WATER DESALINATION –
DEEP ENOUGH TO DIVE IN?

In our Initiating Coverage report on the Water Sector in November 2011, we highlighted three promising areas: the Water-Waste-Energy Nexus, Network Management and Desalination. In this report, we examine the current state of Desalination, how it has evolved from a single-purpose utility addressing water scarcity to become an integral part of any water sourcing strategy. We also examine the myths and misperceptions surrounding Desalination and how they have become outdated. The Desalination sector currently delivers 66 million cubic meters of water each day and this is expected to double in the next four years. Central to our study is how Desalination has become a global industry that is now mainstream and self-sustaining, spawning new opportunities.

"Desal is not Desal is not Desal"

The Water industry does not normally benefit from disruptive technological events. Desalination is an exception. Advances in membrane technology and energy recovery devices over the last ten years have brought three fundamental changes: 1) an 80% drop in the energy requirements, 2) the discovery that membrane technology could be used even more efficiently for most types of water treatment and even more cheaply, and 3) that this technology could also be used for small-scale applications. Hence "Desal is not Desal is not Desal" according to Earl Jones, Partner at Liberation Capital. It is a much bigger market, and it is all about membranes.

Investment Themes

"It is hard for some VCs to make the numbers work because the market for a specific technology can be quite limited…Desalination is liked because the application is wide and scalable" explains Jeff Green, CEO of NanoH2O. Our selection of Desalination investment themes focus on both new technologies and new business models.

New and potentially disruptive technologies in membranes, de-ionisation, and forward osmosis hold promise but will need time to scale. Equally, opportunities exist with emerging system integrators, new service business models and a growing replacement market offer attractive opportunities with more predictable (positive) cash flows, manageable risk and potential for technology roll-up.

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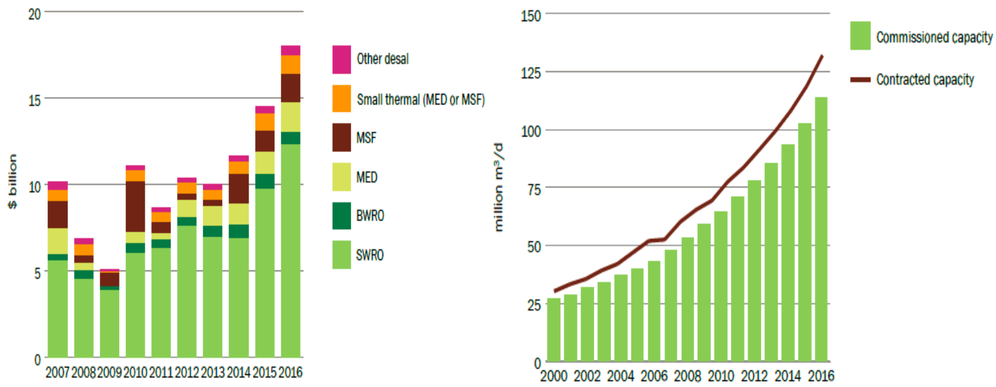
INTRODUCING THE DESALINATION MARKET

According to Global Water Intelligence, the global Desalination capacity is projected to almost double in the next four years from 66 million m^3/day in 2009 to 120 million m^3/day in 2016. This is despite a severe 50% drop in new plant orders in 2008.

EXHIBIT 1: GROWTH IN DESALINATION CAPACITY TO 2016



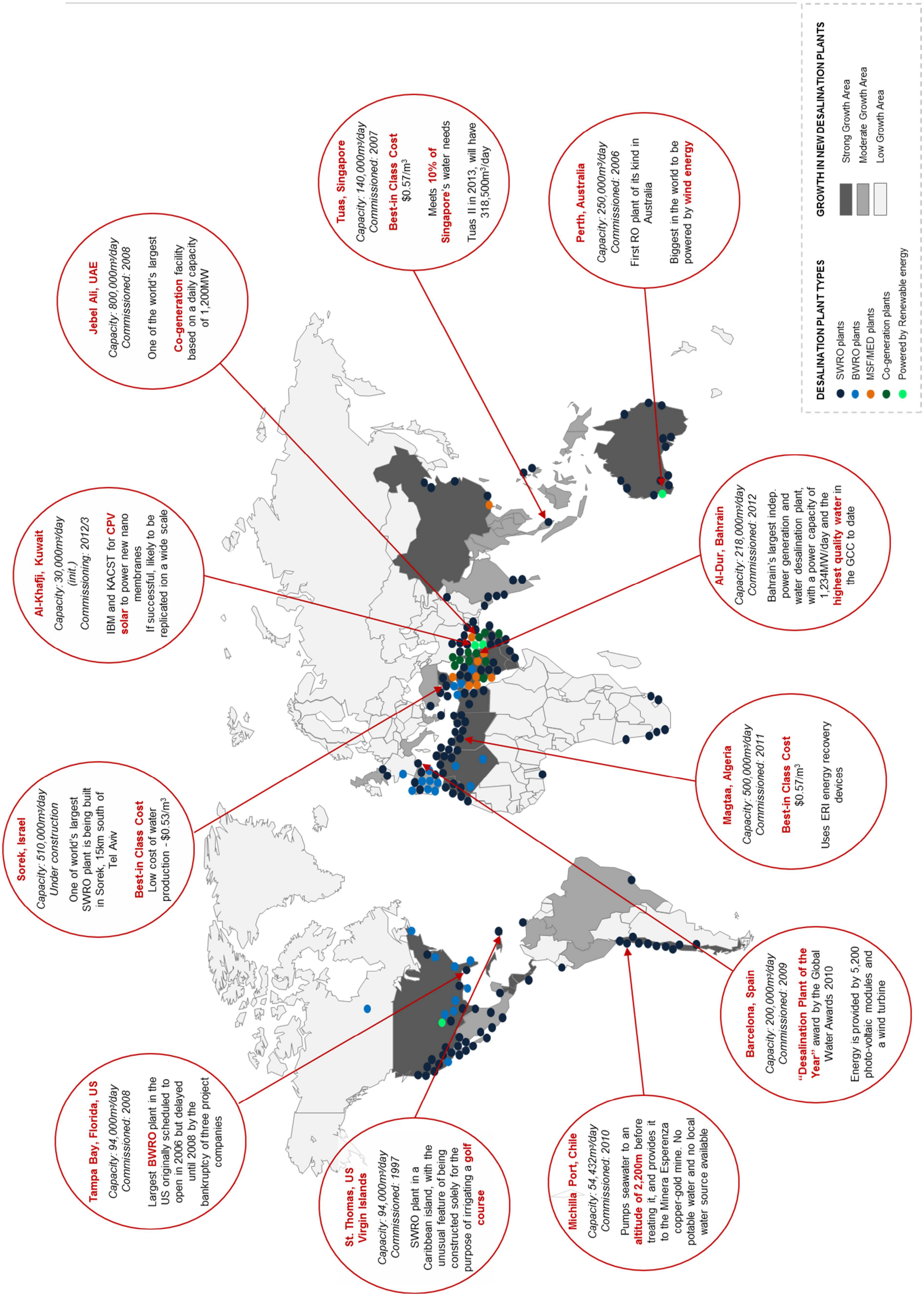
Source: Global Water Intelligence

Although the 2008-2010 financial crisis put a halt to many plants, the demand for water increased during that period. Tom Rooney, CEO of Nasdaq-listed California-based Energy Recovery, Inc. (“ERI”), notes that “in 2011 we saw pent up demand that had built up over the last three years and now we are seeing a huge increase in our sales pipeline and new orders”.

Although overall Desalination Capex is increasing, average deal sizes have been getting smaller: as Nityen Lal, Partner at ICOS Capital points out, “one of the most important trends in the Desalination market is large growth in small scale (10,000m^3/day) plants. The reason for this is that larger deals require political consensus, strong financial markets and long-term stability, all three of which are in short supply at the moment - even in growth markets such as China and India.”

Most of the new capacity is being installed in the Middle East, India and China, where the need for Desalination is greatest. Spain, Turkey, the US, Australia and even Chile are also seeing healthy demand. Although the Middle East has historically favored multi-stage flash distillation (“MSF”), the increasing cost-effectiveness of reverse osmosis (“RO”) makes it a viable option even there. Very large facilities will use multiple-effect distillation (“MED”).

EXHIBIT 2: OVER 15,000+ DESALINATION PLANTS IN 150 COUNTRIES SERVING 300 MILLION PEOPLE



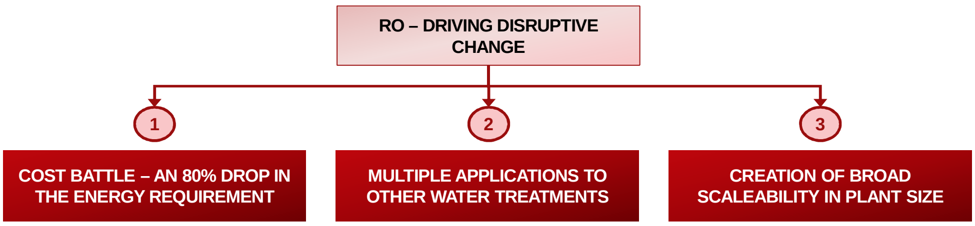
Source: Global Water Intelligence, Fraser, Newsrun, GP Bullhound

CHANGING THE PERCEPTION OF DESALINATION

The conventional *Myths and Misperceptions* (IDA[1], 2011) about Desalination are that it is expensive, energy inefficient, and environmentally unfriendly, and that conservation will fill the water supply gap. These views are outdated and are becoming increasingly irrelevant with each passing year. These misperceptions recall the early desalination plants that were set up in the Arabian Gulf in the 1960-70s (the first plant was commissioned in 1947 in Kuwait). The only technology of that period was a thermal distillation process now known as MSF. Then, it was the only alternative source of water. These huge facilities in the Middle East were single-purpose seawater plants that provided drinking water to the coast and also to cities such as Riyadh 500km away.

Over the last ten years, there have been significant "leaps" in technology for membranes, energy recovery devices and plant design for RO. These leaps were "disruptive" and have put in motion three fundamental changes that are allowing Desalination to become a high-growth and sizeable global industry.

EXHIBIT 3: THREE MAIN CHANGES TO THE PERCEPTION OF DESALINATION



Source: GP Bullhound

These changes have allowed RO to expand to almost all sources and uses of water. These shifts furthermore address fairly squarely two of the popular misconceptions around expense and energy inefficiency. Improvements in brine discharge are helping to address misperceptions about RO being environmentally unfriendly to marine life. That better demand side management could negate the need for RO simply ignores the size of the need and that needs are often in regions that have water stress. It is not an "either-or" debate. RO-based Desalination is becoming a core component of any water sourcing strategy.

1. Winning the Cost Battle - Dropping RO Energy Requirements by 80%

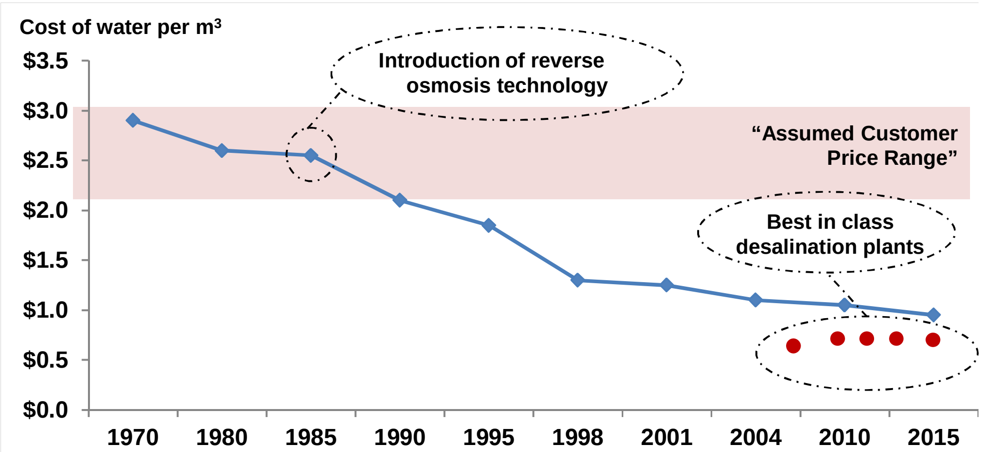
The energy cost of RO has dropped by approximately 80% in the last 10 years to the point where it is becoming an affordable source of water for many applications. Energy requirements "are now down to 2.3-2.7 kWh/m^3 which is actually quite good. 1.8kWh/m^3 is already achievable. However, there is a thermodynamic limit of about .70 kWh/m^3 and hence "a big price drop is not feasible anymore" according to Professor Alexander Zehnder. The race to reduce energy in Desalination has largely been run. Best-in-class plants are running at 65% efficiency and there are unlikely to be major leaps ahead but incremental gains. Depending on the local cost of a kWh of power, the final operating costs per m^3 of

[1] *International Desalination Association*

desalinated water at a large facility can range between $0.47-0.79. When compared to an assumed customer price range of $2-3/m^3, Desalination is clearly viable.

"The key point is that energy costs have reached a level where Desalination is ready to go mainstream" explains Paul O'Callaghan, CEO of O2 Environmental. Most of the reduction so far has been in improvements in membrane technology and in energy recovery devices. "ERI single-handedly halved the cost associated with desalination and as a result were able to achieve 70% market share" according to Paul O' Callaghan. "The capital cost for ERI's solution is 2% of total plant cost but provides a 60% saving in efficiency" according to Tom Rooney, CEO of ERI.

EXHIBIT 4: EVOLUTION IN THE COST OF DESALINATION (1970-2015)



Sources: Global Desalination Plant Market (Frost & Sullivan, 2009), Nikolay Voutchkov 2010, GP Bullhound

The potential for further cost reductions for RO on the Opex and energy side are individually incremental but as a whole could yield another 20% in the next 5 years. Cost reductions will be found in improved membrane productivity, pretreatment for less fouling, recovery of energy from the brine and using less saline water as an input.

"Attention will now be focused on the capital costs, plant efficiency and plant uptime. According to Tom Rooney, "even today, there is a 10-30% downtime for a large desalination plant". This trend is already supported by the fact that the level of standardisation and pre-assembly of RO plants is reducing the time to commissioning as well as the minimization of plant failures. With more than 15,000 plants already in place we expect further improvements in Capex and uptime.

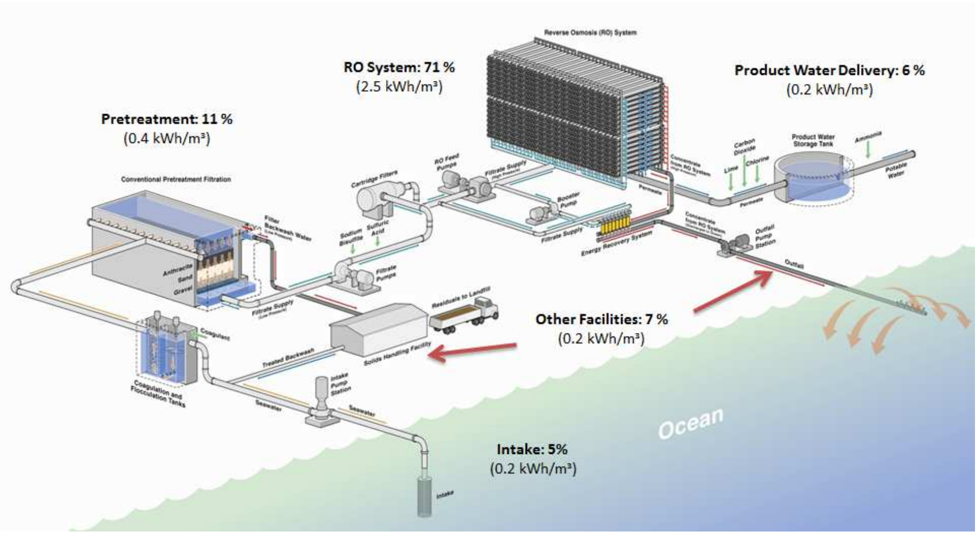
EXHIBIT 5: SEAWATER DESALINATION – IMPROVEMENTS IN COST AND EFFICIENCY

Parameter	In 2010	By 2015	By 2030
Cost of Water ($/m³)	$0.5-0.8	S0.4-0.7	$0.3-0.4
Construction Cost ($/m³)	$1,200-2,100	$1,000-1,700	$500-1,000
Power Use of SWRO System (kWh/m³)	2.5-2.8	2.1-2.6	1.3-1.7
Membrane Productivity (m³/day/membrane)	1.7-3.3	2.4-4.0	6.6-10.6
Membrane Useful Life (years)	5-7	7-10	10-15
Plant Recovery Ratio (%)	45-50%	50-55%	55-65%

Sources: Membrane Seawater Desalination: Overview and Recent Trends (Nikolay Voutchkov, 2010)

Looking further out, there are potentially greater cost reductions again coming from membrane. According to Dr. Nikolay Voutchkov, President of Global Water Consulting, “water travels in a curvilinear torturous path of randomly formed molecular pores as it passes from one side of the membrane to another...if membranes had a structure resembling a honeycomb allowing water to travel in a straight path, their productivity per unit area could increase 20 times. Membrane material science can do for membranes what silicon material science did for computers – bring them to a quantum leap scale down in size and costs without sacrificing productivity and drinking water quality.”

EXHIBIT 6: KEY ENERGY USES IN A 193,750M³/DAY PLANT



Sources: Membrane Seawater Desalination: Overview and Recent Trends (Nikolay Voutchkov, 2010)

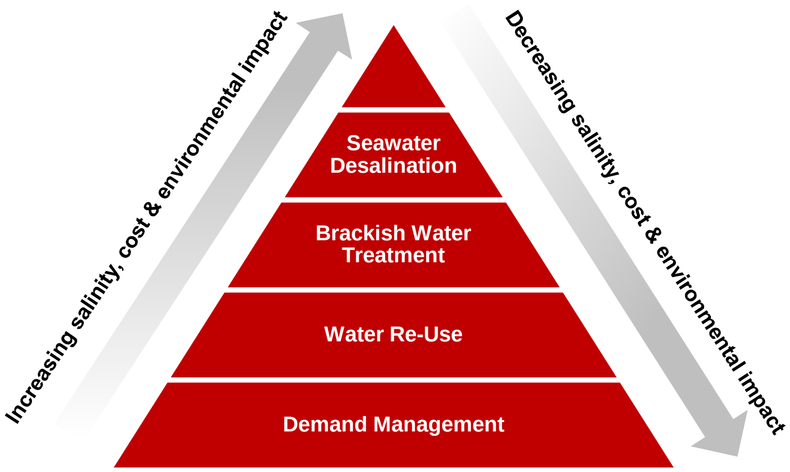
2. The Multiple Applications of RO to other Water Treatments

“Desal is not Desal is not Desal” says Earl Jones, Partner at Liberation Capital. “We normally think of Desalination as the desalting of seawater. It is much more than this: it is treating brackish water, or frack water and industrial wastewater in addition to seawater”. “Because Desalination is a very controlled process water quality can be controlled, it is very suitable for industries which may have very specific requirements such as the computer chip manufacturers and food processors” explains Professor Alexander Zehnder. Such is the growth in use of membranes today that Desalination and RO have become synonymous.

Of the 15,000+ plants in production around the world, about half are in the US and are largely dedicated to ground water rather than seawater. Groundwater has salinity because it is often close to the ocean as in the case of Florida (US) or because there are higher levels of salt and impurities in the bottom of depleted aquifers. Brackish water has less in it to remove and as a result is 40% cheaper to process.

Industrial wastewater systems also use RO technology together with pre and post treatments for a widening array of applications. One big growth area at the moment is water treatment for hydraulic fracturing for the natural gas industry. The cost of processing the water is fed into the final price of gas. Specialist membrane designs are being developed for most industry verticals ranging from power, computers, food and beverage and this is opening up a wide range of opportunities for system integrators.

EXHIBIT 7: SALINITY, COST AND ENVIRONMENTAL IMPACT



Source: GP Bullhound

SWRO has reached an assumed customer price range (set in this report in the \$2-3/m^3 range) but it is still the most expensive form of water. This forces the question as to why more is not being done with cheaper sources of water. We believe that with SWRO becoming a more viable alternative to any water sourcing strategy, it has a beneficial impact in that it forces municipals and industrials to increase water reuse. In Israel, often a leading indicator, where a large portion of water is sourced from SWRO, 85% of that same water is reused in agriculture. There are also increased and now enforced regulations for industrials to be accountable for their effluent and to treat it before it returns to the ground water or rivers or is used in agriculture.

When asked for a disruptive technology that could eliminate a significant amount of the costs of Desalination, Dr. David Lloyd Owen, MD of Envisager, put forward wastewater recovery. “It takes desalinated water that has subsequently been used and makes potable water out of this for a fraction of the cost of desalinating new sea water”.

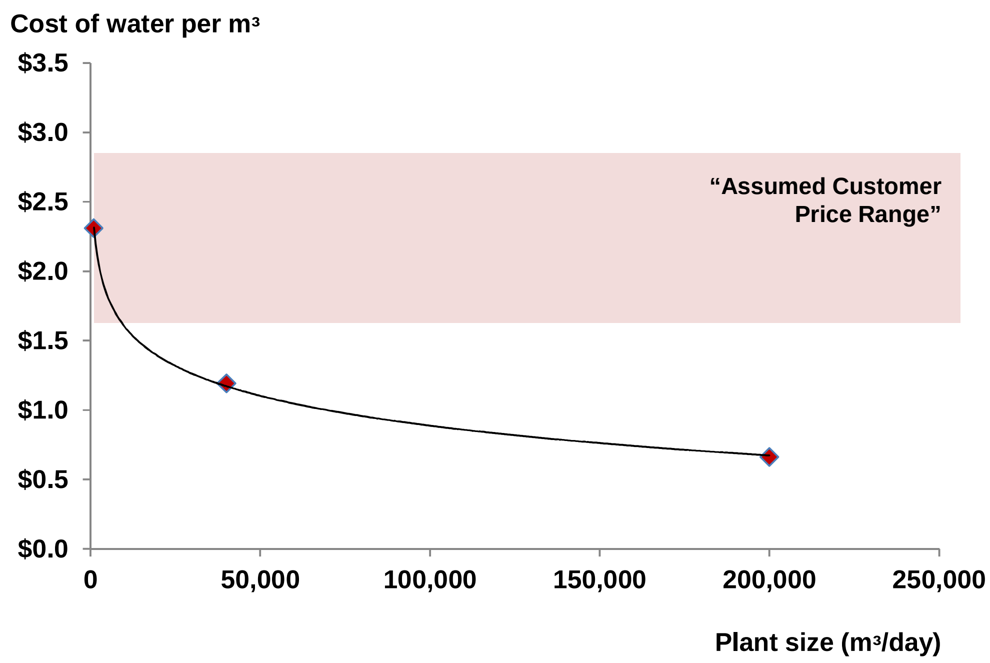
3. Achieving Small Scale Economics

According to Rick Stover, EVP at Desalitech, “RO is the most useful and scalable technology. It ranges from the mega plants that serve one million people to the micro scale. All this is done through the same eight-inch membrane elements.”

Achieving scalability for applications below 50,000m^3 is one of the major successes for the industry. This means that off-grid, remote locations and mid-sized industrials can become part of the market, expanding it dramatically. A little discussed but equally important fact is that with smaller applications, the fully loaded cost is taken into account. Larger facilities that are publicly funded tend to measure themselves only on operating expenditure (“Opex”).

Smaller desalination or water treatment units also mean more localized application. Despite the improvements in Opex costs, transport can remain as one of the largest cost items. “Today, the energy input to pump water from Northern California to Southern California is the same as the energy required for Desalination in California. As water has to be transported ever longer distances and as new desalination plants implement best-in-class technologies, it will reach a point where it is cheaper to make it than move it” mentions Paul O’Callaghan. This becomes even more relevant when considering areas of water stress or there is an industrial need can be isolated and remote such as Western Australia, island communities and tourist locations. Another extreme example given by ERI’s Tom Rooney is that “in Chile, Desalination is pumped 4,000m up to the copper mines”.

EXHIBIT 8: DESALINATION HAS BECOME AFFORDABLE EVEN FOR SMALLER PLANT SIZES



Source: GP Bullhound

INVESTING IN DESALINATION

Fitting the Desalination industry into a classic VC model is difficult. While the industry has some great investment opportunities, it does not benefit from Moore's Law where efficiencies keep doubling every 18 months. However, the Desalination sector does operate on incremental efficiencies more in the 10-15% range over several years. To compensate for this, investors need to take into consideration the scalability of the technology and the route and time to market adoption.

"It is hard for the VCs to make the numbers work because the market for a specific application can be quite limited. You need to find a broader segment where one solution is repeatable. Desalination is liked because the application is wide and scalable" describes Jeff Green, CEO of Nano H2O. Membranes have received much attention because this is where there has been considerable progress with some 20% more efficiencies in store.

Membranes are also supported by the fact that it is a scalable business (standard eight-inch size) with the industry doubling in the next four years and with a growing replacement market. However for a new and innovative technology such as NanoH2O's to be successful it must gain market share from the volume players such as Dow, Toray, Koch and Hydranautics. It is therefore welcome that in its recent $40 million capital raise, the original financial investors were joined by strategic players such as BASF and Total.

Can Single Technology Players Make the Grade?

It is doubtful whether a single-technology company in fact can make a viable investment proposition. Industry insiders recognize that single product companies even with "disruptive technologies" are best bought by larger players that can commercialize their technology in half the time and give the distribution reach necessary. According to Even Lovell, Partner at Virgin Green Fund, "a lot of water technology businesses are not 'companies'; they are technologies and it is very hard to build a company around a single technology. It is even harder to get venture returns from a single technology based business". This will give a boost to the emerging system integrators that can adopt new technologies to increase their customer proposition.

Some single-technology players have proven to be able to make the grade. For instance, Energy Recovery Inc. ("ERI") introduced a "disruptive" technology in 2000 with a pressure recovery device that saved 60% of the energy costs in a desalination plant. "We were ready for prime time in 2000 and even though we were very disruptive it took us eight years to become dominant in the industry" explains Tom Rooney, CEO of ERI. Even with 70% market share and a 95%+ efficiency, it is difficult to be a single-product company. Supplying the Desalination industry in 2008-2010 saw a 50% drop in new plant build because of the financial crisis and the stock of ERI's share price suffered a 70% drop in that period as a result. "People got disappointed when they saw the slowdown in spending by municipals in desalination. The demand for water is still increasing but the growth in installation of desalination plants is driven by the bureaucracy around municipal budgets and available spending". Today, ERI's share price is rebounding because of the increase in new large plant build and also because of its diversification into oil and gas.

Another successful single-technology company is Israel-based Desalitech which introduced a novel approach to the traditional desalination systems, creating a recycle loop process called Closed Cycled Desalination. This evens out the flux and pressure in the membrane area. By recirculating the seawater and recalibrating the pressure throughout the membrane, you get better and more even pressure and hence performance all along the membrane".

Identifying the Opportunities

EXHIBIT 9: DESALINATION TECHNOLOGY LANDSCAPE

Source: GP Bullhound

Desalination had long been the purview of the larger equipment and Engineering, Procurement and Construction ("EPC") companies. Historically, MSF and RO were a large engineering company competency as they were large scale, specialized and contracts subject to public tender. With the 80% drop in costs for RO and the viability of smaller scale plants together with the increasing industrial applications for RO, opportunities have opened up for a breed of new entrants. They fall into two categories: new technologies and new business models/markets. New technologies in membranes, ion exchange, and forward osmosis hold a natural attraction to VC investors, have considerable promise but may be some ways off from commercialization and hence bear the risk of time to market, acceptance and exit values.

However, as the RO market grows and permeates geographies and industries, private investment will be needed. The increasing variety of applications and customers is opening up opportunities in services such as replacement, leasing, BOP and ushering in new system integrators. While less sexy or exciting than new technologies they bring a higher level of certainty of customer revenues and ultimately serve as a platform to roll up the new technologies. As Earl Jones, Partner at Liberation Capital describes it, “not the best technologies win, but those with the best business models and routes to market”.

NEW TECHNOLOGIES

Membranes

Even with the recent advances in membrane technology more are on the way. Membrane technology is specializing in end-user needs (e.g. dairy, food, beverages, chemical and general industrial) and therefore developing numerous sub-categories: such as spiral RO for brackish water as opposed to seawater, nano filtration, ultra filtration, micro filtration, and hollow fiber membranes. New developments are occurring where membranes can be more selective for specific ions better at gas separation, nitrate removal, chloro-hydrocarbons, and poisonous impurities from ground water such as arsenic. While the most publicized of these advances is the NanoH2O product set, the major suppliers such as Koch are developing specialist applications. Carbon nano-tubes and polymetric membranes (which incorporate nano-particles into the membrane polymer matrix) are expected to yield cost savings of up to 20%. Some specialist engineers - such as Dr. Nikolay Voutchkov - estimate that beyond the opportunities of the next five years there are big gains longer term for 80% efficiency gains. (see the *“Winning the Cost Battle”* section)

Ceramic membranes offer the advantages of 99.9% recovery rates, durability & long life, and resistance to degradation from chemicals. They are ideally suited for industrial applications such as the chemical and metals industry and are robust and can be cleaned. Ceramic membranes mimic the performance of zeolite - a natural compound in geology that has just the right size holes - and is “the perfect water filter” according to Professor Alexander Zehnder.

Aquaporins

Aquaporins have to be the “dream” of the Water industry. It is a manufactured process which mimics the purification process of water in plants and animals via selective transport of water molecules across cell membranes leaving behind salts and impurities. This selectivity via protein is especially useful as some impurity molecules are smaller than water ones. When we can reproduce Mother Nature’s desalination we will truly have done something special. It is very early days and Aquaporin and AquaZ are both developing the technology (both based in Denmark) with an estimated reduction of 70-80% in energy costs when compared with RO. It is still a number of years from commercialisation but could represent a long shot bet. Key again, once the technology is ready, would be the route to market and scalability. Ultimately, this would be an M&A target for one of the major membrane players.

Forward Osmosis

There has been some good development in Forward Osmosis ("FO") recently and most industry observers recognize that it could reach a broader acceptance in three to four years. The technology uses a high saline solution that "draws" the salt out of the water (rather than in RO pushing the water out of the salt water) and hence needs only around three bar of hydraulic pressure, whereas RO needs 60-80 bar). This could have significant benefits not just in terms of energy requirements but also in capital costs as the system does not need the strength of RO and could be built from cheaper plastics. Membranes too would need less replacement as they would not be subject to the same pressure and fouling. Leading players are US-based Oasys Water and listed UK-based Modern Water. Niche applications in the near term would be where you need low pressure and in zero brine discharge environments.

US-based Saltworks Technologies has taken to achieving this by splitting the process into multiple stages of four pools separated by different membranes: sunlight or waste heat is used to create an 18% concentrate out of seawater and that concentrate is passed via a set of two one way ion bridge membranes. The first pool/membrane draws the positive sodium ions and the second draws the negatively charged chlorine ions. In the last stage, the highly charged sodium and chlorine pools rebalance and draw out the remaining NaCl leaving fresh water. This is a virtually self-powered process and most likely to be realised in off-grid environments or where cap ex is limited or where there is a surplus of brine.

De-ionisation

Netherlands-based Voltea's technology involves a combination of membranes and electrodes. Electricity in the electrodes attracts the respective positive and negative ions through a membrane leaving clean water. The system can be regenerated and flushed by reversing the process. Here again the benefits of low pressure and self-cleaning can have niche applications in water reuse, power plants and water softening. This is still in early days and some skeptics believe the combination of electrodes and membranes will find it hard to compete on a large scale with a single-membrane process. However, as the needs for water sourcing adapt to specific surroundings and applications, deionization certainly has its uses and this is most likely to be in industry.

NEW BUSINESS MODELS AND ROUTES TO MARKET

Capex and Plant Uptime

Whereas progress to date has been centered on reducing Opex (energy), more attention will now be focused on Capex and how to increase returns on investment. One clear area for improvement is increasing plant uptime from the average of 70-80%. "We are now getting close to the laws of physics and yet we keep chipping away at inefficiencies…attention will now be focused on the capital costs: plant efficiency and uptime" Tom Rooney, CEO of ERI. Interestingly, while most of the innovation to date has been focused on membranes and energy recovery devices they actually only represent 5% and 2% of the capital cost of plants respectively. Capex has often been taken out of the cost equation as plants tended to be public projects but as more private capital enters the equation alongside smaller applications, the fully-loaded costs will be measured.

With the increased number of plants, standardisation in plant design and some pre-assembly is happening which will lead to improvements in reliability and faster deployment. Attention will also be centred on pumps, water transport, and controls which make up the bulk of the BOP. Pre-treatment is also seeing some progress. Benefits include limited use of expensive chemicals, less fouling of the membranes (a major contributor to plant down time). New multi-media filter technologies for pre-treatment are showing signs of promise such as UK-based Bluewater Bio's Filter Clear which while originally designed for the food and beverage industry can be applied to SWRO pre-treatment.

Brackish Water, Frack Water, Wastewater and Water Reuse

If you can take the salt out of seawater economically other sources of water should be an easier challenge. The strides that have been made in SWRO can be applied to other types of water and are cheaper too. Earl Jones explains, "we are seeing major freshwater sources like coastal aquifers, becoming saline through seawater encroachment…developing new water sources through water reclamation and reuse make strong economic sense…it makes strong environmental sense too…it is on average 40% cheaper to process than seawater and there is more of it as the water from aquifers is becoming brackish". In fact, most systems in the US are for brackish water.

The fastest deployment of membrane based treatment solutions are likely to be smaller scale and will treat seawater or brackish water at first and then be used for wastewater treatment at the second pass. It is the success in proving the economics of seawater desalination that is opening up adjacent areas and will prove a boon for water solution providers.

The Replacement Market for Membranes

With the aging of the current pool of RO plants and with the doubling of installed capacity in the next four years, the replacement market for membranes represents a significant growth opportunity. RO membranes typically need replacing every three to six years depending on usage and fouling. The Desalination industry speaks mostly about new plants, but it is the replacement market that could be the most attractive to new technology companies. Membranes are standardized (eight-inch elements) regardless of whether they are installed in large or small plants, and hence offer scalability. They also offer room for constant upgrades in performance as Nano H2O is targeting. At $300-600 a set and with large plants containing 20,000 to 40,000 membrane sets, this represents a fast growing market. Challenges will be around volume production and how to compete with the majors such as Dow and Toray. Challengers are already appearing in the form of cheaper replacements from China. Service providers who can establish long term relationship with the operators could do quite well.

System Integrators

"We are heading towards a period that will usher in the growth of the cutting edge system integrators. They will specialise in areas such as pre-treatment, post-treatment and disinfection. They will have modular approaches that will address specific needs and will offer their solutions as an outsourced service. It will look like customisation but the unit operations will be standardized. They will differ from the current integrators who go after the large end-to-end jobs; these new players will be able to manage medium to mid-sized solutions. A typical player could be one who has a catalogue of five solutions and sells them coupled to a service package" according to Rick Stover, EVP at Desalitech.

This group could bring about some of the best growth prospects. There will likely be a lot of M&A activity targeting local service and solution providers. Single-product companies will be bought by the players with the balance sheets looking to add to their solution offering. They will also likely have need for growth capital.

Service Models

Asset ownership & Design, Build, Own and Operate ("DBOO") models are not regarded kindly by VC investment committees. In the case of water they do make sense, DBOO model not only eliminates technology risk but can even out revenues and build strong cash flows from which to expand and offer new technologies as they become proven and available. "Developing a service model often means many multiples on margin contribution as compared to a one-time capital sale. Companies such as Seven Seas Water have developed a very successful business model and are technology agnostic" as described by Earl Jones, Partner at Liberation Capital. A strong base in customer flows allows service providers to gain scale and open up the capital markets as well as the option to become a technology roll up should it choose to do so.

This service model is being and will be increasingly rolled out across a number of industries such as the food and beverage and oil industry. The Seven Seas Water model is likely to be copied in other geographies that have similar demographics and needs as the Caribbean.

DESALINATION AND RENEWABLE ENERGY

Desalination is unsustainable in the long term if based solely on fossil fuels. This is not just because the cost of fuel is likely to continue to rise (and it is finite) but that the areas where Desalination is needed are either remote or do not have access to cheap oil/coal. Certainly as the cost of wind and solar power reach local grid parity, the option to use renewables becomes more viable each year.

Wind Applications

In Australia, the nine-year drought brought about serious efforts to conserve water and to develop the Desalination industry locally. In a country with cheap coal, there was a natural resistance to investing in renewable energy-powered desalination. In Australia, it took three years to get the first RO plant in place but when people saw the benefits of it, three more were commissioned. In November 2006, in Perth, the Kwinana facility of 130,000m^3/day was commissioned and is powered by 24MW of wind power. In January 2010, the 100% wind powered plant in Sydney (67 turbines) was switched on and will supply 15% (can go up to 30%) of Sydney’s water.

In the Netherlands, Dutch Rainmaker is commercializing a small-sized wind-based water production technology that completely cuts out the need to generate electricity thereby increasing efficiency and can be run off the grid. The mechanical energy created by the turbine drives compressors that chill incoming air to 4℃ and produces water through condensation. While not a new concept, the “special sauce” is in being able to produce 7,500 liters of water per day with one 30-metre tower with an Opex of €1.2-1.5 / m^3. The technology was co-developed with the Wetsus Water Centre in Leuuwarden in the Netherlands and is being commercialized in the Middle East in 2012.

Solar Applications

Even in oil-rich Saudi Arabia, there is some enlightened self-interest supporting the use of renewables for Desalination. The Saudis use over one million barrels of oil per day to produce desalinated water. As Nityen Lal, Partner at Icos Capital, points out “about one third of oil used by some of the major Gulf countries is spent on production of water. If not climate change or security of fuel supply, then pure economics is a compelling reason towards adoption of renewable desalination”.

In 2010, IBM and King Abdulaziz City for Science and Technology (“KACST”) agreed plans for a facility in Al Khafji (Saudi Arabia) that would be powered by concentrated solar photovoltaic and use a new nano-membrane developed by IBM to desalinate water, remove harmful toxins such as arsenic and reduce the amount of membrane fouling. The facility is going on stream in 2012 and will produce 30,000 m^3/day at an initial cost of \$1.5m^3. Based on this, there are already plans to build other facilities with a total of 300,000 m^3/day or 10% of the country’s needs. The Saudi government has stated that it will put in place a policy to have the majority of its desalination plants powered by solar power by 2030. Better to sell the oil at \$100 a barrel…

PARTING SHOT – OUR WILD CARD

In November 2011, the Randolph Harley Power Plant in Saint Thomas (US Virgin Islands) experienced a failure in its heat recovery boiler that forced the shut down of the MED facility that supplied 95% of the Island's drinking water. The stoppage to the 6,800m^3/day facility occurred just before the peak tourist season. Within 46 days, the island's water supply had been fully restored to 7,500m^3/day by installing 8 container-housed RO units from Florida-based Seven Seas Water (of which key investors include Virgin Green Fund, Element Partners and Advent-Morro).

The emergency "fix" is providing the island with water at $1.14/m^3 excluding energy costs according to WAPA, the local utility. Although a more permanent RO solution will come on stream in 2013 supplied by Seven Seas Water, the ability to supply a quick and reasonably-priced emergency patch was only possible because of the nature of RO technology. "I am not aware this has been accomplished anywhere else" proudly explains Doug Brown, CEO at Seven Seas Water.

EXHIBIT 10: MOBILE UNITS FROM SEVEN SEAS WATER IN THE US VIRGIN ISLANDS

Source: Seven Seas Water

The alternative solution of refurbishing the MED facility would have taken more than 12-18 months and would have yielded no cost advantage. Aging power plants & vintage MSF facilities from the 1970s are providing an attractive new replacement market for RO. Pictured above are the mobile units from Seven Seas Water now supplying all St Thomas' needs. They are lined up inside the now quiet MED facility.

This indeed may be a sign of things to come. The ability of RO to scale, to be readily available and also treat most types of water on an as-needed basis will be a significant boost to companies such as Seven Seas Water. Furthermore, the ability to provide the service on a Build-Own-Operate ("BOO") basis means no capital outlays for WAPA, but provides attractive recurring revenue streams to Seven Seas Water.

MARKET ACTIVITY

Recent Financing Activity

Date Announced	Target	Country	Investor(s)	Investment (US$m)	Business Description
May-12	Water Standard Company	US	Mitsui & Co. Global Investment, Inc.	250.0	Desalination plant developer
May-12	Desalitech	Israel	Liberation Capital	6.3	Closed-circuit desalination
Apr-12	Ocean Pacific Technologies	US	-	1.5	Desal energy recovery
Apr-12	NanoH20	US	BASF; Total Energy Ventures; Keytone Ventures; Khosla Ventures; Oak Investment Partners; CalPERS; PCG Clean Energy & Technology Fund	60.5	Nanocomposite membranes
Apr-12	Clean Runner, LLC	US	-	19.6	Produced water treatment
Feb-12	Voltea	Netherlands	Pentair; Rabo Ventures; Unilever Ventures	6.0	Capacitive deionisation
Jan-12	Cerahelix, Inc.	US	Maine Technology Institute; Maine Small Enterprise Growth Fund; Others	0.3	Nanofiltration membranes
Dec-11	Aqualyng Holding	Norway	IFC; Clean Resources Asia Growth Fund; Others	65.0	Desalination plant developer
Sep-11	FilterBoxx	Canada	XPV Capital; EnerTech Capital	9.0	Packaged treatment systems
May-11	Saltworks Technologies	Canada	Innovative Clean Energy Fund (British Columbia)	1.0	Desal using waste heat
May-11	Saltworks Technologies	Canada	Cenovus Energy Inc; Teck Resources Limited	2.6	Desal using waste heat
Feb-11	Osmoflo	Australia	Marubeni Corporation	50.0	Desalination plant supplier
Jan-11	Clean Membranes Inc	US	Morningside Venture Investments Limited	-	Anti-fouling membranes
Q4-10	Seven Seas Water Corporation	US	Virgin Green Fund; Element Partners; Advent-Morro	16.1	Desalination plant developer
Sep-10	AquaZ A/S	Denmark	Vaekstfinden; Elsweb; Bankinvest	-	Aquaporin membranes
Aug-10	Voltea	Netherlands	Rabo Ventures; Pentair	4.6	Capacitive deionisation
Q3-10	Seven Seas Water Corporation	US	Virgin Green Fund; Element Partners; Advent-Morro	6.7	Desalination plant developer
Q2-10	Seven Seas Water Corporation	US	Virgin Green Fund; Element Partners; Advent-Morro	8.1	Desalination plant developer
May-10	FilterBoxx	Canada	XPV Capital; EnerTech Capital; The Walshingham Fund	-	Packaged treatment systems
Jan-10	Clean Filtration Technologies, Inc.	US	Dow Venture Capital	3.5	Self-cleaning metal membranes
Aug-09	Bio Pure Technology	Israel	US Venture Partners; Pitango Venture Capital; Aurum Ventures; Elron Electronic Industries	12.0	Advanced nano-filtration membranes
Jul-09	inge	Germany	BayTech VC; Taprogge; Emerald Cleantech Fund I LP; Sustainable Performance Group N.V.; Siemens Venture Capital GmbH; StoneFund N.V.; Entrepreneurs Fund LP	7.0	Low-pressure membrane desalination
Feb-09	Oasys Water	US	Advanced Technology Ventures; Draper Fisher Jurvetson; Flagship Ventures	10.0	Forward osmosis desalination
Feb-09	Triton Format AG	Germany	zouk ventures; Meidlinger Partners LLC	13.2	Low-energy desalination
Feb-09	Seven Seas Water Corporation	US	TPG Growth; Virgin Green Fund; Element Partners	15.0	Desalination plant developer
Jan-09	Advanced Hydro Inc.	US	Quercus Trust; 21 Ventures	0.5	Membrane fouling reduction

Source: CapitalIQ, Global Water Intelligence, Newsrun, GP Bullhound

Recent M&A Activity

Date Announced	Target	Target Country	Acquirer	EV (US$m)	LTM EV/ Revenue	LTM EV/ EBITDA	Target Description
European/US							
May-2012	Seprotech Systems Inc.	Canada	Wesa Group Inc.	-	-	-	Packaged membrane bioreactors for water recycle
Apr-2012	Sustainable Environmental Technologies	US	Cancen Oil Canada Inc.	35.7	8.7x	40.3x	Water treatment and sustainable energy solutions
Jan-2012	SwissINSO Holding Inc.	US	InsOglass Holding SA	6.3	-	9.5x	Solar energy-powered desalination technology
Nov-2011	OHL Medio Ambiente Inima	Spain	GS E&C Corporation	311.3	1.8x	-	Desalination plant developer
Aug-2011	H2Oil & Gas Ltd.	UK	FilterBoxx Water and Environmental Corp.	-	-	-	Membrane-based SWRO solutions for the oil and gas industry
Jul-2011	VAG Holding	Germany	Rexnord	251.4	1.2x	-	Valves for water and wastewater
Jul-2011	YSI	US	ITT Corporation	309.0	3.1x	-	Sensors, instruments, software and data collection platforms for water quality monitoring
Apr-2011	Danfoss Socla	France	Watts Water Technologies	175.7	1.3x	-	Self-acting and actuated valves and backflow preventers
Apr-2011	Norit Clean Process Technologies	Netherlands	Pentair	503.0	2.3x	14.4x	Membranes and clean process technologies for desalination and water reuse
Apr-2011	Cardo Flow Solutions	Germany	Sulzer Ltd	858.0	1.9x	12.8x	Equipment for collecting, treating and transporting seawater
Jun-2010	Godwin Pumps	UK	ITT Corporation	580.0	2.9x	-	Water pumps and related engineering equipment
Feb-2010	WoozyFly, Inc.	US	STW Resources Holding Corp	-	-	-	Desalination technologies for oil and gas hydraulic fracture flow-back saltwater
Dec-2009	Pump Engineering Inc. - PEI	US	Energy Recovery Inc. (ERI)	27.1	2.9x	-	Advanced technology pumps
Apr-2009	Calder GmbH	Switzerland	Flowserve Corporation	45.0	1.9x	-	Energy recovery devices and pump systems for RO
Rest of the World							
Jun-2012	Windesal Limited	Australia	Danvest Australia Pty Ltd.	-	-	-	Wind-powered desalination plants
Mar-2012	Environmental Care Management Company Ltd	Thailand	SMC Power Public Company Ltd	2.5	-	-	Membrane technology developer
Mar-2011	Sinomem Technology Ltd.	Singapore	CDH Investments	271.1	2.8x	9.4x	Membrane technology developer
Feb-2011	OSMOFLO Pty, Ltd.	Australia	Marubeni Corporation	-	-	-	Desalination plant developer for the coal seam gas, oil and gas and other industries
					2.7x	**6.9x**	
					2.1x	**2.9x**	

Source: CapitalIQ, Mergermarket, Newsrun, GP Bullhound

SELECTED COMPANY PROFILES

Company	Business Description	Features / News	Investor(s)
APTwater Founded in 1996 HQ: Long Beach, California	Designs, develops and operates water treatment solutions that enable water reuse for municipal, industrial, environmental and private sectors in the US and internationally	Offers HiPOx (energy-efficient and cost-effective water disinfection process) ARoNite (hydrogen-based biological treatment system) and PulseOx (in-situ chemcial oxidation technology)	Kleiner, Perkins, Caufield & Byers, and XPV Capital
AQUAPORIN Founded in 2005 HQ: Copenhagen, Denmark	Develops water purification and seawater desalination solutions based on aquaporins, proteins embedded in the cell membrane that regulate the flow of water	Does not yet have a commercialised product but is working towards marketing, selling and licensing its final membrane technology in 2013	$6.8m from Goldschmidt Capital AS and Syddansk Teknologisk Innovation AS
aquaZ Founded in 2006 HQ: Nordborg, Denmark	Develops membrane technologies for sea water desalination plants. Offers Aquaporins, a family of membrane proteins regulating the transport of water and glycerol across the hydrophobic cell membranes	Numerous awards including being listed in the Cleantech Group's Cleantech 100 in 2009 and 2010, winning "Best Presentation" at CleanTech Invest 2009	BankInvest Group and Vaekstfonden (unspecified amount)
CLEAN RUNNER Clean Water Solutions Founded in 2011 HQ: Portsmouth, New Hampshire, US	Develops dirty and contaminated water reclamation and treatment systems. PetroCleanse technology cleans produced water from natural gas and oil wells and returns it for reuse without relying on chemcials	Investors include Cate Street Capital, an investment company specialising in bringing green technologies and environmentally sustainable development projects to commercial operation	Cate Street Capital
Desalitech Advanced Desalination Technologies Founded in 2008 HQ: Tel Aviv, Israel	Provides water treatment solutions for the applications of seawater desalination, brackish water desalination, industrial water upgrade and wells water purification	Deployed first commercial units in early 2009 and commissioned several desalination units of up to 1,500m³/day since. Currently working on and promoting many additional RO projects	Over $10m from Aquagro Fund and Liberation Capital
Dutch Rainmaker Founded in 2007 HQ: Leeuwarden, Netherlands	Engages in the design, production and assembly of equipment used to produce water from air using the mechanical energy from wind	Also offers a system which treats and produces drinking water from sea water and has off grid applications	Icos Capital
ERI Founded in 1992 HQ: San Leandro, California, US	Develops, manufactures and sells energy recovery devices and high-pressure and circulation pumps that save 60% of the energy and has 70% market share. Listed on NASDAQ since mid-2008	In 2009, acquired Pump Engineering, a developer and manufacturer of pumps for SWRO and BWRO	Public Company

Company	Business Description	Features / News	Investor(s)
FILTERCLEAR A BLUEWATER BIO COMPANY Founded in 2003 HQ: Glasgow, UK	Markets filtration technologies including Spruce Media Filtration Technologies for commercial installation	Awarded a "Highly Commended" ranking by the Institute of Chemical Engineers (IChemE) for innovation and excellence	Owned by UK-based Bluewater Bio
HTI Hydration Technology Innovations Founded in 1986 HQ: Scottsdale, Arizona, US	Manufactures and markets forward osmosis technology for application in sectors including oil and gas, industrial / municipal wastewater, military water and desalination, and humanitarian disaster relief	Forward osmosis products originally developed in co-operation with US DoD and DARPA. Also engages in the integration and installation of membrane filtration wastewater treatment systems.	n/a
MODERNWATER Founded in 2006 HQ: Guildford, UK	Engages in the sourcing, development and deployment of technology-based solutions for the economic availability of fresh water and treatment of wastewater	Owns eleven key patent families at various stages of the patent process. Has a global reach with operations in the Middle East, S. Africa, China, USA and the UK	Public Company
NanoH$_2$O Founded in 2005 HQ: El Segundo, California	Designs, develops, manufacturers and markets reverse osmosis membranes for desalination plants worldwide, focusing on the synthesis of membrane materials for desalination and water reuse	Has won numerous awards including the 2011 Aquatech Innovation Award, 2011 Artemis Project Top 50 Water Company and 2011 Global Cleantech 100 Company	$100m+ from Khosla, OakTree, PCG AM, Keystone, Capital Dynamics, BASF, Total
OASYS WATER Founded in 2008 HQ:Boston, Massachussets, US	Provides forward osmosis technology that lowers the cost to produce clean water. It offers Engineered Osmosis, a platform incorporating forward osmosis and a draw solution to make salt water treatment economical	In March 2012, announced that Select Energy Services LLC, a provider of engineered water solutions to the oil and gas industry, would be the exclusive operator of Oasys' technology in the Permian Basin	$10m from Advanced Technology Ventures, Draper Fisher Jurvetson, Flagship Ventures
Porifera Founded in 2008 HQ:San Francisco, California, US	Produces membranes using carbon nanotubes to improve membrane performance. Its products are based on technology licensed exclusively from the Lawrence Livermore National Laboratory	Porifera's membranes have been described as "One of the Top Ten Water Technologies to Save the World" by Global Water Intelligence magazine	Numerous grants including $1.1m from the Advanced Research Project Agency to fund development of carbon nanotube membranes
Saltworks™ Founded in 2008 HQ: Vancouver, Canada	Develops and commercialises thermo-ionic desalination technology solutions for desalination and brine treatment	Saltworks' founders Ben Sparrow and Joshua Zoshi were among the winners of Business in Vancouver's Top Forty Under 40 Award 2011	Over $2.5m from Cenovus Energy Inc. Also awarded cc. $1m grant from British Columbia's Innovative Clean Energy Fund

Company	Business Description	Features / News	Investor(s)
(Seawater Greenhouse) Founded in 2000 HQ: London, UK	Provides a low-cost solution using seawater and sunlight to produce fresh water for agricultural purposes in a greenhouse environment	In March 2012 both won first prize for Best Product at Climate Week 2012, joined UK Clean and Cool trade mission to San Francisco in March 2012, and was featured in Forbes' Green Tech News	n/a
SEVEN SEAS WATER Founded in 1996 HQ: Tampa, Florida, US	Provides water and wastewater solutions to municipal, private and industrial consumers in the Caribbean and Mexican markets, and designs, installs and operates water treatment plants	Delivered SWRO units to St. Thomas in response to a critical water shortage within 28 days	$50m from investors including Element Partners, Virgin Green Fund and Advent-Morro
(SolAquaGen) Founded in 2008 HQ: Aylesbury, UK	Develops commercially viable methods of solar powered desalination (which can also use waste heat as their energy source), to be utilised in two main products: the "Water Machine", a pure desalination unit, and the "Self Irrigating Cool House", a sustainable solution for agriculture in water stressed areas	Recently awarded a Technology Strategy Board "Smart Award" for its innovative technology, which it expects to be ready in summer 2012. agreed a JV with a local partner in Saudi Arabia to increase its Middle Eastern presence	n/a
TRITON WATER Founded in 1851 HQ: Norderstedt, Germany	Designs, constructs, commissions and services maritime water and industrial treatment systems. Offers a broad range of filtration technologies and processes including microfiltration, ultra filtration, nanofiltration, RO and electrode-ionisation	The world's market leader for seawater desalination for cruise ships using reverse osmosis	$13m from Meidlinger Partners, Zouk Capital, EDB Investments Pte Ltd and Wolbern PE
Voltea Founded in 2006 HQ: Sassenheim, Netherlands	Develops water desalination technologies, offering systems based on Capacitive de-ionisation (CapD-1), a platform technology to obtain desalinated water with low energy consumption	Has won several awards for its technology including being named in the 2011 Global Cleantech 100 and winning a place on The Artemis Project's 2011 list	$10m from Pentair, Inc., Rabo Ventures and Unilever Ventures Ltd

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