

Investment opportunities in a water-constrained world:

Groundwater replenishment and reverse osmosis desalination

For Professional Investors – September 2015

Executive summary

**Orange County
Groundwater
Replenishment System
(GWRS)**

**Carlsbad Reverse Osmosis
Desalination Plant**

Investment opportunities

1. Executive summary

David Richardson

Managing Director – Global Head of Marketing & Client Service



David joined Impax in August 2012 from Global Energy Investors where he was a Managing Partner. He previously co-founded and served for 22 years as Managing Director of Business Development at Dwight Asset Management Company (later acquired by Goldman Sachs Asset Management). Prior to Dwight, David headed Project Development at Mark Technologies Corporation and successfully developed a number of large scale wind energy projects. David received his BS in Mechanical Engineering from the University of California and is licensed as a Civil Engineer, and is a Chartered Financial Analyst.

Investment opportunities in a water-constrained world

EXECUTIVE SUMMARY

California is in its fourth year of a record-breaking drought that is wreaking havoc on California residents and impacting the rest of the country. With no end in sight, in January Governor Brown declared a State of Emergency and imposed strict water conservation measures on residents, businesses, municipalities, and farms with a mandate to cities and towns to reduce their water usage by 25%.

Farmers are by far the largest consumers of water, and accordingly, agricultural use of water-saving technology such as drip irrigation and water reuse is clearly on the rise. But in addition, residents, businesses, and municipalities are also learning to embrace water-saving techniques. Residents and businesses were slow to respond to state appeals for voluntary water conservation during the first three years of the drought. They have been much quicker to respond to the recent imposition of \$500/day excess water usage fines.

The purpose of this paper is to highlight municipal solutions to water conservation through the lens of two cutting edge water projects in California and to suggest ideas for global investment opportunities arising from these and similar projects. The first is the groundwater replenishment system being utilized in Orange County, California. The second is a reverse osmosis desalination plant in Carlsbad, California.

ORANGE COUNTY GROUNDWATER REPLENISHMENT SYSTEM (GWRS)

The Orange County Water District (OCWD) is responsible for protecting a 360 square mile basin located near the lower Santa Ana River which is home to 2.4 million people. In 2008, OCWD began operating the 20 acre Orange County Groundwater Replenishment System (GWRS), developed with the Orange County Sanitation Department (OCSD). The GWRS is the world's largest purification system for potable reuse, capable of producing up to 70 million gallons (265,000 cubic meters) of potable water every day. This is sufficient to meet the needs of almost 600,000 residents of the Santa Ana River Basin with treated water that exceeds all state and federal drinking water standards.

As far back as the early 2000's there were purely financial reasons to find a solution to the need for more fresh water in Orange County. The two departments (Water and Sanitation) together faced the prospect of spending hundreds of millions of dollars on remedial measures to enhance access to fresh water, install seawater intrusion fixes and build additional ocean discharge systems. In addition, the existing infrastructure was creating severe environmental disruption from discharging millions of gallons of highly-treated wastewater into the Pacific Ocean. To address these financial and environmental issues, the two agencies developed a long-range plan for groundwater replenishment, GWRS. Orange County's Sanitation Department agreed to supply the Water District with treated wastewater at no charge, and the Water District agreed to fund and manage GWRS operations. The result was a master feat of civil engineering and water reuse that now supplies household water for well over half a million residents.

Today, GWRS captures and purifies 70 million gallons of waste water through multiple processes involving microfiltration, reverse osmosis, disinfection with ultraviolet light and chemical treatment with hydrogen peroxide.

These purification methods are performed by technology and parts from a number of well-known water treatment technology companies, and not surprisingly, order books from around the world are growing.

The purified water is used in two ways:

- 1) As a seawater intrusion barrier in Huntington Beach and Fountain Valley – where 113,000 cubic meters of the treated water is injected each year along the coast to form a barrier to prevent the incursion of seawater into the aquifer,
- 2) Pumped to Anaheim where the water sits in large basins and slowly recharges the aquifer for reuse by the district.

Investment opportunities in a water-constrained world

GWRS



Microfiltration bay at the Orange County Groundwater Replenishment System



Pipes lead to the UV disinfection units



Reverse osmosis membrane banks



Pump and pipe infrastructure

GWRS has shown that the cost of reuse is far lower than that of other water sourcing systems. On a subsidy-free basis, the cost of water from reuse at GWRS is 12% to 17% lower than that of other water systems¹.

In drought-stricken California, the value of innovative water solutions such as that demonstrated by GWRS cannot be overstated. On the back of the \$7.5 billion municipal water bond approved in California in November of 2014, other municipalities are formulating long-term water plans and weighing options to supply residents with fresh water for the long term. Existing infrastructure is dated and inefficient, and in some areas rainfall amounts are drastically lower with no outlook for change. For now the current California water conservation measures seem to be helping, making replenishment efforts slightly less urgent in some areas. However, the case for water infrastructure investment in most of the southern states in the U.S., and equally, other parts of the world such as China and India is clear. The success of GWRS is driving domestic and international demand for similar water re-use systems, rewarding investors with steady, long term returns.

CARLSBAD REVERSE OSMOSIS DESALINATION PLANT

Poseidon Water, a water project development specialist headquartered in Boston, Massachusetts, is currently building the Western Hemisphere's largest seawater reverse osmosis ('RO') desalination plant in Carlsbad, California. Set to begin operations this November, the plant will supply 7% of San Diego's drinking water (serving 300,000 households) at a rate of 50 million gallons per day, yet will add only \$3 to \$5 per month to the average household water bill². The plant will operate under the control of the San Diego County Water Authority (SDCWA). The plant is expected to "provide San Diego County with a locally-controlled, drought-proof supply of high-quality water that meets or exceeds all state and federal drinking water standards"³. The plant includes a seawater intake system, a concentrate return pipeline, and a clean-water pipeline and pump station. The plant brings in 100 million gallons of seawater per day (mgd) and converts half of that to high quality drinking water.

The remainder has an elevated salt content and is mixed with more seawater to dilute it to acceptable levels. It can then be returned to the ocean without adversely impacting the area's marine life and recreational activities.

Reverse osmosis uses high pressure pumps to force seawater through a membrane which has holes large enough to allow water molecules to pass through, but too small to allow the larger salt molecules through. Historically, the vast amount of energy required for this process made desalination prohibitively expensive.

Investment opportunities in a water-constrained world

Today, due to improved efficiency, the energy needed has declined by about half of that required just 20 years ago. To be sure, seawater desalination is still expensive; it generally costs twice as much as conventional water treatment solutions. However, at a cost that remains less than a penny a gallon, desalination is becoming an attractive option for drought-stricken communities.

Today, 15,000 desalination plants operate worldwide, although most of these treat brackish groundwater rather than seawater due to the higher cost of treating seawater. Due to their higher cost, seawater desalination projects are unlikely to proliferate at the rate of other water treatment systems; however, as the need for fresh water continues to increase worldwide, so will the development of seawater desalination plants. As with the groundwater treatment system described above, a number of well-known companies supply the parts and technologies that enable plant operations, including membranes, pumps, pressure vessels, and cartridges.

Investment opportunities in a water-constrained world

POSEIDON



Pipes and pumps move filtered seawater to the clean well



RO desalination membrane banks



Micro filtration, a pre-treatment ahead of the RO membranes



Energy efficiency technology

INVESTMENT OPPORTUNITIES

The proliferation of projects such as the two outlined above provide multiple investment opportunities for investors seeking to participate in the long term growth around environmental solutions to water demand and supply shortages.

The groundwater replenishment system is a highly cost-effective system; however, as a sub-set of water recycling, it has been slower to take off due to the association with negative public campaigns such as the infamous “toilet to tap” campaign⁴. As the need for access to potable water has continued to grow however, public perception has begun to change, and at least one study has found that “if they trust the utility, the majority of people understand that recycling water is unavoidable”⁵.

Abroad, Singapore, Australia, Namibia and India are already recycling water for potable use, while in the U.S. California, Virginia, and New Mexico are doing so. Malaysia and China are among the countries currently exploring the viability of building water recycling plants.

In the U.S. seawater desalination projects for ‘potable’ applications have been constructed in various parts of the country, with Poseidon Water also owning an operating facility in Tampa Bay, Florida. Other facilities are being ‘de-mothballed’ for example in Santa Barbara and Redondo Beach, California, and there are plans for additional plants in Huntington Beach, (Poseidon) and Monterey, California (American Waterworks). Texas, which has experienced a lengthy drought along with high population growth, is looking closely at desalination options.

Outside of the U.S., the Middle East has a number of large seawater desalination plants, and Israel will soon get half of its water from desalination. Europe, Asia, and Australia also have desalination plants, and South American countries have a number in development. Estimates call for a doubling of desalination plants across the world by 2050⁶.

Viewing the two projects discussed above as a microcosm of emerging global water investment opportunities, the providers of services and components to both direct and indirect potable water reuse projects offer a range of more economically sensitive as well as more defensive investment opportunities. Perhaps the easiest way to take advantage of the likely growth in desalination and water reuse is through equity exposure to the publicly held companies that manufacture products and provide services to these systems. Customers are both private and public entities, and the scale of water purification projects means that thousands of components must be purchased and installed, and perhaps most importantly, replaced at varying intervals.

Water projects use large amounts of water infrastructure equipment including pumps, pipes, valves and measuring equipment. These businesses tend to be more economically sensitive as firmer overall economic activity increases construction spending and higher tax receipts enable more funding for municipal water infrastructure.

INVESTMENT OPPORTUNITIES (CONTINUED)

Water treatment companies typically supply razor/razorblade products such as membranes and filtration media to these projects. The equipment has predictable replacement cycles and provide 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. Accordingly, pricing power, earnings stability and cash generation are typically robust. 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.

At Impax, we view the investment opportunity through this “picks and shovels for miners” approach which focuses on suppliers of specialized equipment and captures the growth potential of select specialist companies which sell mission critical equipment and supplies to these plants. We recognize that understanding the position of each company in its respective market cycle, and making allocations to those companies at the right time has the potential to lead to compelling and differentiated investment returns.

¹Without subsidies, the cost to run GWRS is about \$750/\$800 per acre-foot compared to \$900 per acre-foot for other systems. With the subsidies currently in place, the cost is \$513 per acre-foot, or \$34M per year.

²As capacity increases, the household bill will also increase; however, the increases are expected to be minimal.

³See The Carlsbad Desalination Project, www.carlsbaddesal.com.

⁴This campaign was directed at Direct Potable Reuse (DPR) systems, while the GWRS describes itself as an Indirect Potable Reuse (IPR) system.

⁵Dr. Shane Snyder, Professor of Environmental Engineering, University of Arizona, quoted in “From Wastewater to Drinking Water” by Renee Cho, April 4, 2011 at www.blogs.ei.columbia.edu.

⁶See “Water challenges make UK desalination plants more likely”, Institute of Chemical Engineers, www.icheme.org, September 11, 2013.

Investment opportunities in a water-constrained world

CONTACT INFORMATION

David Richardson
Managing Director, Global Head
of Marketing & Client Service

New York: 646 543 8182
d.richardson@impaxam.com

Molly Ono
Director, Business Development
& Client Service

Portland: 503 998 1113
m.ono@impaxam.com

Nicola Fritz
Client Service & Business
Development

New York: 646 696 1583
n.fritz@impaxam.com

Michael Disabato
Client Service & Business
Development

Portland: 503 855 9900
m.disabato@impaxam.com

www.impaxam.com

Disclaimer

This document has been prepared by Impax Asset Management Limited ("Impax") authorized and regulated by the Financial Conduct Authority). Impax is a registered investment advisor with the SEC. Registration does not imply a certain level of skill or training. The information and any opinions contained in this document have been compiled in good faith, but no representation or warranty, express or implied, is made as to their accuracy, completeness or correctness. This document does not constitute an offer to sell, purchase, subscribe for or otherwise invest in units or shares of any fund managed by Impax. It may not be relied upon as constituting any form of investment advice and prospective investors are advised to ensure that they obtain appropriate independent professional advice before making any investment in any such Fund. Any offering is made only pursuant to the relevant offering document and the relevant subscription application, all of which must be read in their entirety. Prospective investors should review the offering memorandum, including the risk factors in the offering memorandum, before making a decision to invest. Past performance of a fund or strategy is no guarantee as to its performance in the future. This document is not an advertisement and is not intended for public use or distribution.

Under no circumstances should any information contained in this document be regarded as an offer or solicitation to deal in investments in any jurisdiction including, but not limited to, the United States of America. In particular, the shares of Impax Environmental Markets (Ireland) Fund, Impax Environmental Markets plc, Impax Food and Agriculture Fund, Impax Asian Environmental Markets (Ireland) Fund, Impax Asian Environmental Markets plc and Impax Asset Management Group plc are not registered under United States securities laws and, subject to certain limited exceptions, may not be offered, sold transferred or delivered in the United States or to US persons.

Impax is wholly owned subsidiary of Impax Asset Management Group plc, whose shares are listed on the Alternative Investment Market of the London Stock Exchange. Authorised and regulated by the Financial Conduct Authority. Registered in England & Wales, number 03583839. Registered Investment Advisor with the SEC.