INVESTING IN WATER:
TAPPING INTO A SOURCE OF RESILIENT GROWTH

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CONTENT

1. INTRODUCTION

Impax has been researching and investing in listed water and water-related companies since 1999, and running a dedicated water strategy since 2008. Over this period, the number of companies in the water value chain has increased significantly and, in the main, these companies have grown rapidly.

The water opportunity is surprisingly diverse and resilient with risk characteristics comparable to equity markets. It runs through the global economy; across many end markets, sectors and regions. Water also provides attractive opportunities through the full economic cycle encompassing both defensive and cyclical businesses.

This paper highlights some of the interesting new developments and technologies in the rapidly growing water industry. It discusses the drivers of this market, catalysts for further change and the impact of tightening global water and water-related regulations.

2. REINFORCING THE INVESTMENT HYPOTHESIS

Globally, clean water supply and demand imbalances persist and the long-term drivers discussed below support the superior growth of water companies. An ever-increasing gap between supply and demand, exacerbated by climate disruptions and extreme weather events, is set to require substantial capital investments in water treatment technologies and distribution infrastructure. This opens the door to investment opportunities in many new technologies and services to conserve, treat and distribute water.

THE GROWTH DRIVERS

i) Population and urbanisation

The global demand for water will continue to grow rapidly. While improving technologies are leading to more efficient water management, rising populations are putting the world's freshwater resources under considerable strain. According to the UN, the global population is expected to increase from around 7 billion to an estimated 9 billion by 2050. Over 6 billion of this is expected to be concentrated in urban areas[1]. Meanwhile, the global volume of fresh water remains static. Just 2.5% of the total 336 million cubic miles of water on earth is considered 'fresh' and only 0.025% is accessible surface water[2].

ii) Living standards

Increased urbanisation, coupled with greater affluence in developing countries are changing consumption patterns. Higher standards of living are associated with a rapidly rising demand for clothing and personal products, and a higher protein diet, which all increase the pressures on water supply.

Many items taken for granted by modern urban dwellers require significant amounts of water to produce. For example, a hamburger takes 460 gallons (2090 litres) of water to make; a cotton t-shirt requires 650 gallons (2950 litres); one egg takes 50 gallons (227 litres) and a cup of coffee 35 gallons (160 litres)[3]. Major water infrastructure development is needed to service this rapid growth.

iii) Infrastructure

There is an estimated $7.5 trillion to be spent globally over the next 15 years on water infrastructure[4]. In developed nations there has been significant underinvestment in repairs and upgrades, especially to urban infrastructure, much of which was built in the late 19th and early 20th centuries. The useful life of these systems is considered to be around 60 to 80 years.

Water leakage is a major problem in many cities, 15–25% of water is lost every day in the US from pipe leaks, while London loses 180 million gallons (818 litres) per day from ageing water infrastructure[5].

Authorities are working to solve this problem. For example, Thames Water has proposed a long-term objective to reduce leakage by approximately 50% by 2035, and to keep leakage levels in line with other developed world cities[6]. In the US, the Environmental Protection Agency conducted a study that identified an investment requirement of $298 billion for the upgrading and maintenance of the US waste water and storm water infrastructure network[7].

In Sao Paulo, the quoted water utility is investing BRL 4.3 billion ($1.3 billion) in its Water Loss Program between 2009 and 2019. Its strategy is to combat water loss through the replacement and repair of water pipes, preventative maintenance of water meters and non-visible leak research[8].

iv) Regulation

Governments and regulations play an important role in driving water supply and demand patterns and can dictate the quality of water, service, and water pricing. Water infrastructure, and particularly water treatment, have moved sharply up national and local governments' agendas in recent years as a result of the influence of regulations over these aspects of water governance. Investment opportunities require careful due diligence of regulations and how they may develop in future.

v) Changing weather patterns

The increased incidence of extreme weather events and climate change are exacerbating the strains on global fresh water supply. Rising temperatures fuelled by global warming are accelerating glacial ice melt. The depletion of this freshwater source could have catastrophic effects on ecosystems and freshwater supplies[9].

In the second half of this century, annual rainfall is forecast to be up to 40% lower than current levels. In the Northern hemisphere, summer rains are predicted

to become scarcer and summer temperatures to rise. The International Panel on Climate Change (IPCC) warns that summers could be 6°C hotter in Spain and Portugal by 2070[10].

Droughts are leading to significant increases in the use of groundwater, especially from agricultural sources. In many regions groundwater is being used at an alarmingly disproportionate rate to replenishment. According to the UN, by 2030 the world is projected to face a 40% global water deficit[11].

Solutions currently being worked on include investing in more water efficient infrastructure and technology, reclaiming more waste and storm water, and reducing water used for landscaping and irrigation.

Figure 1 below illustrates the global trends that are emerging as a result of these strong growth drivers, together with the responses they are generating from governments, regulators and the water industry.

FIGURE 1: GLOBAL TRENDS DRIVING LONG-TERM GROWTH IN WATER OPPORTUNITIES

Global trend		Response
	Demand for clean water outpaces supply	Water scarcity is a top risk identified by governments, corporations, and academia[1]
	Required investment in global infrastructure	$7.5 trillion projected spending globally over next 15 years in water infrastructure[2]
	Tightening global water regulation	$300 billion directed to address water pollution by China's Water 10 Plan[3]
	Adaptation to changing weather patterns	Increasing incidence of both drought and flooding cause investment requirements in water systems
	Innovation and evolving technology	New technology and upgrades to existing systems create further investment opportunities

1 World Economic Forum | Global Risks 2015;
2 McKinsey Global Institute | Bridging Global Infrastructure Gaps – June 2016;
3 China Water Risk | New Water Ten Plan to Safeguard China's Waters

3. DEBUNKING THE MYTHS AROUND INVESTING IN WATER

Water is critical across the global economy. It has a wide range of end markets, from consumer to industrial, capturing cyclical and defensive models across business lines. Investing in water is often assumed to be narrow, high risk and principally focused around utilities. This is not true. The case for water investment goes beyond utilities and stretches across a diverse range of businesses including: water infrastructure providers, water treatment companies, pump and pipe manufacturers, GPS and filtration systems, water reuse and desalination technology, leak detection and flow measurement software as well as businesses involved in water conservation. We review some of these opportunities in sections 6 and 7.

Hence, it is possible to hold a broad range of stocks with exposure to the wide range of end markets. In addition, water investment offers broad regional allocation prospects and spans diverse geographies.

While developed markets offer stable growth from utility, infrastructure and water technology companies, less developed markets with substantial urbanisation programmes provide exposure to higher-growth opportunities. For example, companies in this sector of the market currently quote demand for the pumps, pipes and valves required in water infrastructure construction to be growing steadily at 2% to 4% a year globally, but demand in developing markets is increasing by 4% to 7%[12].

Impax's water universe currently numbers approximately 260 water companies with a combined market capitalisation of $1 trilliion.

Our investment team seeks to identify companies with good earnings visibility and resilience that offer opportunities at different stages of the economic cycle.

FIGURE 2: A DIVERSE RANGE OF INVESTMENT OPPORTUNITIES

Water sector	Categories	Growth area
Water Infrastructure	• Pumps, pipes, valves • Demand reduction products, metering • Infrastructure projects • Reuse, conservation, irrigation	• Infrastructure upgrades • Smart applications • Drought resiliency
Water Treatment	• Chemical treatment • Filtration, membrane technology, desalination • Physical treatment • Monitoring, testing	• Tightening regulation • Pollution mitigation • Water reuse
Utilities	• Operators of water supply and treatment infrastructure • Providers of potable water and wastewater	• Energy efficiency • Infrastructure investment • Desalination

4. WATER USERS AND WATER STRESS

Generally speaking water users can be grouped into three categories: domestic water use; agricultural use; mining and industrial use. There are a number of drivers of water stress linked to the use of water in different contexts which we examine below:

i) Domestic water use

Domestic water use accounts for 10% of all water consumption. However, population growth, urban migration and rising living standards are increasing the pressures on domestic water availability. The world's population is growing by roughly 80 million people each year and changes in lifestyles and eating habits will require more water consumption per capita as this continues[14].

At the same time, there is huge disparity between developed and developing country water use and variations in water consumption per person. In Malaysia, every 100 people have access to approximately 1 million cubic metres of water (991 million litres), while in India this volume must supply 350 people, and in Israel, 4,000. Between 1987 and 2003 people living in Cambodia, where the majority do not have access to improved water supplies, used an average of 1.8 cubic metres of water (1800 litres) per capita. People in Costa Rica used one hundred times more. The residents of Australia on average each use another 300 cubic metres again per year (300,000 litres) - much of this to water their lawns and fill pools[15]. Geographical imbalances are adding to stresses on supply as developing countries look to catch up to their developed neighbours. However, this is also fuelling the emergence of more diverse solutions to the water consumption problem.

The solution providers

Water recycling, conservation, groundwater replenishment and desalination are key methods of addressing the strains on domestic water use. Individual countries have looked to tackle domestic water supply shortages in different ways. Singapore, which has a population of five million people demanding 1.7 million cubic metres of water (1.7 billion litres) every day, is likely to see its water demand double within 50 years. The country has limited natural water resources due to its small land area. In the late 1990s Singapore initiated a programme to become increasingly self-sufficient in its water supply, and began collecting treated wastewater flows that would otherwise have been discharged into the ocean. The programme currently meets 30% of Singapore's water demand and is projected to meet up to 55% by 2060.

Countries including Malaysia and China are currently exploring the viability of building water recycling plants to help increase domestic water supply. In the US, seawater desalination projects for 'potable' applications have been constructed in various parts of the country. Water re-use is projected to grow around 5% on an annualised basis for the next 10 years but significantly higher growth rates are expected in developing markets and Asia[16].

ii) Agriculture

Agriculture is by far the biggest consumer of water, accounting for 70% of total global consumption. Already approximately 10% of the world's food is produced with over-pumping groundwater[17]. This will inevitably increase as the demand for meat and other water-intensive agri-industries grows. Without improved efficiency measures, agricultural water consumption is expected to increase by 20% globally by 2050. Continued strains on water resources from population and economic growth mean that by 2050 approximately half of the global grain production will be at risk due to water scarcity[18]. There is a wide range of companies pursuing innovative technologies to combat water waste and improve agricultural efficiency that can help reduce the burden on water consumption.

The solution providers

Crop production is one of the most intensive consumers of water. For example, it can take more than 20,000 litres of water to produce 1kg of cotton[19]. Companies are developing alternatives to the water and chemical-intensive cotton industry. One major innovation is the use of man-made cellulose fibres such as viscose which is sourced from renewable raw wood which yields a higher volume of fabric than cotton.

• GPS Solution technology

New GPS technology is enabling farmers to produce higher yields with lower expenses and can create a more environmentally friendly farm. New GPS technology designed to improve precision agriculture and productivity is being used for the efficient manipulation and analysis of large amounts of geospatial data. GPS-based applications in precision farming work on farm planning, field mapping, soil sampling, tractor guidance, crop scouting and yield mapping, and offer a way of improving efficiency in agricultural water consumption.

• Aquaculture

Global seafood production is shifting towards aquaculture, particularly as continued overfishing puts pressure on already overexploited wild fish reserves. Historically, aquaculture has been a challenging sector, having to deal with pollution, chemical inputs, disease and parasites. However, companies and regulators are exploring new techniques to make aquaculture more sustainable. Salmon farming in some countries, including Norway, is benefiting from stringent regulation and improved husbandry practices and these areas of the industry are reducing water pollution.

iii) Mining, shale oil and gas extraction

The mining industry is the second largest industrial consumer of water after power generation, using between seven and nine billion cubic metres of water per year[20]. The use of water in mining has the potential to impact the quality of surrounding surface water and groundwater and produce toxic wastewater which could contaminate rivers or lakes.

The issue of hydraulic fracturing (fracking) and its potential impact on environmental pollution has also entered the mainstream consciousness in recent times. Water is a key component of the fracking process. It takes up to 9.6 million gallons of water (43 million litres) to frack a single well, an increase of 28 times from 15 years ago[21]. Better water management, combined with recycling, can save hundreds of thousands of dollars and reduce environmental damage.

Solution providers

Investments in technologies and projects to save and recycle water used in fracking have been developing rapidly in recent years. New conservation methods focus on using brackish water or effluent instead of fresh water as well as using pipelines and various treatment systems to more efficiently clean and reuse the vast quantities of water that flow through the operations. Companies are designing filtering systems that make water fresh enough to be reused for fracking or even irrigation, and are examining ways to help replace fresh water use and restore wetlands, rivers and streams.

5. THE CHANGING REGULATORY ENVIRONMENT

i) Water quality and pollution

Water quality – and safety - remains under constant threat of pollution from many sources. Water, air, and soil pollution are closely linked. Carbon emissions, largely from the burning of fossil fuels that are released into the atmosphere are transformed into acid rain, which then falls to the ground and contaminates the soil. The chemicals and pollution from the air will eventually filter through the soil and be released into the groundwater, which is then pumped for use by humans. The cycle of air, water, and soil pollution is increasingly exacerbated due to the human desire for more innovation, technology, and agricultural production. Below we review some of the major problems in the key geographies:

US

The two most important laws regulating water quality in the US are the Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA). These were created in the 1970s along with other pivotal environmental laws such as the Clean Air Act and the National Environmental Policy Act, which created the Environmental Protection Agency (EPA). The CWA regulates the discharge of pollutants into waterways and the SWPA ensures the quality of drinking water. The SWPA delegates authority to the EPA to ensure safe drinking water and it sets standards to control the level of a broad range of contaminants including lead and polychlorinated biphenyls (PCBs).

These laws have continued to evolve over the ensuing decades. For example, in 2015 the EPA released new water pollution rules that would bring more waterways and wetlands under federal protection although these rules are not yet being applied as they are being challenged in the courts.

There are some worrying examples of acute pollution incidents which highlight the pollution and regulatory issues across the region:

• LA sewage pipe break

In July 2016, a damaged sewage line built in 1929 spilled 2.4 million gallons (11 million litres) of untreated waste onto the streets of downtown Los Angeles and flowed through the Los Angeles River. It was the biggest spill since 1998 when more than 30 million gallons (136 million litres) of sewage spilled during the El Nino storms, and prompted closures of beaches in Los Angeles to prevent people being exposed to bacteria and viruses[22].

• Flint water crisis

Flint, Michigan has experienced a severe case of lead contamination in its water system, with thousands of children being exposed to high lead levels. Lead used to be commonly used in drinking water pipes until the dangers of exposure became clear, particularly its impact on a child's neuro development. Its use was banned in the 1980s but many older pipes remain in place particularly in the service lines that connect houses to the water mains. In 2014, Flint switched its water supply from the Detroit Water and Sewerage Department to the Flint River, in part to save on cost.

However, the new water supply was not treated properly before entering its antiquated distribution system resulting in corrosion of the lead pipes which led to elevated levels of lead in drinking water for several months. The crisis has highlighted the need, more immediately, for better testing procedures, but also a long-term goal of removing all lead service lines in the US which would take many years and require billions of dollars of new infrastructure spending[23].

While the Flint crisis attracted much media attention, the US has a long history of water contamination causing severe public health issues. For example, General Electric's pollution of the Hudson River with polychlorinated biphenyls (PCBs) between 1947-77 is a major historic contamination of the Hudson River Valley[24]. More recently levels of hazardous perfluorooctanioic acid were found in the water supply at Hoosick Falls[25]. These incidents highlight the extent of the issues and huge investment required.

China

China's 13th Five-Year Plan commitment
China's 13th Five-Year Plan (2016-2020) sets an ambitious target of reducing water consumption by 23% by 2020[26]. The plan aims to tackle the country's severe water pollution problem by reducing two of the main measures of pollution — chemical oxygen demand (COD) and ammonia nitrogen concentration — by 10% in the next five years. It also targets overall waterway health, with the aim of getting 80% of major waterways to achieve a tier-three standard by 2020, up from the current 76.7%. Wastewater treatment rates are also set to increase to 95% in urban areas and 85% in rural areas over the life of the plan. The plan comes in conjunction with the Chinese government announcement that it would spend 2 trillion yuan ($330 billion) to tackle water pollution[27].

A report released by the Chinese government in 2016 found that more than 80% of wells used by farms, factories and households are unfit for drinking or bathing due to contamination. About one-third of surface water has been rated unfit for human contact. China's government has started to address the environmental effects of its rapid economic growth policy. Beijing's annual per capita water availability is about 120 cubic metres (120,000), about one-fifth of the UN's cut-off line for absolute scarcity. The government has drawn up plans to develop a coastal desalination plant to provide one-third of the city's tap water by 2019 with the aim of spending 7 billion yuan (£667 billion)[28].

India

Eighty percent of sewage in India is untreated and flows directly into the nation's rivers, polluting the main sources of drinking water. Indian cities produce nearly 40,000 million litres of sewage every day and barely 20% of this is treated[29].

The Indian government has implemented an ambitious infrastructure development plan to help clean up water pollution. It is redirecting the capital saved on subsidies to plans including a $40 billion project to clean-up the Ganges river, under the Clean Ganga Mission[30].

Europe and UK

The European Union Water Framework Directive introduced a comprehensive river basin management planning system to help protect and improve the health of rivers, lakes, estuaries, coastal waters and groundwater. The relevant agencies are now reviewing the second cycle of these plans that will cover the period to 2021.

ii) Endocrine disruptors

Endocrine disrupting chemicals (EDCs) are chemicals that can disturb the endocrine system, which is vital in human metabolism, growth and development. EDCs are present in many household and industrial products and have also been found in trace amounts in drinking water, seawater, coastal sediments, inland sediments, and freshwater. In the last two decades there has been a focus of interest on whether EDCs pose a danger to human health[31].
Wastewater discharge affects surface water quality with EDCs, pharmaceuticals and personal care products (PPCPs) that are not completely removed during wastewater treatment. Fracking chemicals also contain EDCs.

The precise impact of EDCs in water is still unknown. However, this is an area that is an important focus for future research and has considerable implications for the supply of water in both developed and developing regions. There is increasing regulation around the use of EDCs, leading to further opportunities for testing and monitoring companies serving the water industry.

iii) Treating polluted water and water reuse

Communities around the world are increasingly exploring the possibilities of water reuse or the use of treated wastewater for non-potable and potable applications. Non-potable reuse is already widely practiced and ranges from using treated wastewater to water golf courses to various industrial applications.

According to the National Academy of Sciences, approximately 12 billion gallons (55 billion litres) of municipal wastewater is discharged directly into an ocean or estuary - if recycled, that translates to 6% of the estimated US water demand that could be met from water re-use. While health concerns regarding the use of recycled water for potable applications are understandable, the National Academy of Sciences does not find sufficient cause for concern when examining the evidence of chemical contaminants and pathogens relative to common existing water supplies.

Regulators have increasingly supported water reuse applications through detailed reuse/reclaimed water regulations and codes. For example, California's Division of Drinking Water adopted regulations for groundwater replenishment using recycled water that provided detailed guidance on testing, monitoring and reporting requirements for indirect potable water reuse, where treated water is first injected into groundwater. In conditions of water scarcity and higher commercial prices for water, industrial users can increase their use of recycled water for purely financial reasons. Reusing 150,000 gallons a day (approx. 680,000 litres), at a cost of $5 per 1,000 gallons (approx. 4,500 litres), can save $274,000 annually[32].

Water treatment technologies and processes, including nano-filtration, reverse osmosis, UV disinfection and chemical treatment, have proved to be highly effective for water reuse purposes, and are expected to continue to be deployed by water utilities operating in water stressed regions.

iv) An overview of regional regulatory regimes

Developing a deep understanding of regulation and working to anticipate regulatory responses forms a significant portion of an investor's due diligence when looking at water investment opportunities. Regulators

need to maintain a delicate balance that ensures the protection of consumer rights while attracting the investment necessary to source, treat, and transport water reliably. Global regulatory regimes play a critical supervisory role in establishing frameworks to govern tariffs and operating standards.

Most water regulators can be considered in one of four categories: (a) separate regulatory agency with a licensing regime; (b) regulation by contract; (c) regulation by contract with a separate regulator and (d) self-regulation.

In the United Kingdom and in some parts of the US, independent water regulators issue licenses and set tariffs for water utilities as separate regulatory agencies. Aside from their independence from the water utilities, these regulators are often granted a significant measure of independence from political entities with long-term appointments, separate administrative staff, tariff-financed funding and statutory authority. The US has a multitude of state-level regulators, some as standalone water regulatory authorities and some as part of multi-sector regulatory authorities, which leads to a notable divergence in regulatory attitudes and standards, and creates a wide spectrum of regulatory conditions to monitor.

The US regulatory system is also concerned with the regulation of private or investor owned water utility companies which control approximately 16% of the country's water utility systems. The vast majority of water systems remain in municipal hands and are largely self-regulating.

In countries such as France, Germany and the Philippines, water utilities can be operated by private service providers that contract with the public sector asset owner. Unlike the US, the majority of French water utilities are operated by private service providers that are usually contracted for 10 to 15 years. Finally, the fourth major category of economic regulatory models is a hybrid between the contractual and independent regulatory mechanisms. The most important distinction of this hybrid approach versus ordinary regulation by contract is that the contracted tariffs are subject to the supervision of an independent regulator.

v) Water pricing

Water tariffs are dictated by supply and demand triggers and are rising around the world. A selection of tariff trends across 25 major cities (75% in developed markets and 25% in emerging markets) reveals some interesting results particularly when overlaying the extent of water stress experienced in the specific cities. Reference figures, 3, 4 and 5.

Between 2011 and 2015:

- Both wastewater and water tariffs increased above the global inflation rate of 2.1% (CPI).
- Wastewater tariffs increased at a compound annual growth rate (CAGR) of 4.8% against drinking water which rose at 3.3% - the latter's slower rate of increase due to greater political scrutiny on drinking water prices.
- Both wastewater and water pricing – measured as USD per cubic meter – are significantly higher in North America and Europe relative to the rest of the world.
- North American tariffs have seen a compounded average increase of 5.5% against Europe's 0.6% water and 2.9% waste water trends which reflect a combination of a healthier demographic trend in North America and a regulatory environment that may be more supportive of much needed capital deployment.
- Water prices in cities subject to a high risk of water stress are rising at twice the rate of prices in low to medium and medium to high risk cities[33].

FIGURE 3: REGIONAL VIEW OF WATER AND WASTEWATER PRICING

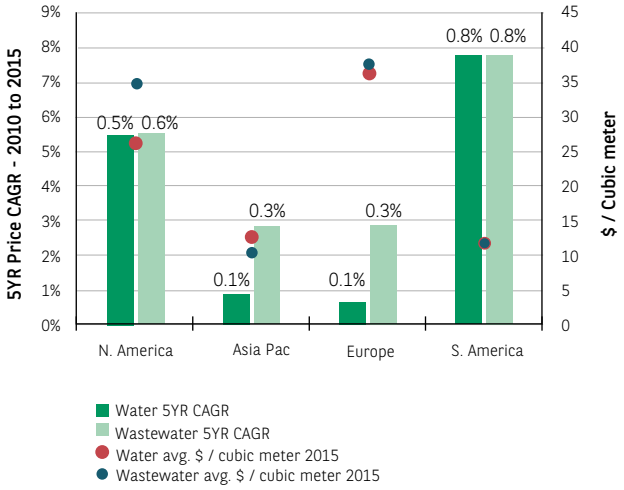


FIGURE 4: 5YT WATER PRICE CAGR – SEGMENTED BY WATER STRESS STATUS

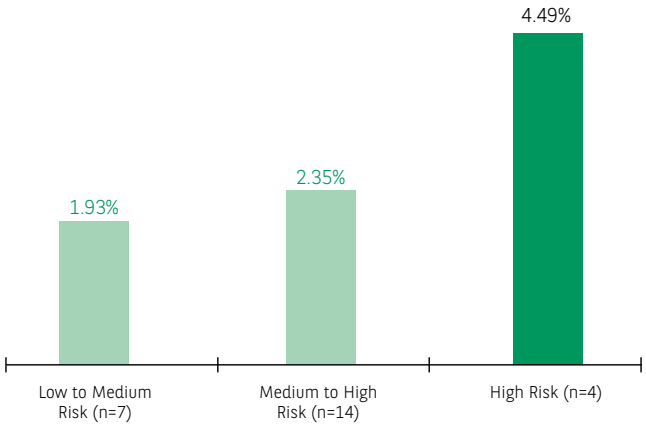
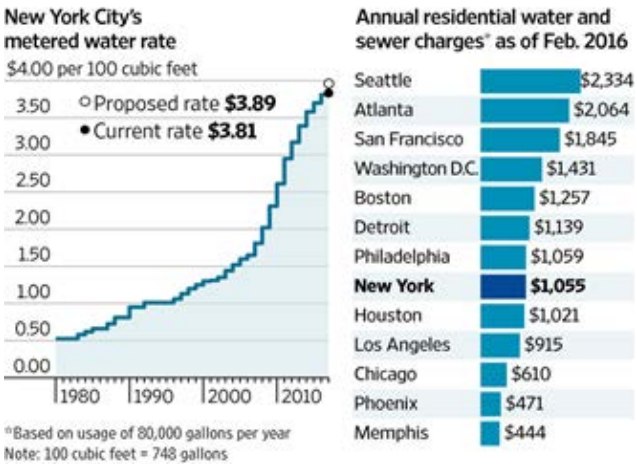


FIGURE 5: RISING TIDE: MAYOR BILL DE BLASIO'S ADMINISTRATION PROPOSED INCREASING THE PRICE OF WATER IN NEW YORK CITY BY 2.1%



Source: New York City Department of Environmental Protection. The Wall Street Journal

vi) The need for a supportive regulatory environment

It is important that investors have visibility and confidence in the future of water regulation. Regulators need to be able to authorise sufficiently attractive rates of return to attract private sector capital to finance new water infrastructure projects, while maintaining equitable access to a basic human need. Regulation in the water sector has generally been successful and has delivered value for money and attracted investment for several decades, although water pricing can be politically challenging in many countries.

A balanced approach from the regulators becomes even more important in times of crisis. For water utilities, growth is based on ongoing high levels of investment to meet demand and improve resource efficiency. Regulation generally supports this, typically leading to the generation of higher receipts and supports earnings growth. Both California and the Sao Paolo region in Brazil have suffered severe droughts in recent years. During these droughts, share prices for many of the water utilities serving these regions initially underperformed broader market indices as investors were disappointed by drought-related surprises to both revenues and costs. Much of the initial share price underperformance for water utilities in drought affected regions has subsequently been recovered and is due, in no small part, to supportive regulatory action with water utilities permitted to recover drought related expenditures, primarily through raising prices for users.

Investors need to have the confidence to look through periods of underperformance and have this confidence maintained by regulatory support for the utilities.

6. INVESTING IN WATER SOLUTIONS PROVIDERS: The value chain

i) Water infrastructure

Pumps, pipes and valves manufacturers: These are relatively commoditised products, with some early cyclical exposures to the construction and the general industrial capital expenditure cycles. As outlined in section 3, (see Figure 2, page 4) growth of 2-4% on a global basis appears to be steady and developing market growth is expected to be significantly higher. Although relatively commoditised, new technology is producing premium products with significantly increased energy efficiency.

Demand reduction products and metering infrastructure is predominantly a developed market technology, with the potential for double digit market growth. Construction market exposure implies a degree of early cyclicality.

Global growth rates for infrastructure projects are generally accepted to be considerably higher than the rate of growth of other global infrastructure spending. However, emerging market growth expectations are often quoted in the 12-18% range. In particular, attractive Asian opportunities exist given government commitments to invest heavily in water infrastructure.

Furthermore, under President Trump we expect to see a significantly increased water infrastructure spend in the US. He has cited poor water quality as a major issue and a priority to be addressed. Accordingly, we expect to see higher spending on related components, services and other infrastructure hardware that comply with local environmental standards.

ii) Water treatment and efficiency

Solutions to using water more efficiently span industrial sectors as diverse as cement, semi-conductors, biotechnology and food processing.

Water treatment companies typically supply products such as membranes and filters to these projects, often on a repeat purchase model so the buyer is tied to buying replacements from the equipment supplier. The equipment has predictable replacement cycles and provides manufacturers with relatively stable earnings profiles. This is also the case for suppliers of mission-critical water chemicals which, while low value from a monetary perspective, could not be more crucial from a process and safety standpoint.

Chemicals used for the treatment of municipal/utility water sources (water and waste water) as well as industrial water and waste water have a growth profile of GDP + 1-2%. Water chemicals tend to be an operating expenditure item and are often characterised as having relatively low monetary value, but high importance in the treatment process. Rather than relying on new capital investment for growth, water chemical companies tend to have clear earnings visibility due to the importance of their product in existing processes. This area exhibits a degree of cyclicality but is generally defensive.

Filtration, membrane technology, and desalination businesses are less cyclical than water infrastructure companies, but nevertheless are exposed to both industrial and utility applications. Filters wear out and need replacing hence all 'membrane' or filtration-based businesses offer investors above-average earnings visibility due to the high proportion of recurring 'consumables' revenues generated.

Global growth rates for filtration of around 5% are widely expected[34], whereas domestic water treatment in China is expected to grow at more than 30% by 2020[35]. Companies in this segment have high value-added products which command higher margins than those of other products in the value chain and historically this has been a focus for substantial corporate activity.

Technologies with highly specialised physical water treatment applications, such as ozone and ultraviolet water treatment, are used in a number of utility and industrial applications. The emerging ballast water treatment sector is another area with interesting investment potential. Companies in this field tend to have high margins, specialised technologies and strong pricing power. The global water treatment equipment market is predicted to grow at approximately 2-4%, while 13.5% annual growth and 15-20% are considered achievable in China and India respectively. There are relatively few market participants and historically this has been an area of significant merger and acquisition activity.

Companies involved in the manufacture of machinery for water sample testing, as well as the laboratories involved in sample analysis and pollution monitoring, focus on fulfilling increasingly strict global water purity regulations and are active in both the industrial

and utility fields. The sector has forecast global growth rates of 5-7%, with China and India offering growth rates of 11% and 15-20% respectively.

iii) Water utilities

Regional regulatory regimes are key to understanding global water utilities. The UK, for example, runs on 5 year investment cycles, with inflation passed on to the consumer and contributing to the regulatory asset value of the company. The US system sees utilities invest and subsequently request a region-specific cost of capital from the regulator to enable competitive returns. China operates on a cost-plus model, set and approved by local governments to allow a return on equity of 8-10%. Tariffs are expected to rise in the coming years in order to facilitate the substantial growth expected in the country.

Utilities are defensive in nature, tend to perform well during periods of market volatility and generally offer higher than average dividend yields. As well as several pure-play companies in the water sector, many multi-industry and electrical equipment companies also have a presence which they can leverage against the various end markets, geographies and technologies. Companies whose activities significantly, though not entirely, relate to the water sector make up an important component of the water industry and are often among the leading providers of a key product or technology.

7. EVOLVING TECHNOLOGIES

There are a number of innovative technologies being developed to improve the quality of water and make water delivery and use more efficient. We view the investment opportunity which focuses on suppliers of specialised equipment and captures the growth potential of select specialist companies which sell mission critical equipment and supplies. It is important to understand the position of each company in its respective market cycle, and make allocations to those companies at the right time which has the potential to lead to compelling and differentiated investment returns. Current areas of water technology innovation include leak detection, precision irrigation, water reuse, new water treatments, automated and advanced metering and flow management and desalination. With the providers of more sophisticated treatment equipment such as UV disinfection or water quality analytics businesses, the value-added nature of such equipment, mandated oversight in terms of water quality and a relatively narrow competitive landscape can lead to above average pricing power.

Below we describe some of the most interesting investable new developments in water treatment.

i) Desalination – reverse osmosis

With an approximate global capacity of 80 million cubic meters per day (80 billion litres), about 1% of fresh water consumed globally is derived from desalination[36].

The energy consumption required has been significantly reduced in the past two decades, partly due to the widespread uptake of reverse osmosis (RO) technology, which is now a commercially viable process. This process removes the salt by filtration, utilising membrane technology as opposed to traditional thermal methods, essentially for capturing salt-free steam after heating.

The International Desalination Association (IDA) has specifically challenged the desalination industry to achieve a further reduction of 20% in energy requirements for seawater desalination by 2025[37] – a combination of the integration of renewable energy, the use of lower pressure solutions and potential advances in membrane technologies make this target seem achievable.

Desalination offers attractive investment opportunities to participate in the growth of the industry. Incumbent technology providers to the industry include membrane manufacturers and demonstration stage technologies which are under development at institutions such as Stanford and MIT and include the use of porous electrodes or perforated graphene membranes with optimised permeability. These aim to achieve similar desalination results with significant energy savings. A study by MIT scientists revealed further improved techniques which can desalinate water two to three times faster than reverse osmosis[38].

The desalination market is expected to show robust growth, especially in coastal regions where energy is relatively cheap. Global market growth is currently around 6%[39].

ii) Ground water replenishment

Despite its significance, groundwater has also received little attention in climate change impact assessment, compared to surface water resources. Regulatory support has been increasing, leading to growth in real-world applications of potable re-use projects. Some recent examples include:

The GWRS – the Orange County Groundwater Replenishment System – has been in place since 2008 and is the world's largest purification system for potable reuse. It is capable of producing up to 70 million gallons (approx. 320 million litres) of potable water per day and can meet the needs of almost 600,000 residents while exceeding all state and federal drinking water standards. GWRS uses multiple processes to accomplish this. GWRS has shown that the cost of reuse is far lower than that of other water sourcing systems. Its success is driving domestic and international demand for similar water reuse systems, rewarding investors with steady, long-term returns.

After turning to direct water re-use under drought conditions in 2014, the City of Wichita Falls in Texas is planning the development of a more permanent indirect potable re-use project that will supply up to 10-12 million gallons (45-55 million litres) per day[40].

iii) Smart irrigation

GPS technology solutions enhance the efficiency of farming, so farmers can quickly and easily improve their everyday planning and decision making. This segment produces GPS-enabled technologies that have applications in precision agriculture and enable improved agricultural productivity. Precision irrigation solutions help monitor and control the irrigation systems and help apply the right amount of water.

iv) Water metering

Metering is an attractive area for investment because it is playing an increasing role in facilitating the more efficient use of water. Traditional meters do this simply by linking use with cost. Advanced metering solutions, such as smart meters, extend this concept by providing more extensive data in real-time rather than once every few months.

The advanced metering market is growing at about twice the rate of traditional metering, driven by customer demand and increasing regulation. This growth has been a key factor in recent merger and acquisition activity in parts of the water industry that have had relatively stable market structures for the best part of a century. Advanced metering was an early example of the Internet of Things and will continue to play an important role in solving the world's water scarcity problem.

v) Water pumps

Smart pump technology is developing rapidly, for example with the launch of wastewater pumping systems with integrated intelligence. Such systems can adapt performance in real time, reducing the need for inventory and provide feedback to pumping station operators, increasing efficiency and reliability. Such systems are simpler and cheaper to run than traditional technology and more energy efficient.

FIGURE 6: EVOLVING LANDSCAPE OF SOLUTIONS

Source : Impax

8. OUTLOOK

Investing in water has yielded consistent risk-adjusted returns for investors as highlighted by the FTSE EO Water Technology Index versus the MSCI World Index. Water can be an underappreciated investment with the focus on a narrow range of stocks. We show the range of water investments is both deep and diverse and offers significant potential.

Impax has an experienced team of specialists with a deep understanding of the technologies and companies in the water universe, having gained specialised knowledge over many years. Our dedicated investment team follows policy and regulatory developments around the world and apply this knowledge to the investment process.

Although water has provided an effective defensive position over the past few years, its value is expected to rise in tandem with global demand. We expect strong growth to continue over the coming years. Proposed spending on water-related infrastructure development is huge in both developed and developing countries. This should give rise to direct investment opportunities and generate business for listed, investable companies. Furthermore, the broadening gap between water supply and demand will continue to drive the need for more effective solutions around the world and thus substantial capital investment. Water offers attractive growth opportunities in widely diversified end markets. It is a resilient area for investment and we believe looks set to deliver outperformance for decades to come.

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