100.5	13.8	9.1	2.8
Spain	93	3.1	1.0	3.2
South Africa	91.8	8.8	10.0	5.0
Sweden	85.9	- 2.4	2.1	1.0
Canada	78.9	8.9	11.6	2.4
United States	65.8	4.4	5.4	2.7

Source: NUS Consulting Group. The survey is based on prices as of 1 July 2006 for an organisation with an annual usage of 10,000 cubic metres. All prices are in US cents per cubic metre and exclude VAT. Where there is more than a single supplier, an unweighted average of available prices was used. The percentage change is calculated using the local currency in order to eliminate currency movement distortion.

Nevertheless, there is still a wide range of prices across the world. Prices are 71% lower in the US than they are in Germany and in emerging markets, they tend to be lower still than the average price in more developed countries.

Figure 37: 2006 water cost comparison (US$/m³)

Prices in emerging markets tend to be much lower than in more developed countries

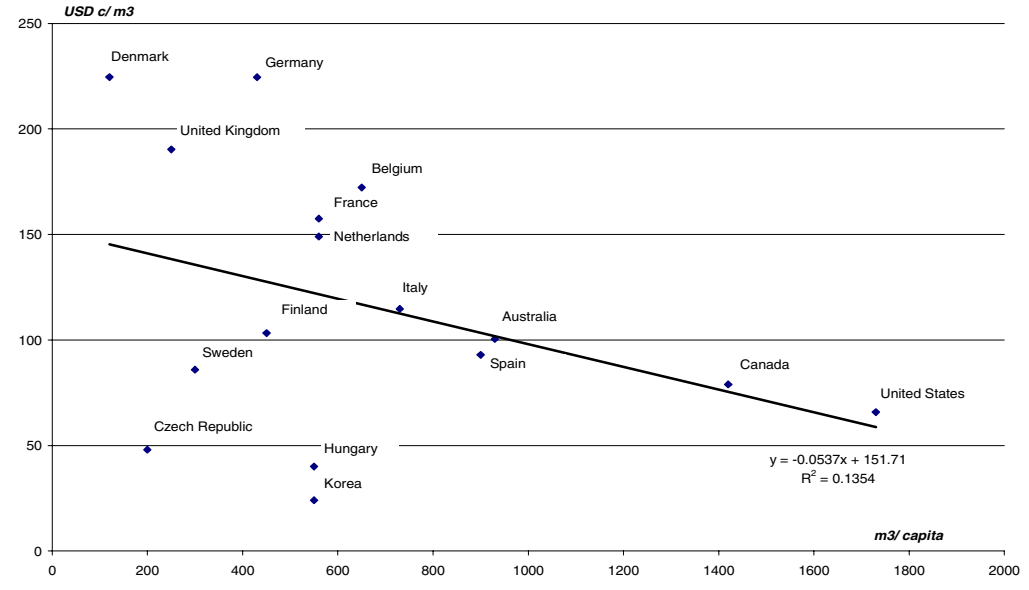


Source: NUS Consulting Group

In our view, the question is not really one of demand determining prices. As we illustrate below, the correlation between the price of water and its consumption is fairly loose. Consumption is a function of several factors: the level of subsidies, water costs as a percentage of average real income, the water infrastructure network, the type of governance and the weight of the agriculture in each country, to name a few.

Figure 38: Correlation between water abstraction per capita and the price of water

The correlation between the price of water and its consumption is fairly weak



Source: NUS Consulting Group, World Resources Institute

Instead, we think the more likely key determinant of prices is the degree of subsidy. Many regions use water as a political tool and refuse to make citizens pay an economic price. Spain is an interesting example. The Barcelona water network is managed by a private operator and water is much more expensive than it is in cities in which water is scarce but

managed by municipalities. IWA reported in 2003 that in Barcelona the price of water was US$0.88/cubic metre compared with US$0.6 in Seville and US$0.5 in Valencia. It seems unlikely that these price disparities will be allowed to persist in the long term. In more mature water markets (France or the UK), differences in prices between cities and regions are much more limited because the differences in level of capex and type of governance are not as significant.

(b) Private sector participation remains low

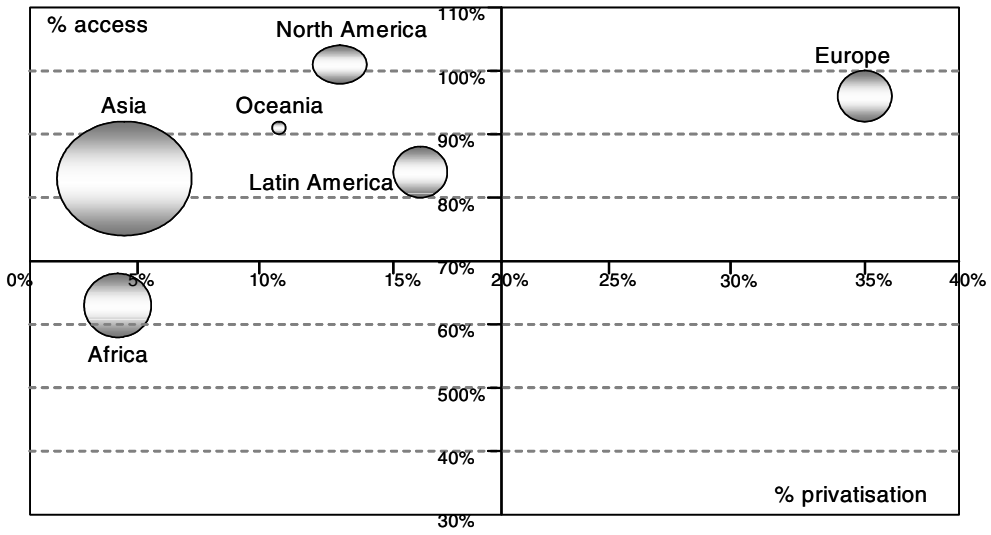
Private sector participation remains low…

The involvement of private operators in the water sector has long been the subject of debate. There is a school of thought that private operators should not be involved because water is such a key basic necessity. Others think that public utilities have been incapable of delivering water and sanitation satisfactorily. The World Bank has been promoting greater private sector involvement.

For the most part, water supply and sewage services are still provided by public sector bodies. In Europe, only 35% is provided by the private sector and less than 15% in North America. In Asia and Africa the figure is less than 5%. In Latin America the private sector now provides around 15% after substantial political efforts in the 1990s.

…35% of water supply in Europe is provided by the private sector; this is less than 15% in North America

Figure 39: Water supply: opening up the market and access to the water network



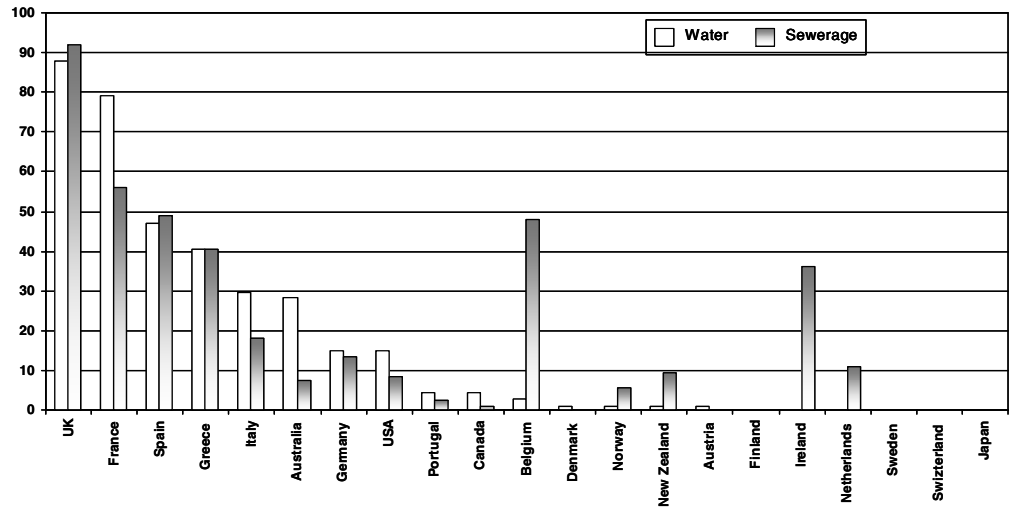
Source: Massons, Credit Suisse research

In our view, the opening up of markets to the private sector does not depend on the level of economic development (GDP per capita) or the size of the market, but rather on political choices and financing constraints.

- Among industrialised countries, only the UK, France and Spain have resolutely chosen to open up this activity to the private sector, at rates of more than 50% in both water and waste. Conversely, the Netherlands, Sweden, Switzerland and Japan have maintained 100% municipal management.
- In emerging markets, Malaysia, the Czech Republic and Chile have a delegation rate of more than 50%. We would note that in these countries and emerging markets more generally, water-supply activities are typically more open to the private sector than are sewage services.

Figure 40: Opening up of the market in mature countries: % of water and sewage owned by the private sector 2005

Water and sewage services are almost entirely privatised in the UK and entirely public in Sweden, Switzerland and Japan…



Source: Massons, Credit Suisse research

We expect the role of the private sector to increase for two main reasons:

…but we expect it to increase

- Municipal/public utilities often lack the resources to maintain their water networks.
- Municipal/public utilities often lack the technical expertise to cope with increasing environmental standards or to manage existing water networks efficiently.

Infrastructure might not necessarily be privatised, however—we think public/private partnerships provide an appropriate solution. A private operator can sign a contract with a government agency to supply services (water delivery, waste water treatment, sewage or construction work) and a regulator sets the standard for price and quality. Subject to this safeguard, we think it makes sense for countries (or cities) to use private operators, especially where municipalities have failed.

Among the industrialised countries, the UK and France have already largely opened up to the private sector, and these markets are fairly well concentrated. On the other hand, Italy, Germany and the US are still barely open to private-sector operators and offer substantial development potential, in our view. We believe that the major groups (Suez and Veolia Environnement) are likely to concentrate their efforts on Europe and the US and thus reduce their risk profiles.

Italy, Germany and the US are still barely open to private-sector operators and offer substantial development potential

Figure 41: Structure of the water market in developed countries

	UK	France	Spain	Germany	Italy	US
Regulation	Regulator	Contractual	Contractual	Contractual	Regulator	Mixed
Private sector (%)	100%	79%	48%	15%	12%	13%
Concentration	Average	Strong	Strong	Weak	Weak	Weak

Source: Company data, Credit Suisse research

(c) Which Utilities to play?

Over the last few sections of this report, we have shown that capex in the water sector looks set to increase dramatically over the next couple of decades in most regions. We expect growth to be quickest in the emerging markets, especially in countries such as India, China, Brazil and Russia. On aggregate, we expect average real growth of 6.7% per annum.

We also think private operators will take a bigger role in the sector in the future and hence private sector market share will increase progressively from very low levels.

As a result we could argue that the growth rate for utilities ready to benefit from these two trends should be higher that that of the water sector in general. Hence, when water utilities discuss organic growth rates (in value terms) of c.10%, we think the projections are perfectly achievable, not only for the next five years but probably also over the next 20. The bigger issue for water utilities, in our view, will be how to cope with growth rather than how to find it. We think a limiting factor will be the availability of competent managers to manage water contracts.

Figure 42 summarises the main global utilities exposed to the water sector.

Figure 42: Main listed water utilities

Company name	of main listing	Sales (2006, US$)	% related to water	Rating
3i Infrastructure	GBR	966	100%	N/A
Aguas Andinas S.A	CHL	442	100%	N/A
Aguas de Barcelona	ESP	4,214	39%	N/A
American States Water Co	USA	268	83%	N/A
Aqua America Inc	USA	533	100%	N/A
China Water Affairs	HKG	7	63%	N/A
Consolidated Water	USA	38,229	100%	N/A
Dee Valley	GBR	36	100%	N/A
Hongkong & China Gas	HKG	1,733	2%	O
Kelda Group Plc	GBR	1,630	99%	N
Manila Water Co	PHIL	132	100%	N/A
Northumbrian Water Group	GBR	1,234	96%	N
NWS Holdings	HKG	1,614	4%	U
PBA Holdings Berhad	MYS	43	95%	N/A
Pennon Group	GBR	1,441	50%	O
SABESP	BRA	2,464	100%	N
Severn Trent Plc	GBR	2,907	100%	N/A
Suez	FRA	63,720	13%	O
Tianjin Development Holdings Ltd	HKG	346	8%	N/A
Transfield Services	AUS	1,919	8%	N
United Utilities Plc	GBR	2,237	75%	U
Veolia Environnement	FRA	RESTRICTED	35%	R
YTL Power International Berhad	MYS	989	63%	U

Source: Company data, Credit Suisse estimates

Veolia (Restricted): Veolia is the world leader in water services (34% of group revenues are water related). It has typically avoided outright ownership of regulated water assets. The group targets IRR of 12–15%. Stated group strategy is to continue to grow in most regions, with a particular focus on Asia (China, Korea and Japan) and Eastern Europe. The group remains more cautious regarding Latin America where it sees regulatory risks. In Western Europe, the group has maintained a significant presence. Growth prospects are not as strong as in emerging markets but the regulatory environment is stable. Management's long-term organic growth forecasts are between 8% and 10% (in value terms). ROCE has recovered over the past few years and now stands at 8.7% (2006). This compares with a cost of capital of 6.4%.

Suez (Outperform, TP €43): Suez is the second player in the global water sector after Veolia Environnement (14.5% of group sales are water related). It has been historically exposed to the French water sector and expanded outside France in the 1990s. Over the past few years Suez has focused its strategy on energy assets and maintained relatively stable capex in water. In March 2007, the group announced an increase of capex on environmental assets, but in our view, it is not showing the same commitment to water as it is to energy. Water assets should continue to provide growth to the group and we expect returns to remain high.

Pennon (Outperform, TP 644p): Pennon is our preferred pick in the UK water sector. The regulatory nature of the UK water sector is very stable, providing forward visibility both in terms of capex and the allowed returns to capital. The regulated asset base in South West Water is growing at c.2.5% real pa. Pennon has two businesses (the South West Water regional monopoly (72% of EV), and Viridor Waste (28% of EV). Even with the recent run-up in price, we believe that Pennon offers the best value of its UK peer group. We believe that a low cost of embedded debt and forecast growth in the Viridor waste business (operating profit growth is c12% organic and double this rate if we include acquisitions) reduces sensitivity to the allowed return at the next price review in water (due in November 2009). In addition, we would not rule out a takeover, although we believe that management would have a strong hand in the event of any negotiations with a bidder.

Water is still small for HKG but major expansion plans are underway

Water only made up 2% of Hong Kong and China Gas (HKG) sales last year but major expansion plans are under way. HKG currently has three water projects operating in China serving 450,000 people, with 3,400km of network and water sales volume of 270m cubic metres in 2006. HKG has been implementing measures to enhance efficiencies and reduce costs/leakages from these projects and is leveraging the experience gathered from its German partner Berlinwasser International (private) to bid for additional water projects. In 2007, HKG plans to add six new gas/water JVs in China with a further 25 projects currently under negotiation. Acquisition capex is budgeted at Rmb2.5bn in 2007.

Similarly, at NWS

NWS Holdings Limited has been operating a 50:50 JV with Suez called Sino-French Holdings (HK) Ltd for more than two decades. Through Sino French, NWS Holdings currently operates 21 water plants in mainland China and Macau with a total daily capacity of 5.68 million cubic metres. Although the contribution from the water operations is very small (less than 1%), Credit Suisse's conglomerates analyst, Cusson Leung, expects this to grow by 17% per annum over the next three years. This is based on assumptions of no hike in water tariffs and the addition of one new project per year. We see significant upside potential should any tariff increase come through.

China Water Affairs Group Limited is a small cap but it gives purer exposure to the China water market (63% of sales are water related) than NWS. CWA engages primarily in investing in and operating of water services projects in the PRC. The Group's current water services include urban water supply, sewage treatment, and water ecology preservation. It currently has water supply companies in Guangdong, Henan, Hebei, Jiangxi, and Shandong, all of which are engaged in urban water supply, with 500,000 tons of capacity and 1.2m people to be serviced. China Water Affairs is actively expanding its business operations in the water services market of the PRC, the aim of which is to establish a well-coordinated supply chain that will cover all aspects of water services ranging from water resources and water supply systems management to sewage treatment and water supply infrastructure construction.

(3) Water demand

We break it down into three areas: agricultural, industrial and domestic efficiencies.

Agricultural efficiencies

Key points: Cutting agricultural demand for water (70% of world water usage) is possible through (a) the introduction of drought-resistant plants or (b) more efficient irrigation techniques such as drip irrigation. Only 2.8% of arable land in China and 1.6% in India uses modern irrigation techniques compared with 100% in Germany and Israel.

Stocks: Monsanto, DuPont and **Syngenta. Jain Irrigation** in India and **Xinjiang Tianye Water Saving Systems** in China.

Agriculture accounts for roughly 70% of world water usage and an estimated 31% is wasted (according to the UNEP). Given the sheer size of the market, measures to improve efficiency could make a significant difference to aggregate world water demand. Moreover, since the demand for food crops in developing countries is projected by the UN to increase by 67% between 2000 and 2030, there has to be greater efficiency of water use to avoid worsening supply shortages.

Methods to increase the efficiency of water in agricultural processes include:

(a) Drought-resistant plants

Monsanto (along with DuPont and Syngenta) is working on drought tolerant crops

Monsanto is working on the development of drought-tolerant corn and cotton. Both products are at a relatively early stage in Monsanto's R&D pipeline, but the company says these are highly likely to be successfully introduced commercially, and each has significant market potential. The company expects drought-tolerant corn is to be commercialised around 2012–15. Management estimates a potential 164 million acreage opportunity globally with anticipated value per acre of US$10–30, representing a US$1bn–5bn market opportunity (versus total 2006 sales of US$7.3bn). Drought-tolerant cotton is more likely to be a post-2015 event. Monsanto anticipates a 36m acreage opportunity globally at a value per acre of US$10–30, representing a US$300m–1bn market opportunity. Several other companies are also working towards the development of drought-tolerant crops, including DuPont (corn), Syngenta (corn and soybeans) and BASF, who signed a collaborative agreement with Monsanto in March 2007.

(b) Drip irrigation

Drip irrigation can drastically cut the amount of water required for effective irrigation

This drastically cuts the amount of water needed to irrigate a field effectively. This irrigation method applies water slowly to the roots of plants by depositing it either on the soil surface or directly to the roots through a network of valves, pipes, tubing and emitters. Drip irrigation may also use devices called micro-spray heads, which spray water in a small area, instead of dripping emitters. These are generally used on tree and vine crops that have wider roots. Subsurface drip irrigation or SDI uses permanently or temporarily buried dripperline or drip tape located at or below the plant roots.

Drip irrigation typically gives higher crop yields and requires less water (depending on the crop and location). For example, in Himachal Pradesh in India, drip irrigation of apple trees has been found to increase fruit yields by 10–45%, and water saving by 25%.

The use of irrigation varies widely between countries. India and China have huge potential to increase crop yields with greater irrigation.

Figure 43: Sprinkler and drip irrigation in selected countries (2000)

Country	Sprinkler irrigation (million ha)	Drip irrigation (million ha)	Total area irrigated by modern methods (million ha)	As % of total irrigated area
China	1.20	0.27	1.47	2.8
France	1.40	0.05	1.45	90
Germany	0.53	0.002	0.532	100
Israel	0.07	0.16	0.23	100
India	0.66	0.26	0.92	1.6
Italy	0.35	0.08	0.43	16
Jordan	0.005	0.038	0.043	62
South Africa	0.26	0.22	0.48	37
USA	3.38	1.05	4.43	21

Source: ICID (International Commission on Irrigation and Drainage)

There is huge potential to roll-out drip irrigation in China and India

In China, sprinkling and drip irrigation currently makes up just less than 3% of the total irrigated acreage. The total area of arable land is 130m hectares and 45% is irrigated (by various methods). According to the Minister of Water Resources, Wang Shucheng, China plans to increase its water-saving irrigation areas by 10m hectares and build more than 17m irrigation works in the rural areas of the north-western, south-western and northern parts of the country, by 2010.

In India, a taskforce was set up in 2003 to investigate the benefits of greater and more efficient irrigation methods. The committee recommended increasing the area under irrigation by 3m hectares over the Tenth Plan period (2004–05 to 2006–07), and a further 14m over the Eleventh Plan (2007–08 to 2011–12). This would entail a total investment of INR 615bn (US$137bn) from fiscal year 2004–05 to 2011–12—equivalent to 300 times the industry's current annual sales. Implementation of the recommendations is already under way in some states, including Andhra Pradesh, Maharashtra and Gujarat.

Hong Kong-listed Xinjiang Tianye Water Saving Systems and Jain Irrigation in India offer exposure

Hong Kong-listed Xinjiang Tianye Water Saving Systems (100% of sales are water related) provides water irrigation systems and has 70% market share in Xinjiang (a province in western China). Relatively high installation costs have been hindering growth for Xinjiang Tianye Water's products outside Xinjiang but government funded irrigation projects are underpinning growth. Net profit at Xinjiang Tianye Water Saving grew 9% in 2006 and 12% yoy in Q1 2007. Eurodrip Irrigation Systems in Greece (90% sales are water related) and Jain Irrigation systems in India (100% of sales) are the two other major listed irrigation providers. Lindsay Corp (86% of sales) in the US manufactures centre pivot and lateral move and hose reel irrigation equipment. Through its subsidiaries, Lindsay operates in the US, Europe, South America and southern Africa.

(c) Reducing water run-off

Reducing water run-off from fields can be achieved simply by flattening the land. Flattening large areas of land is achieved with the use of laser levelling. According to *National Geographic*, laser levelling has reduced water run-off in Arizona by a third. Trimble Navigation is one of the leaders in laser-sight technology for field levelling.

Industrial efficiencies

Key points: Industry accounts for 22% of end water demand. Following major growth between 1960 and 1980, global water withdrawal for industrial use has pretty much stabilised despite continued growth in manufacturing production. In Europe, the Best Available Technology (BAT) is already mandatory for all new installations in industrial processes but comes into force for all existing installations from the end of October 2007. Lower growth numbers (relative to other water-related sectors) are reflected in the forecasts of the companies providing product and services in industrial water use.

Stocks: Alfa Laval, ABB, Hercules, Nalco, Ciba and **Ashland** offer exposure. From a valuation perspective, we think **Hercules** stands out.

Industry accounts for 22% of end water demand. Water is used by industry in myriad ways: for cleaning, heating and cooling; for generating steam; for transporting dissolved substances or particulates; as a raw material; as a solvent; and as a constituent part of the product itself (e.g. in the beverage industry).

Industry accounts for 22% of water demand. Demand growth from this sector has been more muted in recent years

Following major growth between 1960 and 1980, water withdrawal for use by industry worldwide has pretty much stabilised. In Japan, industrial water use has dropped by some 25% since the 1970s in spite of increasing industrial output. The pattern is similar in Europe. In Asia, the growth in industrial water withdrawal was rapid up until 1990 and has since been growing much more slowly, despite the region's high growth in manufacturing output.

According to the UN (in its World Water Development Report No. 2, 22 March 2006), "Given proper incentives, it is generally found that industry can cut its water demand by 40 to 90%, even with existing techniques and practices". Angello Chan, our Chinese Utilities analyst, points out that China still uses much more water to produce a ton of paper or steel than that used by the already fully industrialised nations.

A carrot and stick approach to ensuring efficient practice

There is a 'carrot and stick' approach to implementation. In the US, various states and municipalities offer grants and other financial incentives to industrial and commercial water users to improve efficiency. In Taiwan, the Statute for Upgrading Industries details tax breaks on equipment and process upgrades to enhance efficiency in water and energy use. In Europe, Best Available Technology (BAT) is mandatory as part of the Integrated Pollution Prevention and Control (IPPC) Directive of 1996. However, it has taken several years for this Directive to come into play. It is only since 2000 that all new industrial installations in the EU have been subject to the IPPC Directive. For existing installations an 11-year transition period was granted; this expires on 30 October 2007, from which point the rules should be enforced.

From 30 October 2007, BAT is mandatory for all European companies

Water can be saved either by cutting down on water input, or by water recycling and reuse (see section 3 above). There are several solutions available:

Alfa Laval, produces, among other things, spray nozzles designed to reduce the volume of water coming out of the tap without detracting from industrial cleaning processes, as well as systems designed to recycle water-based fluids in metalworking applications.

Aalberts Industries (24% of sales are water-related), Badger Meter (81%), Ebara (34%), Flowserve (7%) and ITT Corp (39%) provide flow equipment to monitor and regulate the flow of water and minimise its use in industrial processes.

ABB specifically markets itself as a solution provider to the EU IPPC Directive and BAT implementation.

Nalco (100% of sales water-related), Ciba (24%), Hercules (6%), Rohm & Haas (6%) and Ashland (9%) concentrate on water treatment and re-cycling (particularly for use in industrial processes).

Nalco is the largest global player in the water treatment industry. Its water treatment business is divided into two areas: Utility Side Water treatment (scaling, corrosion, microbial control chemicals, 47% of sales) and Process Services (coagulants, flocculants, 53% of sales). Nalco estimates that 30% of its water revenues are tied to the Energy industry and 20% to the Paper industry, with the rest tied to general industrial—this includes the 30–40% of the business in the Utility-Side segment that supplies scaling, corrosion and microbial control chemicals to cooling towers. We expect long-term growth for the Utility division in the mid-single digits; growth in the process chemicals business is likely to be slightly higher.

Kemira's water treatment segment is the world's largest manufacturer and supplier of inorganic coagulants and is one of the top producers of water treatment polymers. The company primarily provides sludge and wastewater treatment services to industries and municipalities. Kemira Water generated US$900m in sales pa in 2006, which was split evenly between industrial and municipal water treatment markets. Kemira has said that it expects its water treatment business to grow by 4–6% over the long run.

Ciba provides raw water treatment (solid/liquid separation and water purification), waste water treatment (solid/liquid separation and foam control), dredging (removal of contaminated sediments from waterways) and produces process chemicals (cooling/boiler water treatment and foam control). The company is forecasting a long-term growth rate of 4% in its water treatment revenues.

Ashland rates itself as a competitor to Ciba, Nalco and GE Water. Its three divisions are: Drew Industrials (treating boiling/cooling water, steam and other waste streams), Drew Marine (provides tank cleaners and corrosion inhibitors designed for ocean-going commercial cargo vessels) and Environment and Process Solutions (acquired in May 2006 from Degussa AG, which produces organic flocculants used in municipal waste water treatment). Top-line growth for the Ashland's water treatment business over the next 5-10 years is expected by the company to be in the 8–12% range.

Hercules supplies water treatment chemicals such as biocides, anti-foams and drainage agents to the Pulp and Paper industry, and the company's total water treatment revenues are roughly US$100m (based on 2006 figures). In 2002 Hercules sold its main water treatment business to GE Water and subsequently entered into an exclusive agreement to provide GE Water with process chemicals, which will run to 2009. Sales to GE Water amount to US$50m per year and sales of process chemicals to the Pulp and Paper industry contribute another US$60m. In short, the products sold to the Pulp and Paper industry are used mostly to keep the process water free of micro-organisms and other contaminants. The 5–10 year long-term outlook for sales growth in this business is in the low single digits, on our estimates.

Domestic efficiencies

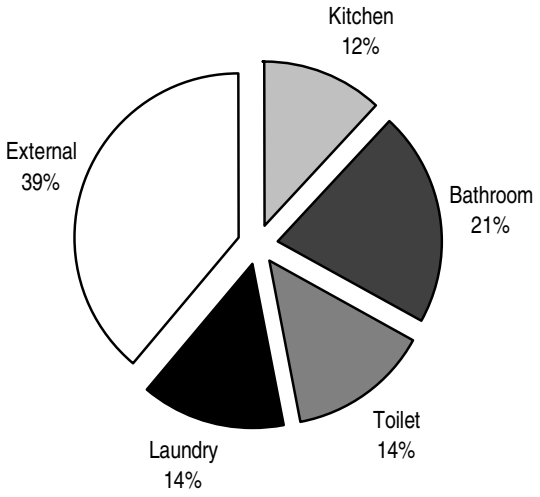
Key points: Domestic water use accounts for 8% of the total but the proportion of this that is wasted is 85%. Legislation is slowly catching up to force the adoption of water-efficient devices and practices. The US and Australia have already passed significant legislation. The US DOE predicts that by 2026, water use for the average American family should be reduced by up to a half that of the pre-1994 figure, when Congress passed the Energy Policy Act. The UK and Europe are somewhat lagging. In the UK, the consultation period on mandatory water efficiency in new buildings finished in March 2007 with legislation due to be discussed later in the year.

Stocks: Metering **(Itron, Badger Meter, China Water Affairs)**, better household plumbing **(GWA International, Watts Water Technologies, Geberit)**, more efficient appliances **(LG Electronics, Whirlpool and Electrolux).**

The UNEP estimates that domestic water use makes up 8% of global water use but that 85% of that water extraction is wasted. There are two approaches to reducing this waste: (1) to raise public awareness through advertising and marketing campaigns (Thames Water estimated that its UK summer 2006 campaign cut demand by 5.3% thereby avoiding water restrictions) or, (2) to install more water-efficient devices. In developed markets, there is an increasing degree of regulation to ensure the installation of efficient water (as well as energy) appliances. We review some of the measures below:

An estimated 85% of domestic water usage ends up wasted

Figure 44: Global household water consumption breakdown



Source: GHD, Credit Suisse research

(a) Meters

Fitting water meters raises public awareness and reduces the amount of water wasted. An analysis of 8,000 UK households between 1996 and 2001 calculated that metering resulted in an average reduction in consumption of 9% (Baker and Toft, 2003).

Fitting water meters typically leads to water saving

According to Itron, there are c. 700 million water meters across the world with demand growth for new and replacement meters of roughly 10% pa. As in so many cases, much of the growth originates in China. Meter installation and monitoring is provided by China Water Affairs, China Water Industry Group and Jiangxi Hongcheng Waterworks Co., Ltd.

Metering is fairly universal across Europe, Japan, the US and Australia. Within the developed markets, the UK is the major exception. The Environment Agency is encouraging metering (about one in four homes have a meter fitted at the moment) and is targeting 75% of households by 2025, although one region (Folkstone and Dover) has had approval from DEFRA to introduce compulsory metering on a phased basis. The 75% target implies demand for water meters across the UK of c.14m over the next 18 years, or 7% growth pa.

Leading water meter suppliers include Itron (30% of sales are water-related), Badger Meter (81%) and Techem (20%). Severn Trent is also a supplier, albeit the contribution to sales is less than 1%.

(b) Household plumbing

According to the Australian consultants GHD, 21% of water is used in the bathroom, 14% goes down the toilet and 12% is used in the kitchen. Water-saving potential is significant (some studies have reported up to 60% water saving). Figure 45 describes some of the water-saving devices available.

Figure 45: Household water saving devices

Solution	Description
Spray taps or fix spray nozzles to existing taps	Reduces volume of water flow from the tap.
High-efficiency shower heads	Mixes air with the water to halve water consumption without any noticeable reduction in effect.
Supply restricting valves	Keeps water flow constant despite pressure fluctuations. May prevent and detect leaks.
Urinal controls	Cistern only flushes after use.
Tap controls	Switches taps off after certain time.
Water saving device (Cistern Dams) in standard toilets	Reduces the volume of water used during flush.
Low-flush toilets	Reduces the volume of water used during flush.

Source: Credit Suisse research

In the US, domestic water-efficient devices are mandatory for new builds

The US and Australia are generally ahead of many countries with respect to legislation on water-efficient devices. In the US, domestic water-efficient devices are mandatory for new builds and regulations are in place to define maximum water-use standards for plumbing fixtures. The US DOE predicts that by 2026, water use for the average American family should be reduced by up to a half of the pre-1994 levels (when Congress passed the Energy Policy Act, which mandated the use of water-efficient fixtures). To promote an early replacement cycle, some states have opted to roll out incentives (e.g. the ultra-low flush toilet rebate in Santa Monica, California).

In Australia, regulation is state-based and so somewhat inconsistent, but all states have had regulations for more than a decade relating to dual flush/low volume toilets for new houses and replacement products and the same for aerators and flow regulators for showerheads and kitchen taps. The pressure from suppliers is now to adopt a subsidised retrofit scheme for the installed base of old-style single flush toilets, as in various US states and cities. In 2004, New South Wales introduced a new house building code, which required a 40% reduction in household water usage for new homes and renovations (achieved through low flush toilets, diffusers in taps, water efficient appliances, water tanks). Victoria has an environmentally driven code that allows a choice between water saving (e.g., a water tank) or greenhouse gas saving (e.g. a solar hot water system) to generate the required Five Star environmental approval, on top of existing low flush/diffuser requirements. In Queensland, Australia, new legislation designed to meet water saving targets in new buildings comes into effect across the whole state (rather than just part of it) on 1 July 2007.

Somewhat surprisingly, in the UK and much of Europe, legislation on domestic water efficiency in new buildings is not in place

Somewhat surprisingly, legislation on domestic water efficiency in new buildings is not in place in the UK and much of Europe. The EU Building Directive (enforced from 2006) specifies energy saving applications in new builds but contains nothing on water-efficiency standards. In the UK, the consultation period on mandating water efficiency in new buildings finished in March 2007 with legislation due to be discussed later in the year. Setting water efficiency standards in existing buildings is also tabled for investigation by the UK government.

In China, there are no federal laws that set standards for plumbing equipment, but Beijing, Tianjin and Shanghai have taken measures to promote domestic water saving, including subsidising water-saving taps or toilets and rolling-out education programmes.

There are limited ways to gain exposure to this theme in the market as (a) many products are supplied by unlisted manufacturers or (b) they make up only a tiny proportion of sales of listed corporates.

Five possibilities are Geberit (100% of sales from sanitary ware and plumbing supplies), The Longmead Group (15% of sales from ceramic bathroom accessories), GWA International (75% of sales) and Watts Water Technologies (16% of 2006 sales of plumbing equipment to DIY centres, 100% of sales related to water).

(c) Washing machines

Washing machines currently account for 14% of household water usage, but significant strides have been made in terms of water efficiency. According to *Which? Consumer Magazine*, current models use approximately half (25 litres per load) the water of the average 10-year old machine. Stricter limits on water usage are increasingly an issue: Rating and labelling washing machines on their water efficiency is already mandatory in Australia, albeit only voluntary in Europe and the UK for the time being. California is trying to impose standards of water efficiency (not just a label) on any machines sold there from the end of 2007.

California is trying to impose standards of water efficiency (not just a label) on any machines sold there from end-2007

LGE has been promoting its water-efficient washing machine since 1H06, a steam-based system that uses roughly 13 litres per load. Contribution to overall sales however is still very small: washing machine sales accounted for 6% of total in FY06 with the steam machine contributing 13.8% of this. Siemens (through its JV with Bosch) is another provider, but again washing machine sales represent only a tiny proportion of the total. Other companies active in this arena are Electrolux (6% of sales from washing machines) and Whirlpool (5% of sales).

(d) Car washes

Garden hoses and car washing are usually top of the restricted list in the developed markets when drought fears set in. Washtec (listed in Germany) has developed a system called AquaBio, which is an eco-friendly water recovery system for gantry car washes.

Figure 46: Stocks exposed to generating greater water efficiency

Name	% Water related sales	Category	Country	Credit Suisse Rating
Xinjiang Tiayne Water Saving System	100%	Irrigation Systems	China	NR
Jain Irrigation Systems	100%	Irrigation Systems	India	NR
Nalco	100%	Water treatment	United States	Neutral
Geberit	100%	Sanitary ware and Plumbing	Switzerland	Underperform
Watts Water Technologies	100%	Sanitary ware and Plumbing	United States	NR
Eurodrip Irrigation Systems	90%	Irrigation Systems	Greece	NR
Lindsay Corp	86%	Irrigation Systems	United States	NR
Badger Meter	81%	Flow regulating equipment	United States	NR
GWA International	75%	Sanitary ware and Plumbing	Australia	Underperform
ITT Corp	39%	Flow regulating equipment	United States	Neutral
Ebara	34%	Flow regulating equipment	Japan	NR
Itron	30%	Water meter suppliers	United States	NR
Aalbert Industries	24%	Flow regulating equipment	Netherlands	NR
Ciba	24%	Water treatment	Switzerland	NR
Techem	20%	Water meter suppliers	Germany	Restricted
Longmead Group	15%	Sanitary ware and Plumbing	United Kingdom	NR
Ashland	9%	Water treatment	United States	Neutral
Flowserve	7%	Flow regulating equipment	United States	NR
Hercules	6%	Water treatment	United States	Outperform
Rohm & Haas	6%	Water treatment	United States	NR
LGE	6%	Washing Machines	South Korea	Outperform
Electrolux	6%	Washing Machines	Sweden	Underperform
Whirlpool	5%	Washing Machines	United States	NR

Source: Company data, Credit Suisse research

Appendix 1: Water stress

We can divide the problems with the water supply-demand balance into five broad categories.

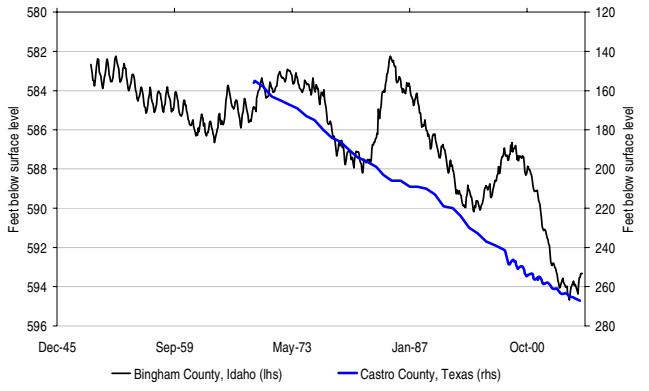
(i) The current mismatch

There is enough water to go round, but distribution is a problem

In aggregate, there is sufficient fresh water to meet global demand. 10.5m cubic kilometres of freshwater is more than enough to supply the 6.5bn global population. As the UN put it, providing universal access to the basic minimum of 50 litres a day per person would mean re-distributing just 1% of the amount of water used currently. The problem is essentially a question of distribution of the freshwater resource given spatial and time variations in its natural delivery.

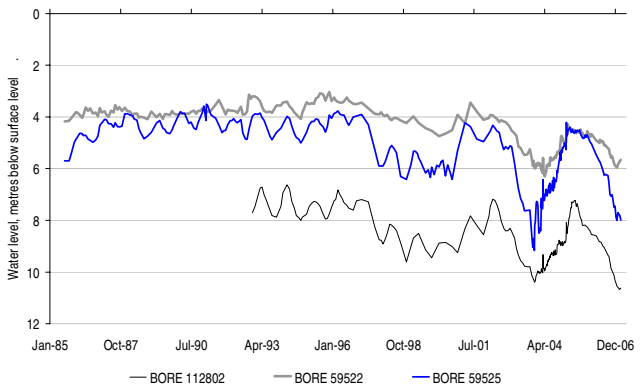
Just over a fifth of the world's water used is from groundwater. As this has been exploited faster than rainwater is able to replenish the reserve, water tables in parts of China, India, western Asia, Russia, the United States and Australia have dropped.

Figure 47: US ground water levels



Source: US Geological Survey

Figure 48: Victoria, Australia: ground water levels



Source: Victorian water resources

Groundwater levels have declined significantly in parts of North America, Europe, Australia, India and China

North America's largest aquifer, the Ogallala (which stretches from Texas to South Dakota), is being depleted at a rate of 12bn cubic metres (bcm) a year. Total depletion to date amounts to some 325 bcm, a volume equal to the annual flow of 18 Colorado Rivers. Between 1991 and 1996, the water table beneath the north China plain fell by an average of 1.5 metres a year. More than half of Europe's cities are exploiting groundwater at unsustainable rates. Chronic water shortages are already affecting 4.5m people in Catalonia, where authorities are pressing for the construction of a pipeline to divert water from the Rhone in France to Barcelona.

Of the total amount of water used globally, 65% is from surface water (rivers, streams and lakes). Again, demand has outstripped the rate of replenishment. The most vivid illustration of this is the decline in the Aral Sea. At one stage, the Aral Sea was the world's fourth biggest inland sea, and one of the world's most fertile regions, but overuse has meant that by 1998, the Aral Sea had lost 75% of its total volume.

An estimated third of the world's population currently lives in water-stressed or water-scarce countries

The UN defines countries (or areas) as water stressed *on an absolute basis* when annual water supplies drop below 1,700 cubic metres per person. When supplies drop below 1,000 cubic metres per person, the UN defines the country as water scarce. Under this definition, an estimated third of the world's population currently lives in water-stressed or water-scarce countries.

Water-rich countries are also under supply pressure given their relative demand for water. The UN defines a country as suffering high *relative* water stress if demand is greater than 40% of the renewable water supply. Medium-high water stress is defined as demand of between 20% and 40% of supply. On numbers compiled from the World Resources Institute and the UN, we calculate that 9% of the global population is suffering from relatively high levels of water stress and 58% of the global population is suffering high or medium-high relative water stress.

Even water-rich countries are under supply pressure given their relative demand for water

In the tables below, we show the regional aggregates and how the worst affected and most populous countries in the world stack up under these definitions.

Figure 49: Water supply and demand at the regional level, 2000

	Population mn 2000	Water supply km3/pa 2000	Water supply per inhabitant m3/pa 2000	Absolute Stress or Scarcity Flag*	Water withdrawals km3/pa 2000	Water withdrawals per inhabitant m3/pa, 2000	Demand/ supply 2000	Water Stress relative reading
Asia (excluding Middle East)	3,398	14,514	4,271		2,148	632	14.8%	Moderate
Central America & Caribbean	168	1,259	7,498		101	600	8.0%	Low
Europe	714	7,771	10,886		418	586	5.4%	Low
Middle East & North Africa	406	638	1,571	Stress	324	797	50.7%	High
North America	315	6,556	20,826		525	1,669	8.0%	Low
Oceania	29	1,693	58,403		26	903	1.5%	Low
South America	350	17,266	49,401		165	471	1.0%	Low
Sub-Saharan Africa	673	5,537	8,228		120	178	2.2%	Low

** water stress defined as annual water supplies less than 1700 cubic metres per person; water scarcity defined as annual water supplies less than 1000 cubic metres per person.*
Source: World Resources Institute, UN

The Middle East and North Africa have the greatest absolute and relative water supply problem. Asia (ex the Middle East) is classified as moderately stressed. Oceania, South and North America are, in absolute and relative terms, water rich. Obviously, however, these regional aggregates disguise problems within these areas.

China and India are both close to the absolute stress level of 1,700 cubic metres per inhabitant and demand relative to supply is medium-high. The US is water-rich in absolute terms but given massive relative consumption per head (nearly three times that of Japan) is classified as moderately water-stressed on a relative basis. In absolute and relative terms, Brazil is one of the most water-rich countries in the world.

Figure 50: Absolute water stress or scarcity: 20 worst affected countries, 2000

	Population mn 2000	Water supply km3/pa 2000	Water supply per inhabitant m3/pa, 2000	Absolute Stress or Scarcity Flag	Water withdrawals km3/pa 2000	Water withdrawals per inhabitant m3/pa, 2000	Demand/ supply 2000	Water Stress relative reading
United Arab Emirates	3	0.2	62	Scarce	2.3	708	1150.0%	High
Saudi Arabia	21	2.4	112	Scarce	17.32	806	721.7%	High
Libya	5	0.6	113	Scarce	4.268	804	711.3%	High
Bahrain	1	0.1	149	Scarce	0.3	446	300.0%	High
Qatar	1	0.1	165	Scarce	0.29	479	290.0%	High
Jordan	5	0.9	181	Scarce	1.01	203	112.2%	High
Yemen	18	4.1	229	Scarce	6.63	370	161.7%	High
Malta	0	0.1	253	Scarce	0.051	129	51.0%	High
Singapore	2	0.6	265	Scarce	0.19	84	31.7%	Medium-High
Israel	6	1.7	279	Scarce	2.05	337	120.6%	High
Barbados	0	0.1	376	Scarce	0.09	338	90.0%	High
Algeria	31	11.7	384	Scarce	6.07	199	51.9%	High
Oman	2	1	410	Scarce	1.36	557	136.0%	High
Djibouti	1	0.3	426	Scarce	0.019	27	6.3%	Low
Tunisia	10	4.6	481	Scarce	2.64	276	57.4%	High
Cape Verde	0	0.3	668	Scarce	0.022	49	7.3%	Low
Egypt	67	58.3	866	Scarce	68.3	1,015	117.2%	High
Kenya	31	30.7	991	Scarce	1.58	51	5.1%	Low
Morocco	29	29	992	Scarce	12.6	431	43.4%	High
Cyprus	1	0.8	1,017	Stress	0.24	305	30.0%	Medium-High

Source: World Resources Institute, UN. Data sorted according to Water supply per inhabitant

Figure 51: Water stress or scarcity for the 20 most populous countries, 2000

	Population mn 2000	Water supply km3/pa 2000	Water supply per inhabitant m3/pa, 2000	Absolute Stress or Scarcity Flag	Water withdrawals km3/pa 2000	Water withdrawals per inhabitant m3/pa, 2000	Demand/ supply 2000	Water Stress relative reading
China	1,273	2829	2,222		630.29	495	22.3%	Medium-High
India	1,020	1896.7	1,859		645.84	633	34.1%	Medium-High
United States	284	3051	10,739		479.29	1,687	15.7%	Moderate
Indonesia	209	2838	13,576		82.78	396	2.9%	Low
Brazil	174	8233	47,343		59.3	341	0.7%	Low
Russia	147	4507.3	30,742		76.68	523	1.7%	Low
Pakistan	143	222.7	1,561	Stress	169.39	1,187	76.1%	High
Bangladesh	129	1210.6	9,392		79.4	616	6.6%	Low
Japan	127	430	3,384		88.43	696	20.6%	Medium-High
Nigeria	118	286.2	2,430		8.01	68	2.8%	Low
Mexico	100	457.2	4,571		78.22	782	17.1%	Moderate
Germany	82	154	1,869		47.05	571	30.6%	Medium-High
Viet Nam	79	891.2	11,323		71.39	907	8.0%	Low
Philippines	76	479	6,315		28.52	376	6.0%	Low
Ethiopia	69	122	1,778		5.558	81	4.6%	Low
Turkey	68	213.6	3,130		37.53	550	17.6%	Moderate
Egypt	67	58.3	866	Scarce	68.3	1,015	117.2%	High
Iran, Islamic Rep	66	137.5	2,072		72.88	1,098	53.0%	High
Thailand	61	409.9	6,672		87.06	1,417	21.2%	Medium-High
France	59	203.7	3,436		39.96	674	19.6%	Moderate

Source: World Resources Institute, UN. Data sorted by population size.

(ii) Demand growth

World population growth is projected by the UN at some 30% over the next 20 years (from just over 6bn people today to just less than 8bn). Along with a forecast rise in real incomes (and hence demand) in developing markets this makes the supply/demand situation significantly worse. On our estimates, based on the UN population forecasts, by 2025, this means that 30% of the world's population will be living in countries suffering from high relative water stress and a total of 64% of the global population will be living in countries suffering high or medium-high relative water stress.

In Figure 52 we replicate the regional picture in 2025 incorporating the UN population forecasts, assuming a static water supply and assuming a 10% increase in water demand per inhabitant.

The water problem looks set to worsen with population growth and rising real incomes

Figure 52: Water supply and demand at the regional level, 2025E

	Population m 2025	Water supply km3/pa 2025	Water supply per inhabitant m3/pa 2025	Absolute Stress or Scarcity Flag*	Water withdrawals km3/pa 2025	Water withdrawals per inhabitant m3/pa, 2025	Demand/ supply 2025	Water Stress relative reading
Asia (excluding Middle East)	4,379	14,514	3,314		3,044	695	21.0%	Medium-High
Central America & Caribbean	227	1,259	5,540		150	660	11.9%	Moderate
Europe	707	7,771	10,993		456	645	5.9%	Low
Middle East & North Africa	553	638	1,154	Stress	485	877	76.0%	High
North America	393	6,556	16,689		721	1,835	11.0%	Moderate
Oceania	41	1,693	41,659		40	993	2.4%	Low
South America	461	17,266	37,472		239	518	1.4%	Low
Sub-Saharan Africa	1,194	5,537	4,639		234	196	4.2%	Low

** water stress defined as annual water supplies less than 1,700 cubic metres per person; water scarcity defined as annual water supplies less than 1,000 cubic metres per person*
Source: World Resources Institute, UN, Credit Suisse estimates

Under these projections, the problem remains most acute in the Middle East and North Africa, with demand relative to supply increasing to 76% in 2025E. Asian demand relative to supply moves up to 21% (medium-high stress). Demand relative to supply moves up to 'moderate' stress levels in Central America and the Caribbean as well as North America.

The country breakdown shows that 18 countries (mostly Middle Eastern) are projected to have demand levels in excess of 100% of supply and 58 countries (including India, China, the US and Japan) are projected to suffer high or medium-high relative water stress.

The increasing water shortage has been widely acknowledged by governments around the world. For example:

- In Queensland, Australia, recently leaked official documents widely reported in the media (e.g. ABC News Online, 8 February, 2007) reveal there will not be enough water to meet projected demand as early as 2009.
- In Texas, the Water Development Board stated early last year (January 2006) that about 45% of the projected state population would not have enough water during drought conditions to meet their needs by 2010 (without implementing fairly extensive water management strategies) with a cost to business of approximately US$9bn in 2010, increasing to roughly US$98bn in 2060.
- In China, Li Hailiang, deputy director of the Pearl River Water Resources Committee's water resources section, has predicted a supply gap of 15% (13.5bn m3) pa by 2010 and 31% (26.8bn m3) by 2020 in the Pearl River area.

Figure 53: Absolute water stress or scarcity: 20 worst affected countries, 2025

	Population mn 2025	Water supply km3/pa 2025	Water supply per inhabitant m3/pa 2025	Absolute Stress or Scarcity Flag	Water withdrawals km3/pa 2025	Water withdrawals per inhabitant m3/pa, 2025	Demand/ supply 2025	Water Stress relative reading
United Arab Emirates	6.268	0.2	32	Scarce	4.88	779	2440.8%	High
Saudi Arabia	34.797	2.4	69	Scarce	30.85	887	1285.5%	High
Libya	8.087	0.6	74	Scarce	7.15	884	1192.0%	High
Qatar	1.102	0.1	91	Scarce	0.58	527	580.6%	High
Bahrain	0.972	0.1	103	Scarce	0.48	491	476.9%	High
Jordan	8.029	0.9	112	Scarce	1.79	223	199.2%	High
Yemen	36.567	4.1	112	Scarce	14.88	407	363.0%	High
Singapore	5.104	0.6	118	Scarce	0.47	92	78.6%	High
Israel	8.722	1.7	195	Scarce	3.23	371	190.2%	High
Malta	0.431	0.1	232	Scarce	0.06	142	61.2%	High
Djibouti	1.113	0.3	270	Scarce	0.03	30	11.0%	Moderate
Algeria	42.882	11.7	273	Scarce	9.39	219	80.2%	High
Oman	3.614	1	277	Scarce	2.21	613	221.4%	High
Barbados	0.303	0.1	330	Scarce	0.11	372	112.7%	High
Tunisia	12.17	4.6	378	Scarce	3.69	304	80.3%	High
Cape Verde	0.75	0.3	400	Scarce	0.04	54	13.5%	Moderate
Burkina Faso	23.729	12.5	527	Scarce	1.85	78	14.8%	Moderate
Kenya	57.176	30.7	537	Scarce	3.21	56	10.4%	Moderate
Egypt	98.513	58.3	592	Scarce	109.99	1,117	188.7%	High
Rwanda	15.22	9.5	624	Scarce	0.32	21	3.3%	Low

Source: World Resources Institute, UN, Credit Suisse. Data sorted by water supply per inhabitant.

Figure 54: Water stress or scarcity for the 20 most populous countries, 2025

	Population mn 2025	Water supply km3/pa 2025	Water supply per inhabitant m3/pa 2025	Absolute Stress or Scarcity Flag	Water withdrawals km3/pa 2025	Water withdrawals per inhabitant m3/pa, 2025	Demand/ supply 2025	Water Stress relative reading
India	1447.499	1896.7	1,310	Stress	1,007.89	696	53.1%	High
China	1445.7	2829	1,957		787.18	545	27.8%	Medium-High
United States	354.93	3051	8,596		658.64	1,856	21.6%	Medium-High
Indonesia	271.227	2838	10,464		118.15	436	4.2%	Low
Brazil	228.833	8233	35,978		85.84	375	1.0%	Low
Pakistan	224.956	222.7	990	Scarce	293.73	1,306	131.9%	High
Nigeria	210.129	286.2	1,362	Stress	15.72	75	5.5%	Low
Bangladesh	206.024	1210.6	5,876		139.60	678	11.5%	Moderate
Russian Federation	128.193	4507.3	35,160		73.75	575	1.6%	Low
Ethiopia	124.966	122	976	Scarce	11.13	89	9.1%	Low
Mexico	124.695	457.2	3,667		107.26	860	23.5%	Medium-High
Japan	121.614	430	3,536		93.11	766	21.7%	Medium-High
Philippines	115.878	479	4,134		47.93	414	10.0%	Moderate
Congo, Dem Rep	107.481	1283	11,937		0.83	8	0.1%	Low
Viet Nam	106.357	891.2	8,379		106.11	998	11.9%	Moderate
Egypt	98.513	58.3	592	Scarce	109.99	1,117	188.7%	High
Turkey	89.557	213.6	2,385		54.18	605	25.4%	Medium-High
Iran, Islamic Rep	88.027	137.5	1,562	Stress	106.32	1,208	77.3%	High
Germany	80.341	154	1,917		50.46	628	32.8%	Medium-High
Thailand	68.803	409.9	5,958		107.24	1,559	26.2%	Medium-High

Source: World Resources Institute, UN, Credit Suisse estimates. Data sorted by population size

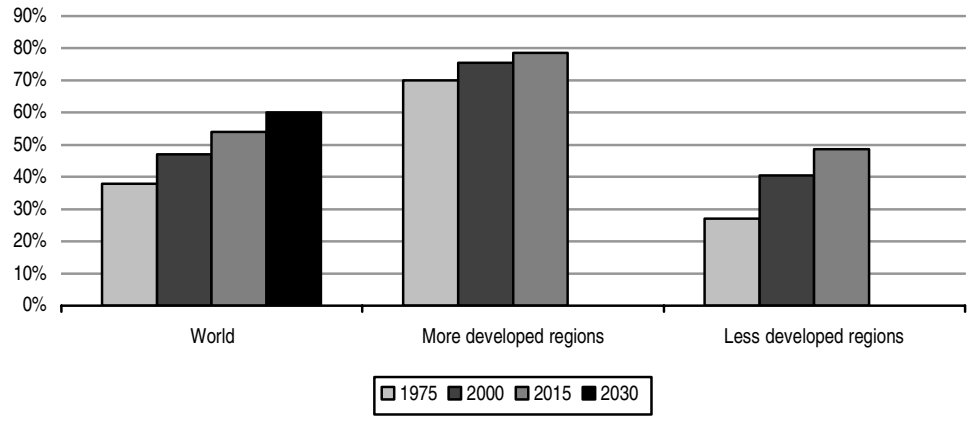
(iii) Shifting patterns of demand

Rural/urban migration is increasing the stress on the supply/demand balance for most utilities and particularly water as it places increased pressure on neighbouring water resources (i.e. local water tables).

The average size of the world's 100 largest cities grew from around 0.2m in 1800 to 0.7m in 1900 to 6.2m in 2000. Currently, half the world's population lives in urban centres, compared with less than 15% in 1900. By 2030, the UN forecasts that 60% of the world's population will live in urban areas. In China alone rural to urban migration is estimated to be around 12m people a year (as estimated by CNN).

Figure 55: Proportion of the population living in urban settlements

Growth in urban areas is adding to the stress on local water resources



the UN forecasts that by 2030 60% of the world's population will live in urban areas

Source: UNESCO-WWAP, 2006

In order for the Millennium Development Goal on water (a UN target to reduce by half relative to 2000 the proportion of people without access to safe drinking water and basic sanitation) to be met by 2015, 961m urban dwellers must gain access to improved water supply.

Figure 56: The distribution of the world's urban population by region, 1950–2010

Region	1950	1970	1990	2000	2010E
Population living in urban areas (%)					
World	29.1	36.0	43.2	47.1	51.3
Africa	14.9	23.2	31.9	37.1	42.4
Asia	16.6	22.7	31.9	37.1	42.7
Europe	51.2	62.9	71.5	72.7	74.2
Latin America and the Caribbean	41.9	57.4	71.1	75.5	79.4
Northern America	63.9	73.8	75.4	79.1	82.3
Oceania	60.6	70.6	70.1	72.7	73.7

Source: UN

Beijing is one example of growing water scarcity on the back of rural-urban migration. Over the last 15 years its population has grown by 4.9 million or 48% to 15.2m people. Falling groundwater tables and problems securing sufficient surface water of adequate quality have led to plans to divert large quantities of water from the south to the north. According to statistics from the Ministry of Water Resources, Beijing has per capita water resources of less than 300 tons, which is only 13% of the national average.

Beijing's population has swelled by 4.9m people in the last 15 years, placing considerable stress on water supply

(iv) Global warming

If the glacier disappears then so does the river

The global temperature is up 0.76°C over the past 150 years (according to NASA GISS Surface Temperature [GISTEMP] analysis), with the strongest rises recorded since the early 1970s. The fourth report from the IPCC predicts a temperature increase for this century of 2.0–4.5°C and a rise in sea-level of between 19cm and 58cm.

Through global warming, the freshwater supply is set to be negatively affected (via river flow and rainfall) and demand looks likely to increase as large tracts of populous areas, particularly within the tropics, are forecast to experience drier, hotter weather.

Glacial river flow is set to be negatively affected by global warming: if the glacier disappears then so does the river. This is the main threat to the Indus, fed by the Himalayan glacier and providing the main water source for approximately 250m people.

The IPCC warned that a temperature increase of more than 2.5°C could affect global food supply and contribute to higher food prices. The impact on crop yields would vary considerably from one region to another. Heat stress, shifting monsoons and drier conditions can reduce yields by as much as one-third in the tropics and subtropics. Dry continental areas, such as central Asia and the African Sahel, would be expected to experience drier and hotter climates, whereas longer growing seasons and increased rains might boost productivity in temperate regions. Higher temperatures would also influence production patterns, shifting production ranges of specific crops towards the poles.

(v) Pollution

The WHO claim that 90% of the rivers are polluted in China

Finally, if there weren't enough problems with the water supply already, pollution has further reduced the available resource. Water pollution is derived from a wide variety of sources: failure to clean industrial waste, surface water run-off from agriculture, inappropriate discharge of sewage and over extraction of groundwater to depths whereby naturally occurring poisons (such as arsenic) fatally contaminate supplies (which is a well documented problem in India). Levels of pollution are arguably worse in developing markets, where preventative legislation is not yet in place to (for example, in China, where the World Health Organisation claims that 90% of the rivers are polluted).

The WHO points out that more than 5m people die from waterborne diseases each year—10 times the number killed in wars around the globe.

Appendix 2: Water works—products and processes

The water industry includes raw water collection, water treatment and production, water and wastewater transmission and distribution networks and wastewater treatment.

There are also related industries working closely with the water industry to provide water and wastewater treatment equipment and technologies, piping network systems and the corresponding construction and engineering services.

Water processes can be classified into four main categories:

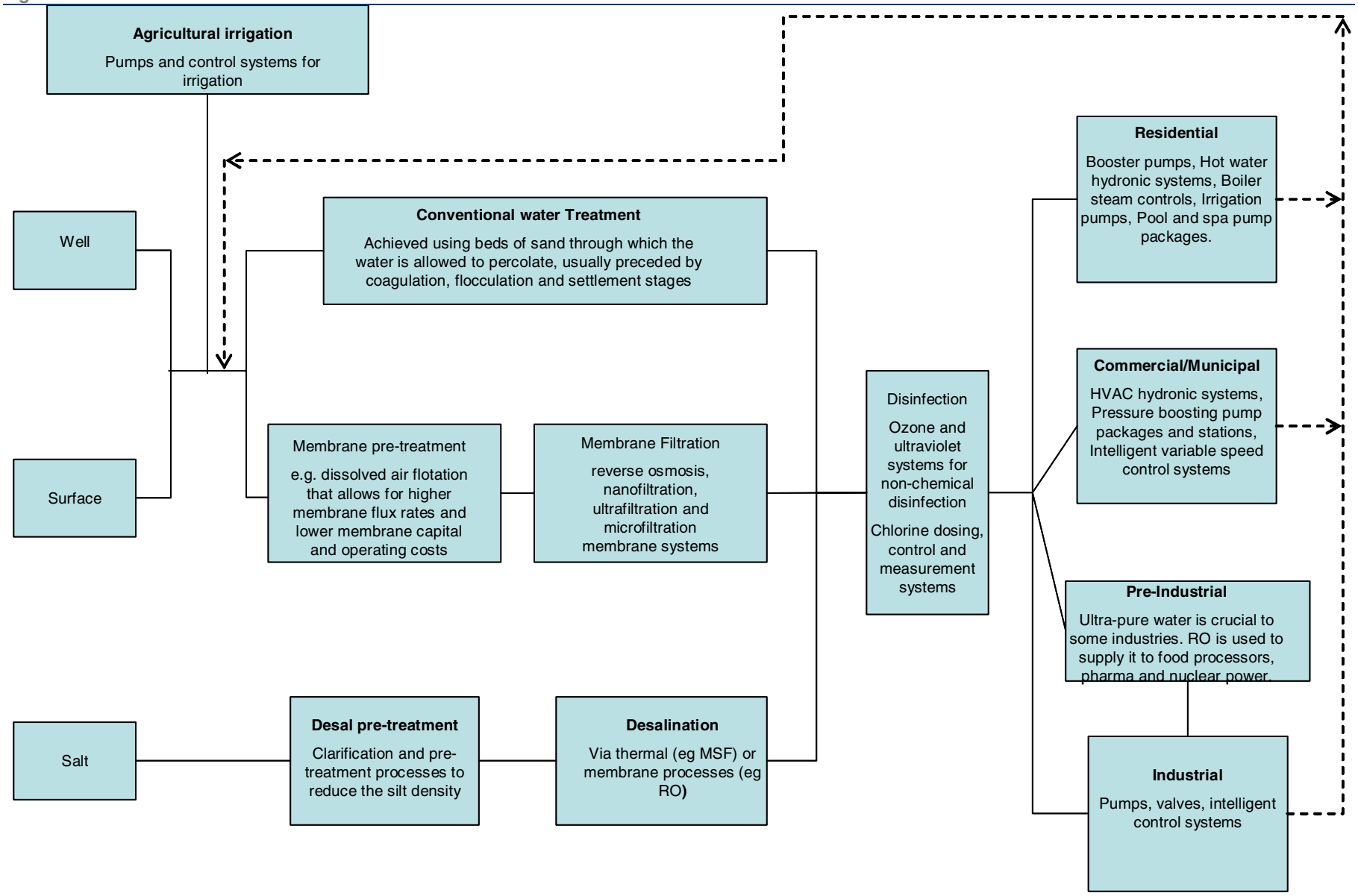
1. Water Intake and Distribution Infrastructure: Pumps & Wells ➔ Treatment Centres ➔ Drinkable water distribution & Storage ➔ Residential & Commercial Facilities.

2. Water Treatment and Purification: Water Intake ➔ Membrane Pre-treatment ➔ Filtration & Clarification ➔ Disinfection ➔ Distribution.

3. Wastewater Processing and Reuse (Residential and Industrial/Agriculture are separate processes): Sump & sewage water + Stormwater ➔ Collection tanks ➔ Treatment ➔ Reuse / Replenish groundwater.

4. Fresh Water Capture (ie Desalinization and Off-shore “water makers”): Desalinization Pretreatment (reducing silt density) ➔ Reverse Osmosis Desalinization ➔ Distribution.

Figure 57: **Water value chain**



Source: Credit Suisse research

Companies Mentioned *(Price as of 04 Jun 07)*
3M (MMM, $77.97, NEUTRAL, TP $86.00, MARKET WEIGHT)
ABB (ABBN.VX, SFr21.40, OUTPERFORM, TP SFr26.00, UNDERWEIGHT)
Alfa Laval (ALFA.ST, SKr375.00, UNDERPERFORM, TP SKr365.00, UNDERWEIGHT)
Alstom (ALSO.PA, Eu95.92, OUTPERFORM, TP Eu122.00, UNDERWEIGHT)
Asahi Kasei (3407, ¥864, NEUTRAL, TP ¥830, MARKET WEIGHT)
Ashland Inc. (ASH, $64.95, NEUTRAL, TP $69.00, MARKET WEIGHT)
Bunge Limited (BG, $79.89, OUTPERFORM, TP $85.00, MARKET WEIGHT)
Cardno (CDD.AX, A$5.85, OUTPERFORM, TP A$6.85)
Chiyoda (6366, ¥2,575, NEUTRAL [V], TP ¥2,700, MARKET WEIGHT)
Coffey International (COF.AX, A$3.90, OUTPERFORM, TP A$5.30)
Danaher Corporation (DHR, $72.27, OUTPERFORM, TP $82.00, MARKET WEIGHT)
Danone (DANO.PA, Eu121.56, NEUTRAL, TP Eu130.00, MARKET WEIGHT)
Dow Chemical Company (DOW, $45.70, NEUTRAL, TP $50.00, UNDERWEIGHT)
Ecolab (ECL, $42.99, NEUTRAL, TP $49.00, MARKET WEIGHT)
Electrolux (ELUXb.ST, SKr175.50, UNDERPERFORM, TP SKr150.00, UNDERWEIGHT)
G.U.D. Holdings Limited (GUD.AX, A$7.94, NEUTRAL, TP A$8.50)
Geberit (GEBN.S, SFr1945.00, UNDERPERFORM, TP SFr1800.00, OVERWEIGHT)
General Electric (GE, $35.82, OUTPERFORM, TP $41.00, MARKET WEIGHT)
Georg Fischer (FIN.S, SFr835.00, OUTPERFORM, TP SFr950.00, OVERWEIGHT)
GWA International Limited (GWT.AX, A$3.97, UNDERPERFORM, TP A$3.90)
Halma (HLMA.L, 225.25 p, NEUTRAL, TP 240.00 p, UNDERWEIGHT)
Hercules (HPC, $20.96, OUTPERFORM, TP $24.00, MARKET WEIGHT)
Hills Industries Limited (HIL.AX, A$5.41, UNDERPERFORM, TP A$5.00)
Hong Kong and China Gas (0003.HK, HK$15.76, OUTPERFORM, TP HK$21.36)
Ishikawajima-Harima Heavy Industries (7013, ¥482, OUTPERFORM [V], TP ¥430, MARKET WEIGHT)
ITT Corporation, Inc. (ITT, $61.98, NEUTRAL, TP $68.00, MARKET WEIGHT)
Kawasaki Heavy Industries (7012, ¥501, NEUTRAL, TP ¥480, MARKET WEIGHT)
Kelda Group (KEL.L, 946.50 p, NEUTRAL, TP 880.73 p, UNDERWEIGHT)
Kubota (6326, ¥1,115, NEUTRAL, TP ¥1,100, MARKET WEIGHT)
Kurita Water Industries (6370, ¥2,790, NEUTRAL, TP ¥2,200, MARKET WEIGHT)
LG Electronics Inc (066570.KS, W59,900, OUTPERFORM, TP W80,000)
Mitsubishi Heavy Industries (7011, ¥728, NEUTRAL, TP ¥700, MARKET WEIGHT)
Monsanto Company (MON, $54.83, UNDERPERFORM, TP $43.00, OVERWEIGHT)
Multiplex Group (MXG.AX, A$4.45, NEUTRAL, TP A$4.66, OVERWEIGHT)
Nalco Holding Company (NLC, $24.43, NEUTRAL, TP $24.00, MARKET WEIGHT)
Nestle (NESN.VX, SFr478.25, OUTPERFORM, TP SFr560.00, MARKET WEIGHT)
Nitto Denko Corp (6988, ¥5,820, OUTPERFORM, TP ¥6,800, MARKET WEIGHT)
Northumbrian Water (NWG.L, 312.25 p, NEUTRAL, TP 321.00 p, UNDERWEIGHT)
NWS Holding Ltd (0659.HK, HK$20.05, UNDERPERFORM, TP HK$20.40)
Onesteel Limited (OST.AX, A$5.08, NEUTRAL, TP A$6.50, OVERWEIGHT)
Pennon Group (PNN.L, 582.00 p, OUTPERFORM, TP 644.00 p, UNDERWEIGHT)
Ricoh (7752, ¥2,640, OUTPERFORM, TP ¥3,000, MARKET WEIGHT)
RWE (RWEG.F, Eu78.45, NEUTRAL, TP Eu86.00, UNDERWEIGHT)
Sabesp (SBSP3, $140.00, NEUTRAL, TP $47.00, MARKET WEIGHT)
Shanghai Electric Group Co., Ltd. (2727.HK, HK$3.64, OUTPERFORM, TP HK$4.95)
Siemens (SIEGn.DE, Eu82.08, OUTPERFORM, TP Eu97.00, UNDERWEIGHT)
Suez (LYOE.PA, Eu40.00, OUTPERFORM, TP Eu43.00, UNDERWEIGHT)
Techem AG (TNHG.DE, Eu57.53, RESTRICTED)
Toray Industries (3402, ¥865, NEUTRAL, TP ¥860, MARKET WEIGHT)
Transfield Services Ltd (TSE.AX, A$12.08, OUTPERFORM, TP A$14.00)
United Group Limited (UGL.AX, A$13.50, NEUTRAL, TP A$15.75)
United Utilities (UU.L, 752.00 p, UNDERPERFORM, TP 683.00 p, UNDERWEIGHT)
Veolia Environnement (VIE.PA, Eu55.34, RESTRICTED)
YTL Power (YTLP.KL, RM2.39, UNDERPERFORM, TP RM1.92)

Companies not rated mentioned in the report:
3I Infrastructure Limited,Aalberts Industries Nv,Acciona,Aguas Andinas S.A,Aguas De Barcelona,Aj Lucas,Alfred Mcalpine Plc,Amec P.L.C.,American States Water Company,Aqua America Inc,Badger Meter,Balfour Beatty Plc, Beckman Coulter Inc,Beijing Capital,Bio-Rad Labs,Bio-Treat Technology,Carillion Plc,China Water Affairs,China Water Industry Group Ltd.,Ciba Specialty Chemicals, Coca-Cola, Coca-Cola Femsa S.,Coffey Intl,Costain Group Plc,Cott Corp Que,Crane Group, Doosan Heavy Industries And Construction, Ebara ,Engtex Group Berhad,Eurodrip Irrigation Systems ,Flowserve

Corp,Fugro Nv, Guangdong Investment,Harbin Power Equipment Co,Hazama,Heijmans Nv,Hitachi Zosen,Homeserve Plc,Hopewell Highway,Hyflux,Idex Corp,Impregilo Spa,Insituform Technolgs -Cl A,Inversiones Aguas,Itron Inc,Jain Irrigation ,Jaks Resources Berhad,Jiangxi Hongcheng Waterworks,Kemira Oyj,Kurimoto,Leighton Holdings,Lindsay Corp ,Longmead Group Plc (The),Lotte Chilsung Bev,Macmahon Holdings,Manila Water Company,Meidensha ,Millipore,Mitsui Engineering & Shipbuilding,Mueller Water Products,Nippon Chutetsukan,Northwest Pipe Co,Oman National Electric Company,Pall Corp,Pan Asian Water Solutions,Pba Holdings Berhad,Pentair,Pepsiamericas Inc,Pepsico Inc, Puncak Niaga Holdings,Qatar Electricity & Water,Qianjiang Water Resources,Rohm & Haas,Sasakura Engineering,Sasebo Heavy Industries,Saudi Industrial Services Company,Severn Trent Plc,Shanghai Industrial Holdings,Shanghai Municipal Raw Water,Shimadzu,Suido Kiko,Syngenta,Tetra Tech Inc,Tianjin Capital Environmental Protection,Tianjin Development Holdings Ltd,Torishima Pump Mfg.,Toyobo Co, Trimble Navigation ,Valhi Inc,Walter Diversified,Washtec Ag,Watts Water Technologies Inc,Whirlpool,Woong Jin Coway, Ws Atkins,Xinjiang Tianye Water Saving Systems ,Yli Holdings Berhad

Disclosure Appendix

Important Global Disclosures

The analysts identified in this report each certify, with respect to the companies or securities that the individual analyzes, that (1) the views expressed in this report accurately reflect his or her personal views about all of the subject companies and securities and (2) no part of his or her compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this report.
The analyst(s) responsible for preparing this research report received compensation that is based upon various factors including Credit Suisse's total revenues, a portion of which are generated by Credit Suisse's investment banking activities.

Analysts' stock ratings are defined as follows***:

Outperform: The stock's total return is expected to exceed the industry average* by at least 10-15% (or more, depending on perceived risk) over the next 12 months.
Neutral: The stock's total return is expected to be in line with the industry average* (range of ±10%) over the next 12 months.
Underperform:** The stock's total return is expected to underperform the industry average* by 10-15% or more over the next 12 months.

**The industry average refers to the average total return of the analyst's industry coverage universe (except with respect to Asia/Pacific, Latin America and Emerging Markets, where stock ratings are relative to the relevant country index, and Credit Suisse Small and Mid-Cap Advisor stocks, where stock ratings are relative to the regional Credit Suisse Small and Mid-Cap Advisor investment universe.*

***In an effort to achieve a more balanced distribution of stock ratings, the Firm has requested that analysts maintain at least 15% of their rated coverage universe as Underperform. This guideline is subject to change depending on several factors, including general market conditions.*

****For Australian and New Zealand stocks a 7.5% threshold replaces the 10% level in all three rating definitions, with a required equity return overlay applied.*

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Overweight: Industry expected to outperform the relevant broad market benchmark over the next 12 months.
Market Weight: Industry expected to perform in-line with the relevant broad market benchmark over the next 12 months.
Underweight: Industry expected to underperform the relevant broad market benchmark over the next 12 months.

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Restricted	4%	

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