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Business



AsiaCase. com TECHNOLOGICAL NANYANG UNIVERSITY the Asian Business Case Centre Nanyang Business School HYFLUX LIMITED AND WATER SUSTAINABILITY TREADING BLUE OCEANS Publication No: ABCC-2009-003 Print Copy Version: 13 Nov 2009 Wee Beng Geok, Ivy Buche with Mark Kroll and Timothy Chua In 2009, Hyflux Ltd (Hyflwc) was one of Asia, s leading environmental water treatment companies with operations in Singapore, China, the Middle East, North Africa and India.

Specialising in membrane technologies, Hyflwc provided integrated solutions for municipal water treatment, industrial manufacturing processes, recycling of spent oils and solvents, as well as production of bio-based specialty materials. The brainchild of entrepreneur Olivia Lum, who in 1989 left a comfortable job with a multinational pharmaceutical company in Singapore to start a business in water treatment systems, Hyflux was an early mover in the early 1990s into China, s nascent industrial water treatment market.

After it moved into the municipal water treatment market sales revenue jumped from S\$17. million in 2000 to S\$554 million in 2008. The 2008 global recession affected Hyflux, s revenue from the industrial segment but the municipal business remained strong, as the company succeeded in securing large-scale high value projects in North Africa. The challenge for Hyflux was to rapidly grow its human capital and organizational capabilities to match its aggressive market penetration strategies. In the past, Hyflux had leveraged on innovative technological development and entrepreneurial drive to grow its business.

In 2009, as a player in the global water treatment business Hyflux had to prove that it had what it took to execute these greenfield municipal projects <https://assignbuster.com/strategy-manager/>

and that it could compete with other global water treatment companies in these new markets.

Associate Professor Wee Beng Geok, Professor Mark Kroll, Ivy Buche and Timothy Chua prepared this case based on public sources. As the case is not intended to illustrate either effective or ineffective practices or policies, the information presented reflects the authors' interpretation of events and serves merely to provide opportunities for classroom discussions.

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edu. sg INTRODUCTION

In June 2009, Hyflux Limited (Hyflux), Singapore's largest water treatment company, announced that it had signed an agreement with Libya's state-owned General Desalination Company (GDC) to build two water desalination plants in the Tripoli and Benghazi municipalities. The Tripoli plant was slated to be the world's largest membrane-based desalination plant with a capacity of 500,000 m³ per day. Together the two plants would have production capacity of 900,000 m³ of refined water daily. Under the contract, which was estimated to be worth more than US\$1 billion¹, Hyflux would undertake all engineering, procurement and construction (EPC) work.

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Although many financial and technical details still had to be resolved, Hyflux Deputy CEO Sam Ong expected the two projects, the first phase of Libya's water desalination programme, to be fast-tracked. Eighty percent of the project cost would be financed in Libya with help from its government. 2 A joint venture company between Hyflux and GDC would be formed to operate and maintain the plants for which the Libyan government had committed to a 25-year agreement to offtake the water produced.

Hyflux would take a minority stake in this joint venture. Water Management and Environmental Sustainability Populations worldwide were increasing at a phenomenal rate, causing the emphasis on water sustainability to shift towards the viable production and treatment of drinkable water globally, at the beginning of the 21st century. There was a growing consensus that the water crisis facing the world was not so much one of availability of water, but rather, in the management of water, especially in the cities of the world.

As industrialisation spread to every corner of the earth, many governments moved to implement regulations on the treatment of effluent wastewater and other fluids from industrial processing. Manufacturers faced not only costlier water supplies, but the need to find efficient and effective methods to manage wastewater. As a result, a number of such companies (ranging from global water giants such as GE Water to small start-ups such as Sinomem Technology, a China-based water company), had begun moving into this greenfield industry.

For Singapore, the emerging global paradigm on sustainable water management was a vindication of the island nation's strategy for water management developed over the course of 40 years, as a result of a lack of

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sufficient indigenous freshwater resources. The Singapore strategy for sustainable water management was, and continued to be, based on the development and investment in its water infrastructure. This meant that the city state had positioned itself at the forefront in adoption of new water technologies and innovations.

It was for this reason that by 2009, more than 50 local and international water companies had established themselves in Singapore, attracted by its location, R; D opportunities, and its potential as a test bed for new technologies and capabilities: When we do a project in Singapore, because of the way the government works, the project becomes a global showroom for us. We don't need to pay a salesperson, because Singapore invites international clients to visit the showroom. 3 Ngo Chiaw Tan, Director, CH2MHILL, a US water company

In 1989, Olivia Lum (Lum), the founder and CEO of Hyflux, then working in a large pharmaceutical company, recognised the growing opportunities in the water business and left her job to start a small trading company in Singapore, to distribute water filtration membrane systems used by manufacturing plants. By 2009, Lum's start-up was Asia's most integrated water and liquid treatment company specialising in membrane technologies. THE COMPANY IN 2009 In 2009, Hyflux was one of Asia's leading environmental and water companies with operations and projects in Singapore, the People's Republic of China, India, the Middle East, and North Africa.

It had its beginnings as Hydrochem (S) Pte Ltd, a small trading company in Singapore distributing water treatment equipment.

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The company's fortunes turned in 1993 after it started operations in Shanghai, China. Renamed Hyflux, the company made its mark there as a provider of innovative solutions for water treatment systems. A little more than a decade later, it became the first water treatment company to be listed on the Singapore Stock Exchange in January 2001. Since 2000, the company's growth had been phenomenal, with sales revenue rising from S\$17.7 million that year to S\$554 million for the financial year ended 2008.

The main driver for this growth was Hyflux's successful move into the municipal water market.

The company made its mark in the international water industry after winning the contract to build Singapore's first plant that converted used water into high grade potable drinking water. Soon after this, Hyflux became a part of the consortium that won the bid to build and operate Singapore's first desalination plant. The company's meteoric rise caught the attention of the international water industry. In 2006, Hyflux was awarded Water Company of the Year at the Global Water Awards by the Global Water Intelligence, United Kingdom.

Hyflux was twice listed in Forbes Asia's Best Under a Billion Company in 2005 and 2006.

In September 2005, Lum's entrepreneurial efforts in this field also earned her a place on Forbes Asia magazine's list of Southeast Asia's 40 wealthiest, the first woman to make it, with a net worth of US\$240 million. In 2002, she was also appointed as a Nominated Member of the Parliament of Singapore. (See Exhibit 1, pg? 20 ? Hyflux Awards and Accolades.) Following its success in

the Singapore municipal market, the company moved quickly to secure a share of China's huge municipal water market.

With the successful completion of the Singapore desalination project, it was able to seize opportunities for similar projects in water-stressed regions in the Middle East and North Africa. In 2007, it spun off its water assets to a business trust, Hyflux Water Trust (Asia's first pure water business trust) which owned 13 plants in China.

Hyflux had a 31.5 percent stake and was also the trustee-manager operating the water assets held by the Trust, as well as managing its business of asset acquisition or enhancement. Prior to the Libyan deal, Hyflux had an EPC order book worth S\$1.5 billion, as well as 15 operations and maintenance (O&M) contracts generating a recurring revenue stream for the next 20-30 years. It also owned and operated 40 municipal and industrial water treatment facilities in 26 provinces in China. 4 The Business As Asia's most integrated water and liquid treatment company, Hyflux's operations spanned the entire value chain of the water-related infrastructure industry.

(See Exhibit 2, pg. 20 ? Water Industry Flow Diagram.) This included the following: * Design and Development (R&D) Manufacturing of components * System Assembly * Project Management * Operations and Maintenance Since the company's inception, its technological focus had been on the development of treatment systems for wastewater and other liquids, based on the use of membrane technologies. Although membrane technology had been around for some time, Lum was the first to see its potential as an

alternative system to the more conventional method of water purification using filter beds, which required more space and used more energy.

From being a trader and distributor of membrane products for wastewater treatment in the early 1990s, by the turn of that decade, Hyflux was developing its own membranes. This was largely due to Lum's relentless focus on filtration membrane technologies as an innovative and cost effective water treatment solution.

Hyflux first established itself in the 1990s, in the industrial water treatment segment, where it had considerable success in selling its water treatment and wastewater treatment systems for manufacturing plants in China and elsewhere in Asia.

Despite its limited resources during the early days, Hyflux devoted resources for research and development of membrane products and systems to treat wastewater and other liquids that could be applied across a wide range of industries. By the end of 2008, Hyflux membranes and systems had been installed in more than 1, 000 plants in more than 300 locations across the world. (See Exhibit 3, pg. 21 — Hyflux Membrane Systems in Key Global Locations.

) In 2009, Hyflux's core businesses included: 1. The water business: Provision of one stop solutions to industrial and municipal clients in the areas of seawater desalination, water recycling, potable water treatment, wastewater reclamation and raw water purification. * Provision of water treatment operations and maintenance services to municipal and industrial clients. * Lifestyle water filtration and purification products for the consumer market.

2. Industrial manufacturing processes: The use of membrane technologies in manufacturing process streams in the biotechnology, pharmaceutical, agri-food, chemicals, petrochemicals, paper and electronic industries.

3.

Specialty materials: The use of membrane technologies to develop and commercialise polymers and specialty materials from natural sources such as sugar cane and corn. 4. Energy: Development and use of membrane applications in waste recycling and energy reclamation such as oil recovery and recycling, palm oil clarification and biofuel processing. By 2009, with targeted R; D efforts, Hyflux had developed a range of proprietary filtration membrane products with different configurations using polymeric, stainless steel and ceramic materials, expanding its membrane applications to a wider range of industries. See Exhibit 4, pg.

22 – Hyflux Membrane Technology and Applications.) However, in the past several years, it was the global municipal water business that had presented Hyflux with some of its biggest growth opportunities. Lum noted: In the municipal sector, especially in some of these emerging economies we are working in, in China and Algeria, the governments are pump-priming the infrastructure sector to stimulate growth. So, we don't see any slowdown in the water sector.

Not only was Hyflux successful in riding the wave of municipal water projects in Singapore and China (see Tables 2 and 3), it was also winning water treatment projects in new markets such as the Middle East and North Africa. The Libyan deal was not Hyflux's first in the North African region.

Hyflux was awarded EPC contracts for two seawater desalination plants in Algeria, one in Tlemcen in 2006 (worth S\$328 million) and the other in Magtaa in 2008. The company beat contenders, including GE Water, to win the Magtaa project, worth an estimated project value of US\$468 million.

Table 2 Revenue Overview – By Geographical Segment Country| 1999| 2000| 2001| 2002| 2004| 2006| 2007| 2008| Singapore| 2, 450| 10, 916| 11, 219| 23, 902| 9, 117| 27, 018| 27, 623| 31, 248| China| 4, 147| 8, 586| 12, 364| 19, 820| 72, 885| 92, 221| 156, 933| 299, 965| Others| 332| 1, 257| 3, 652| 1, 545| 6, 653| 10, 598| -| -| -| -| -| -| -| 8, 230| 223, 011| Total| 6, 929| 20, 759| 27, 235| 45, 267| 88, 655| 129, 837| 192, 786| 554, 224|

Source: Compiled from Hyflux Annual Reports 2000 to 2008 ASIACASE. COM the Asian Business Case Centre Table 3 Revenue by region and segments (Jan-June 2009)

Revenue by Region	Revenue by Segment	S\$Milion	%	S\$Million	%
China	85	38	Industrial	30	14
MENA	131	59	Municipal	192	86
Others	7	3			
Total	223	100	Total	222	100

Source: Hyflux Financial Results announcement. 2Q09 and 1H09 Results Review.

(2009, August 6). As a result of these two facilities, Hyflux emerged as the largest desalinated water supplier in Algeria, providing more than 30 percent of the country's total capacity. A regional office was set up in Algiers, Algeria, to oversee and manage Hyflux's operations.

In mid-2009, Hyflux had 22 Singaporeans on the Algerian projects, including two women. The company had also moved beyond water treatment into oil recycling ? to collect, recycle, and treat waste oils.

To develop the oil recycling business, Hyflux collaborated and formed joint ventures with major players in Singapore, China, Saudi Arabia, and Vietnam. In the Middle East, in 2007 Hyflux formed a joint venture with SEDCO (Saudi Economic Development Company) and LUBREC (Lube Oil Re-refining Co) to jointly invest S\$45 million in a used oil recycling plant at Jeddah, Saudi Arabia.

This joint venture was Hyflux's first in Saudi Arabia, one of the world's largest (per capita) consumers of lubricants. THE FORMATIVE YEARS In 1989, Lum stepped into the unknown when she decided to be her own boss. She was then a young chemistry graduate living in Singapore with a comfortable job at a multinational pharmaceutical company.

(See Exhibit 5, pg. 23 - Olivia Lum Story.) Armed with a single-minded determination to make it big in the business world, but with little resources, she set up a trading company, Hydrochem (S) Pte Ltd (Hydrochem).

In a business environment that was not conducive to small firms, Lum faced many challenges and uncertainties: In the early days when I was selling industrial water treatment equipment door -to-door, I often wondered whether q were on the right business venture. I rode a motorbike from Jurong to Batu Pahat, knocking on factory doors to sell water filters and softeners. In those early days when doors were constantly slammed, I would tell myself every day when I woke up that this is a new day and there will be better opportunities.

The first break came in 1992 when she secured the rights to distribute membranes and membrane filtration plants for an Israeli company,

Membrane Products Kiryat Weizman Ltd (MPW), in Singapore and its neighbouring countries. 7 While installing these membranes and filtration plants for industrial clients, Lum learnt more about the applications of membranes and membrane filtration technology: I was searching for a solution that could recycle waste, treat it, and be able to produce fresh water at the same time. It must be revolutionary because the traditional method used introduces more chemicals into the water, and further pollutes the water.

So, I stumbled upon a membrane technology in the course of my business and I found that membranes can do wonders, as they are just like our kidneys. This is how I ventured into the membrane business and later on, we had our own research facility. 8 Membrane filtration involved forcing raw water into the membrane filters, causing microscopic impurities to be trapped in the membrane's pores.

Treatment with ultraviolet light killed micro-organisms, and the water that was obtained from the process was of the “ ultra pure” quality that was used in wafer foundries and pharmaceutical plants.

Compared with the traditional water purification methods that relied on filter beds, membrane filtration plants required less land, and consumed less energy. Lum was quick to see the potential of this technology: At Glaxo9, we had a lot of challenge in wastewater treatment, despite the fact that we had put in a lot of money. Even a big company like this finds challenge in treating their wastewater, what about all those smaller companies who can't even

afford to put up a water treatment plant? What will happen to all the wastewater...

they just discharge the wastewater to the natural rivers.

I told myself this might be a sunrise industry. 10 The Move to China Although Hydrochem had some measure of success in the Singapore market, Lum felt that it was too small a market for the product. Furthermore, it was an uphill task for a small company when many large multinational firms were also competing in the same market. She then decided that she “ must open another market”.

11 Her targeted market was China: I could already foresee the environmental effects of pollution, a growing population and growing industrialisation. And if you have a shortage of water, you cannot just manufacture water.

You have to look for new sources or recycle water. 12 Armed with this belief, she gathered 10 of her friends (among them were her former professors from the university), to interest them in a new venture ? the China water treatment market which she had identified as having the most potential. I think at that stage most of us didn't actually understand what her business strategy was going to be but she sold us the idea that membranes could do a lot She knows exactly where one should make money, she loves technology and somehow she can blend both.

I think all of us didn't even think twice at that time. 3 D. Murugasu, COO, Hyflux In 1993, with a little more than S\$1 million from investor friends, Lum set up a small operation in Shanghai: China was (then) just starting out and

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not on the same track as the rest of the world, unlike today. On top of that, she was not familiar with how things were done in China. She must have been really brave to come at that time. Most would not have dared, especially when her business was about the environment and water.

At that time, this was not an issue China was focused on. 14 Chen Bao Liu, Former Chinese ambassador to Singapore.

A few years later, Chinese authorities introduced regulations requiring overseas companies to install water recycling facilities in their industrial plants located in China. Overnight, the demand for water treatment systems among foreign-owned factories shot up. These included Hydrochem's Singapore-based customers who had set up manufacturing facilities in China. Lum reflected: If not for the fact that we had got there earlier, I suppose we would have missed the boat.

15 To save money, Lum placed Hydrochem's job vacancy advertisement seeking engineers, on lamp posts in the vicinity of the company's Shanghai premises.

To her surprise, more than 500 engineers turned up for the first interview. Among them was Ge Wen Yue, Hydrochem, s first employee in China, who later became the General Manager of Hydrochem China in 2001: When I first entered the room for the interview, I was very surprised, not because she (Olivia Lum) was a woman but because she was so pretty and young. She spoke with passion about her company and it was very inspiring. When I first joined the company, my salary was half that of my previous job, but I believed that this company had a future.

Basically, she was our boss and also our teacher (sifu). Our staff then learned the English language and hence could not understand the technical jargon in the English language manuals. She sat down and explained the (various) fabrication processes and procedures to us. 16 Ge Wen Yue, GM, Hydrochem, Shanghai Building and branding Hvdrochem membrane systems expertise To build awareness, the company began developing industrial-sized pilot plants to demonstrate the capability and effectiveness of membrane filtration technology to plant operators.

Between 1995-1996, Hydrochem conducted more than 100 pilot plant trials of membrane applications and water treatment technologies for the pharmaceutical, food and electronics industries. 17 Payoffs from the pilot plant trials came in 1998, when the company began securing orders for larger membrane filtration systems from industrial clients, including a 6, 000 m³ per day river water treatment plant for Ramatex, a textile factory in Malaysia.

Hydrochem also began to offer total systems solutions for customers. The first integrated water treatment system project was in 1997 for an MNC joint venture manufacturing facility in Singapore. Besides installing deionization water systems, water systems for dicing machines, the chemical supply and collection systems and wastewater treatment systems, Hydrochem also took on the distribution piping works from its plants to the point-of-use, including equipment hook-up. This capability to provide hook-up installation services broadened Hydrochem, s range of services and set it on a path as an integrated water treatment provider. Similar jobs were also secured in China in the years that followed.

In 1998, Hydrochem acquired the know-how for another water treatment system known as the Electro- Deionization(EDI) system for chemical-free deionization of water using a component called the E-cell stack, developed by E-Cell Corporation, a subsidiary of General Electric.

As part of an agreement to purchase the equipment, E-Cell agreed to transfer the know-how to build such EDI system. Developing proprietary filtration membranes Hydrochem had been using filtration membranes developed by other companies. However, if it wanted to customise water treatment systems to the needs of its customers, it had to develop its own filtration membranes.

This would give the company greater control over the quality and costs of its product, a key component in the costs of water treatment systems. Help came from Singapore's National Science and Technology Board in late 1998, in the form of an R; D grant for Hydrochem to carry out research on filtration membranes.

In 1999, the company commenced R; D to develop its own filtration membranes and in 2000, it received support from Singapore's Economic Development Board in the form of a three-year grant to help subsidise the salaries of R; D staff.

The first two projects using Hydrochem's in-house manufactured membranes went onstream in 2000. They were: (1) a wastewater treatment of textile dyeing water for a plant in Suzhou, China, and (2) a sewage water recycling project for Singapore's Jurong Bird Park. Breaking into municipal water management By 1998, the company had developed a respectable list of

industrial clients in China, but Lum had set her sights on bigger things: We have established ourselves in China, but we are still a very small company. We know that we can do much bigger jobs.

The big ones are like the municipal jobs where you really serve the entire township and so on.

Going to the municipal jobs will widen our market share. 18 With this in mind, Hydrochem began “ knocking on doors”. One Singapore organisation was piqued by the company’s proposition: So when I saw the mailer that came to my office, my curiosity was aroused because they promised us savings in water consumption, so I called my project manager and said, we should contact this company and find out whether they can actually deliver what they promise. 9 Dr Wong Hon Mun, Executive Director, Jurong Bird Park, Singapore (2005) The Jurong Bird Park, one of Singapore’s major tourist attractions, relied on two sources of water: The first was secondary treated wastewater for watering plants and housekeeping and the second was expensive potable water for the Park’s bird population. Hydrochem’s proposal was to design and install an on-site sewage recycling plant, taking the park’s sewage water, using a hybrid membrane filtration system involving ultra filtration and reverse osmosis, to treat sewage water to a standard comparable to potable drinking water.

The park management was convinced and Hydrochem got the job.

In March 2000 when the sewage water treatment plant started operations, Jurong Bird Park became the first zoological institution in the world to recycle treated water for use by its live exhibits, earning the park management

accolades for its sustainability efforts from zoos all over the world. For Lum, it also marked a major milestone for Hydrochem. This is probably the first time that we used such a big scale membrane system for the recycling of sewage water.

More importantly, it also demonstrated that Hyflux was able to put up a big plant, Hyflux was able to make use of the membrane in a very innovative way. 20 The Municipal Water Market Singapore Flush with the success of the Jurong Bird Park project, and with additional financial resources from its first IPO proceeds and venture capital funds, Lum was ready to move on to bigger projects. Her target was the stream of municipal water initiatives in Singapore.

Water had always been a scarce resource in Singapore. The island state imported most of its drinking water by pipeline from neighbouring Malaysia.

The Singapore government saw the need for new sources of fresh water for industrial and public use as water remained a critical issue, even after it had concluded a water agreement with the Malaysian authorities in September 2001. 21 A densely populated city, with no natural aquifers or groundwater, Singapore historically had to depend on external sources of water supply. These constraints in water supply could have an impact on the country's economic development and was a major factor in shaping its relations with its neighbour and major source of water, Malaysia.

The Singapore government's objective was to build and ensure the presence of robust, diversified and sustainable water from different sources long into the country's future: It is this paranoia about survival into the future and

about trying to solve problems before they arise, or to use a more fashionable word, sustainability, that makes Singapore a city of the future, always willing to challenge conventional wisdom, always seeking to break new ground. 2 Khoo Teng Chye, Chief Executive, Public Utilities Board, Singapore, 2006 To do what was needed to be sustainable in water, the Singapore government was ready to embrace new forms of water technologies and in the first decade of the 21st century, millions were earmarked for investment on water-purifying technologies, including desalination plants to take the salt out of seawater and reclamation of used water, as well as structures to collect rainwater and direct it to reservoirs. Lum was quick to see this as the opening that Hyflux needed to make its mark in the global municipal water market.

However, Hyflux's chances of winning large Singapore government water contracts seemed slim. Many of the world's international water treatment firms were waiting to move into the Singapore market. The world's biggest water treatment specialist, Paris-based Suez Lyonnaise des Eaux, had set its sights on the Singapore market.

Suez Lyonnaise des Eaux had more than 222, 000 employees and was engaged in big-city water projects worldwide. Its water works served an estimated 100 million people.

Other international competitors included Paris-based Vivendi Universal, which employed about 275, 000 people, UK-based Thames Water, which had about 12, 000 staff, and US-based Azurix Corp. 23 Closer to home, Hyflux also faced considerable opposition from two entrenched conglomerates, each possessing extensive expertise in water desalination and infrastructure.

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However, unlike the foreign entities, both Keppel Seghers and Sembcorp Industries possessed markedly lower headcounts, at 19, 947 and 10, 815 employees respectively. Keppel Seghers, a subsidiary of Keppel Integrated Engineering, was Hyflux's main contender for the S\$16 million tender of the flagship Bedok NEWater plant.

Keppel Integrated Engineering itself was part of parent company Keppel Corporation's extensive portfolio of interests. Keppel Corporation was majority-owned by the Singapore Government's investment arm, Temasek Holdings and accounted for revenues over S\$5 billion in 2002, when the Bedok NEWater plant was completed. Sembcorp Industries, also a major interest of Temasek Holdings, provided the organisation's water refinery and water treatment capabilities via its Water division.

At the end of calendar year 2002, Sembcorp Industries reported a turnover of over S\$4 billion, far surpassing Hyflux's almost meagre earnings only slightly surpassing S\$45 million. In comparison, in 2000, Hyflux's employees in Singapore and China totalled 135 full-time employees (with 80 in Singapore and another 50 in China). Its capital base was comparatively small in 2001, with a listing on the Singapore exchange's second board (Sesdaq) underscoring its lightweight status in the international water industry.

Despite these odds and sensing in local authorities a readiness to explore new technologies and cost effective water solutions, Hyflux began laying the groundwork to become a serious contender for future municipal water projects. The Jurong Bird Park project secured in 1999 showed that the company could be successful at low cost but effective municipal water projects whilst the company's single-minded R; D focus on membrane
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technologies and applications reflected a strong commitment to exploring new alternative solutions to problems in sustainable water management.

It also helped that membrane technology could be a cost effective solution for the problems of water reclamation (see Box). The Singapore Water Reclamation Study In 1998, Singapore's Public Utilities Board (PUB) and the Ministry of the Environment and Water Resources (MEWR) initiated a joint study – The Singapore Water Reclamation Study, to determine the suitability of using used water as a source of raw water to supplement Singapore's water supply. This new source of water supply would form one of the Four National Taps for stable and sustainable supply of water in the city state.

The aim was to take secondary treated used water, put it through a treatment process to arrive at NEWater of a quality better than that of the WHO and USEPA Drinking Water Standards.

24 (See Exhibit 6, pg. 24 – Singapore: Four National Taps.) In 2001, PUB invited tenders for the first two plants at Bedok and Kranji. This was the opportunity that Hyflux had been waiting for: I called all my people in and told them if we don't make it for this one, it will take us many years to make it. So we worked day and night to win the contract. 5 Hyflux's proposed system for the recycling plant was an advanced dual-membrane (ultrafiltration and reverse osmosis) and ultraviolet disinfection system, which complied with the rigorous membrane specifications set by PUB.

In December 2001, Hyflux won the contract to supply and install a high grade water process plant (capacity of 32, 000m³ per day) for S\$16. 1 million. The company completed the water reclamation plant in record time

within a year of the contract award. NEWater, the name coined for the output of this water reclamation project received high media coverage and media attention also extended to Hyflux and Lum.

The company went on to win two out of the three other projects awarded by the PUB between 2002- 2003.

The first, worth S\$27 million, was to supply entire membrane filtration system for a raw water treatment plant with a capacity of 273, 000 m³ per day. It became the second-largest membrane-based potable water treatment installation in the world. The other was the third NEWater plant commissioned by PUB with a contract value was S\$27. 8 million. The plant used Hyflux, s in-house developed ultrafiltration membrane system (Kristal 300TM)and produced a NEWater output of 24, 000m³ per day.

6 The Seawater Desalination Project – a first for Singapore and for Hyflux
However, the bigger challenge for Hyflux was Singapore’s first seawater desalination project. In September 2001, the PUB put out for tender, a project to Build, Own and Operate (BOO) a desalination plant that would produce 30 million gallons of potable water daily. The plant would account for about 10 percent of the country’s water consumption and the PUB would buy the water from the operator under a 20- year contract.

Out of 11 tenders²⁷, four were shortlisted – Keppel Fels Energy, SembCorp Utilities, and Tuas Power Limited – all government-linked companies, and a consortium, SingSpring, comprising Hyflux and France-based Ondeo Services, and Ondeo Degremont. Hyflux had earlier teamed up with US-based Mirant Corp, one of the world’s largest providers of electricity and
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energy-related products and services. Lum recalled: We didn't have a track record for building such a huge plant.

So the only way for us to get involved was to partner with somebody.

When Mirant came on board, we thought, finally, we got a company that is willing to partner us and not think we are too small. • • One European director told me he was 'too ashamed, to even bring our proposal to his board - "Hyflux is so small, they would all laugh! '? However in June 2002, six months before the tender closed, Mirant pulled out of the Singapore venture. The fallout from the Enron scandal had affected many US energy companies, including Mirant. Within a month, Hyflux found another partner - French water giant Odeo.

Jean-Marc Langard, marketing director for Odeo Degremont, said: 'We actually looked at seven companies here and thought Hyflux was the best for us. '29 Hyflux's initial stake in SingSpring was 40 percent. However by end-2002, with three contracts worth nearly \$70 million, Hyflux had available funds to increase its stake to 70 percent: Along the way, Hyflux kept getting big jobs and, finally, we decided to take a majority stake as it was a strategic project for us. But it was a miracle - when we first started, we were offered only 20 per cent because Mirant thought it was all we could take. 0 Later, due to corporate restructuring at Odeo, Hyflux bought over the rest of Odeo's stake for a nominal consideration.

The bidders for the desalination project proposed different technologies and water treatment processes, from multi-effect distillation, multi-stage flash distillation, reverse osmosis to hybrid systems. SingSpring, s proposed

technology was based on reverse osmosis and used Hyflux's proprietary filtration membrane systems. SingSpring submitted the lowest estimate of S\$0.78 per m³ of desalinated water compared to Keppel Fels Energy's bid of S\$1.41 per m³.

In January 2003, SingSpring was awarded the desalination project for S\$200 million. The award gave Hyflux the critical mass it needed to compete against international heavyweights like Suez Lyonnaise des Eaux and Thames Water for foreign projects. According to Lum: This is Hyflux's biggest project to date... It will position us to be a strategic player in large municipal projects in Singapore and beyond.

31 For Hyflux, revenue streams from the project included more than S\$100 million for the supply of its proprietary membrane systems as well as a steady income stream for 20 years from the minimum capacity offtake guaranteed by PUB.

In September 2005, the Prime Minister of Singapore speaking at the official opening of the SingSpring Desalination Plant said: Over the years, our water industry has grown into a dynamic and vibrant part of the Singapore economy. Hyflux, the parent company of SingSpring, is one of the leaders in this growing industry. 32 Hyflux had made history in Singapore, as a partner of the consortium that, in 2005, built Asia's largest desalination plant, then also the world's largest seawater reverse osmosis plant. China Hyflux's success in the Singapore municipal projects gave it the credentials to tap into China's huge municipal water market.

In 2004, the company won a contract to develop, design, build, own, and operate China's largest 100, 000 m³ per day seawater desalination plant in Tianjin, the sixth largest city in China with a population of more than 11 million.

In the same year, it also won a contract to build a 50, 000 m³ per day plant in the north-eastern province of Liaoning worth a total of S\$240 million. The company continued to build on its success by offering integrated water recycling and desalination plants in which it had ' strong and differentiated * expertise across many provinces in China.

In 2006 alone, Hyflux secured seven projects in Jiangsu, Jiangxi, Hebei, and Tianjin, totalling RMB 593 million. By 2007, Hyflux had a steady pipeline of 31 municipal projects comprising a total of 39 water treatment plants in China. In 2008, Hyflux secured RMB945 million worth of new water and wastewater treatment projects in the Jiangsu, Shandong, Tianjin, and Hebei provinces. In the same year, it also won five longterm operation and maintenance contracts increasing the number of total operating plants from 11 to 15.

These contracts would generate recurring income for the next 25-30 years.

MENA Hyflux entered the Middle East market in 2004 through a joint venture with Dubai-based Istithmar PJSC the largest property development conglomerate in the Middle East, to develop, own and operate water utility projects in Dubai, the rest of UAE and the Middle East. In 2005, it won S\$103 million contract to design, build and operate a 38, 000 m³/day reverse osmosis seawater desalination plant at The Palm Jumeirah, (the world's

largest manmade islands located off the coast of Dubai) and a 40, 000 m³/day membrane bioreactor treatment plant for Dubai Metals and Commodities Centre.

The projects were expected to come onstream in 2005. Armed with its experience in the Middle East, Hyflux next moved into municipal markets in Algeria and Libya in North Africa. THE GLOBAL WATER MARKET Municipal and Industrial Market Globally, 1.

2 billion people in 2006 lacked access to clean drinking water, and the United Nations indicated that by 2025, water scarcity could affect close to 40 percent of the world's population, a high proportion living in Asia. The region had become increasingly affected by growing water scarcity, water pollution, the increasing pace of economic growth, as well as population growth.

China China accounted for 22 percent of the world's population, but it was endowed with only seven percent of the world's freshwater. The Ministry of Water Resources predicted that by 2030, per capita water resources among China's projected 1. 6 billion inhabitants could fall to 1, 760 m³ per capita, nearing the water stress benchmark of 1, 700 m³ per capita.

By 2015, China was expected to have over 109 cities, each with a population of more than one million, placing enormous demands on the supply of urban water services.

The Ministry of Water Resources indicated that 400 of China's 660 cities had insufficient water supplies, and that 100 of these cities faced extreme water shortages. China's water consumption was expected to reach 1, 068 billion tons by 2030, fuelled by strong industrial demand growth. In addition, there

was increased demand by residential consumers, due to the country's rising middle class as well as rural migration patterns into urban centres. The total amount of wastewater discharged stood at more than 70 billion m³ in China in 2005 – industrial wastewater made up about 60 percent, while domestic wastewater contributed the rest.

The treatment rate was about 40 percent with the rest discharged untreated.

The State Environmental Protection Agency of China estimated that the country would need to invest US\$50 billion to build 10,000 wastewater treatment plants just to reach a 50 percent treatment rate. The aim of China's 11th Five-Year Plan (2006-2010) was that by 2010, all cities and seats of county governments would have wastewater treatment facilities with a treatment rate of not less than 70 percent. By then, investment in urban water supply and urban wastewater segments were expected to be RMB143 billion and RMB330 billion, respectively. ³³ Global Water Intelligence estimated China's desalination market growing 160 percent between 2005 and 20¹⁵. ³⁴ A number of global multinationals such as Suez, Veolia, and Thames were active in both municipal and industrial markets of the Asian water sector.

An increasing number of small and mid-capitalisation water companies such as locally-listed Beijing Capital, Tianjin Capital, and Guangdong Investments as well as Singapore-listed Bio-Treat, Epure, and Sinomem, had also moved into these markets. (See Exhibit 7, pg. 5 – Hyflux Competitors.) MENA According to Arab Water World, MENA had five percent of the world's population with less than one percent of the world's available freshwater resources. ³⁶ In 2008, average per capita water availability in the region was <https://assignbuster.com/strategy-manager/>

about 1, 200 m³ per year while the world average was close to 7, 000. By 2025, the regional average water availability was projected to be just over 500 m³/person/year.

According to the World Health Organization, Algeria was “ water stressed” at below an annual availability of 1, 700 m³ of clean water per person. 6 The total value of water and wastewater projects planned for the MENA region over the next decade was approximately US\$120 billion. India The Indian water market was estimated to be worth about US\$1 billion per annum in 2008 (split equally between water provisioning, municipal water treatment, and industrial water treatment) and was expected to grow 15-20 percent annually. India, with a billion-plus population and economic growth rates of eight percent, was on the verge of a water crisis. Several areas, including some of the most densely populated and economically productive, were already experiencing a water crisis.

By 2020, India’s demand for water was expected to exceed all sources of supply. 37 Desalination Market In 2008, there were more than 13, 000 plants operating in over 120 countries globally, producing about 12 million gallons of water per day. However, this made up a mere 0. 4 percent of world demand. The MENA region was expected to invest US\$30 billion in desalination projects by 2015, which would comprise more than 60 percent of the world’s desalination plants.

Saudi Arabia, the largest market for water and wastewater in the region, was expected to invest US\$28 billion by 2018, of which approximately US\$6 billion will be llocated for building new desalination water plants. (See Exhibit

8, pg. 28- Top 10 Desalination Markets and Companies.) INNOVATIONS IN MEMBRANE TECHNOLOGY Lum, s role as a technopreneur adept at combining business and sustainable development was recognised in 2009, when she was ranked by Sunday Times, UK, as among the world's 100 richest eco- pioneers: For many years, she has been at the forefront of driving both R; D and the commercialisation of technologies that address some of the world's most serious environmental threats. 8 Howard Shaw, Executive Director, Singapore Environment Council Lum saw membrane technology as the key to growing Hyflux's water treatment business: Our core business lies in the development and application of membrane technology. We firmly believe that the only way to maintain a competitive edge in business is through improving membrane technology and its innovative use in new markets.

With the flexibility that comes from the continuous development of our proprietary membranes, the market potential is enormous. 39 However, R; D activities were costly and challenging for small start-ups with limited financial resources.

From the very beginning, she focused Hyflux's R; D on the development of membranes for use in water treatment systems for manufacturing plants and later, municipal water projects. In essence, whatever R; D work that was done, had to dovetail with the firm's business strategies. The journey to build a solid capability in membrane technology for use in water treatment systems and applications began when Hydrochem started operations in China in 1993.

Many manufacturers in need of treatment solutions were unhappy with the conventional water treatment and wastewater treatment plants, as they were both expensive and took up space.

They wanted something small and compact which would also save costs and Lum saw membrane technology as the answer but the only problem was: During that time membranes were so expensive, unavailable, and (the technology) so immature. But if you promote something that is so mature and available, where is your added distinct advantage? 40 Once in China, Lum was quick to leverage on the ready pool of low-cost engineering talent, 41 and soon Hydrochem's small team of engineers led by their sifu and boss, were working on cost-effective solutions for manufacturing plants looking for cheaper ways of treating water for their plant processes as well as to manage wastewater coming out of the plants. Through these early R; D efforts, the company developed processes using membrane filtration technology for removing protein from fermentation broths in pharmaceutical plants, and became the first to introduce this application to industrial customers in China. Hydrochem carried out more than 100 industrial plant- size pilot projects with membrane applications and water treatment technologies in the pharmaceutical, food, and electronics industries in China and elsewhere in Asia. 2 While they were meant to build awareness of the effectiveness of membrane filtration technology among potential clients, they provided the firm with ready test beds to further discover and fine tune the attributes of a wide range of membrane filtration systems.

The company also sought and received grants from the Singapore Government to further their R; D activities. The first grant in 1998 was for

Hydrochem to carry out research on the purification of industrial water as an alternative source to city water for industrial use and on the ozonation method for the treatment of dye effluent and refractory organics.

Hydrochem worked at developing its own proprietary membranes and by 2000, it had a team of six fulltime R; D staff, headed by a scientist with a PhD in Chemistry. 43 The focus of R; D activities was on the development of hollow fibre membranes, pilot studies for water treatment systems, feasibility studies, and the trouble-shooting of membrane separation systems to improve their performance in various applications. 44 Membranes were configured differently, in order to obtain maximum exchange surface per unit volume, while limiting circulation polarisation and particle deposits by providing a sufficient flow of treated liquid.

In part, this R; D work was facilitated by a three-year grant from Singapore's Economic Development Board to help subsidise the salaries of its R; D staff.

In the same year, the company also began developing in-house membrane manufacturing capabilities. Lum explained: The technology to produce clean water has been around for some time. The challenge going forward is to produce the cheapest water. 45 To improve water treatment systems and operations, the R; D team also researched on ways of optimising instrumentation and controls (see Table 4).

In October 2003, Hyflux collaborated with Singapore's Nanyang Technological University's Environmental Engineering Research Centre in water treatment research using membrane technology.

The collaboration would allow Hyflux to tap on the centre's staff and equipment – some of these equipment could cost hundreds of thousands of dollars to purchase. Table 4 Hydrochem R; D expenditure (prior to listing on Singapore Stock Exchange) Year| Expenditure (S\$)| FY1997| 131, 000| FY1998| 191, 000| FY1999| 387, 000| 10 months ended| 357, 000| 31 October 2000| | Source: Hyflux IPO Prospectus 2001.

Hyflux invested S\$6.1 million in R; D in 2003 and in the following two years, it set aside five to eight percent of its total revenue for R; D activities. In 2004, in line with the goal of developing Singapore into a global hydrohub, Singapore's Economic Development Board supported a Hyflux initiative to launch an advanced membrane and materials technology R; D Centre in Singapore – the largest in Asia outside Japan. EDB saw this as part of its strategy to spearhead the development of cutting edge technologies in water and environmental engineering.

6 The centre had more than 10 research labs, including a knowledge centre, an innovative process development centre, a novel materials and membrane products development centre as well as advanced machining, prototyping and industrial design functions. By 2005, Hyflux had more than 100 R; D staff comprising 50 research scientists and engineers. 47 Research, development, and production of membranes were also carried out by Hyflux in China through its 55 percent-owned subsidiary, Hangzhou Zheda Hualu Membrane Engineering, providing access to a larger pool of R; D talent.

Collaborations with local and foreign academia and research institutes continued to complement and strengthen Hyflux's membrane researches. In

April 2005, Hyflux signed an agreement with the National University of Singapore to collaborate on research into membrane and materials technology.

In 2006, Hyflux secured an exclusive license to manufacture cutting edge ceramic hollow fibre membranes with the right to sell the membranes worldwide (except Europe) through the acquisition of a 51 percent equity in CEPAration B. V. for 1.5 million euros – a leading Dutch technology institute which owned eight patents in ceramic membrane technology.

The Dutch company's award winning InoCep™ membrane was reputed for being effective and environmentally friendly for a wide range of nonwater industries. In January 2009, Hyflux acquired the remaining shares of its partners in the Dutch joint venture, CEPAration B.

V. , for S\$1.6 million and the Dutch company and its European subsidiaries became part of Hyflux's global platform for membrane technology development and applications. 48 Six months later, at the International Water Week in Singapore, Hyflux CEPAration launched its second generation InoCep™ hollow-fibre ceramic membrane.

This membrane was capable of sustained filtration at temperatures of up to 120°C and could withstand the full range of pH values, whereas existing membranes could only withstand temperatures below 100°C and a smaller range of pH values.

These characteristics made the membrane ideal for solving separation problems for a wide range of industries, from steel mills to food and beverage to biopharmaceuticals. 49 In 2009, Hyflux signed two agreements

for technology collaboration. The first was with Swiss engineering company-Zurich-based ABB. Under a S\$40 million deal, ABB would provide power to a seawater desalination plant in Algeria.

ABB's energy efficient technologies and solutions could help increase the energy and operational efficiency of Hyflux's water processing plants. The second was a collaboration with the Dutch Technology Foundation ? STW, to jointly fund a three million euros (S\$6.

1 million) partnership research programme on advanced membrane separation technologies. STW Partnership Programs were aimed at fostering collaboration between academic and industrial researchers. In April 2009, STW invited scientists in Dutch universities to submit research proposals for Hyflux projects in the area of ceramic and hybrid membranes for various applications. 0 The programme was expected to last two to four years, and Hyflux's role was to commercialise the research work. As Hyflux charted a new course for itself in the areas of water treatment and membrane technologies, global competition was steadily gaining momentum.

In 2009, General ? ectric's Power and Water Division launched its proprietary ZeeWeed™ Membrane Bioreactor (MBR) system that combined proven ultrafiltration technology with biological treatment for water purification.

Similar to

Hyflux's membrane technology, GE's technology allowed scalability of the MBR systems according to the needs of the client. Other competitors in this sector included Canada's UV Pure, which relied on ultraviolet technology to treat water, featuring a proprietary self cleaning mechanism that allowed it

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to operate effectively regardless of the mineral content of the water being processed. FORAY INTO THE CONSUMER MARKET In January 2003, Hyflux unveiled a US\$4.75 million deal with California-based Air 2 Water Inc (A2W) to bring out a 'revolutionary water-making apparatus,- later named 'Dragonfly'.

The new product extracted water from humidity in the air and provided 'a safe, convenient, economical, unlimited source of water,. Hyflux formed two joint ventures with A2W in Singapore to sell the new water-making apparatus. The new companies owned exclusive manufacturing and marketing rights covering almost the whole of Asia: Southeast Asia, China, the Indian subcontinent and Australia. 51 By July 2003, the company had received orders for 20,000 units both from within the region and outside ? including Australia and as far away as the Caribbean and Mexico.

In China, Hyflux appointed giant electrical appliances maker, Haier, to be its contract manufacturer for the Dragonfly. According to Lum: Nobody knows the chemistry of water better than Hyflux and we have the membrane technology that can be miniaturised for home use.

I see great potential in the home consumer market. 52 The consumer market segment contributed S\$3 million to sales in 2003. 53 Over the next five years, Hyflux incorporated both proprietary and licensed technologies into a suite of consumer products, from the Dragonfly appliance to contemporary water filtration appliances for home and office use.

In 2007, Hyflux signed an agreement with Marmon Water LLC, one of the world's largest manufacturers of residential and commercial water treatment

systems, to set up a joint R; D centre in Singapore and a manufacturing facility in China. The two firms also signed twenty-year licensing agreements for the use of each other's technologies to complement product offerings and develop new water treatment and filtration products for the Asian market.

However, by 2008, the revenue contribution from consumer products became insignificant as it was dwarfed by contributions from the municipal projects.

HYFLUX – PEOPLE AND ORGANISATION Hyflux's phenomenal growth had been and continued to be grounded on a wide array of innovations covering membrane technology and its applications, engineering design and systems integration. According to Lum, " In business, you can never stay put no matter how successful you are. People can catch up with you at anytime". 54 Hyflux's vision was " to be the leading company that the world seeks for innovative and effective environmental solutions". Among the key values espoused by the company: * **Boldness:** Dare to dream, dare to do, and dare to excel.

Entrepreneurship: Nurture the entrepreneurial spirit, embrace challenge, and master change. * **Satisfaction:** Exceed internal and external customer satisfaction, take pride in work, and deliver excellence. * **Testimony:** Be the face behind the brand, excel in business conduct, and embrace best practice in corporate governance. This philosophy made Lum drive her people hard, and herself even harder. She admitted that she was a hard taskmaster and that her staff called her ' pressure cooker': Since day one, I have been moving very quickly. Our people understand the pace? 5 She expected

design work for a typical new product, for instance, to be completed within two weeks, during which the team had to report to her every two days.

The time needed for a product to reach the market was about six months, but she thought this was not good enough as some large companies could do it in three months. You must embrace this passion, you must enjoy this pressure. When you wake up, you must be happy thinking about going to work. If you can't have that feeling, then forget it. " I try to push their abilities to the limits.

I tell my people, I, m trying to expose your best performance.

If you can't go beyond that, then let's stop there. But before that, let's explore the limits. 56 As the person whose vision for the company had inspired many to follow her lead, she played many roles – entrepreneur, CEO, technology visionary as well as the public face of the company: People say I seem to be the only one running the company. That's not true. I have a whole throng of people helping me. A company is like a caterpillar.

You have the head moving, but the legs must be moving together too. 7 Since the early days in Shanghai when Lum doubled as sifu to the first Chinese engineers recruited by Hydrochem, training had been the key for building the critical knowledge, skills and competencies required to grow the business, based on the entrepreneurial development of considerable expertise in membrane technologies and its applications: When you just buy off the rack, anyone can do the same, so where is your competitive advantage? 58 Knowledge transfer was critical and engineers were carefully matched with appropriate mentors to impart technical knowledge on the job.

In-house seminars were conducted regularly by the various heads of departments to keep everyone updated in their area of work. A multi-disciplinary approach was also adopted by rotating staff to different departments to enable them to acquire skills in at least two different disciplines. Staff from Shanghai were occasionally posted to Singapore to learn from the senior engineers to enhance their working experience.

Engineers from Singapore were also sent to China for job exposure and to help train their counterparts there.

In order to keep technicians and engineers abreast of new developments and technologies in the field of water treatment and advanced membrane filtration, senior engineers and technicians were sponsored for external courses conducted by local institutions such as the Environmental Engineering Research Centre (EERC), Ministry of the Environment (ENV) and Environment Technology Institute (ETI). Senior engineers were also sent overseas to attend international conferences and seminars to enable them to exchange information with other experts. 9 Many of Hyflux's professional and technical staff were from China where a major proportion of the company's jobs were located (see Table 5). As Hyflux projects moved further afield, Hyflux staff had to venture out to work in unfamiliar terrain on jobs in the Middle East and North Africa. This was especially so for those in systems integration, project management and business development.

Table 5 Human capital | Global Headcount Country| 2004| 2005| 2006|
Singapore| 229| 404| 433| China| 164| 248| 343| India| 0| 9| 20| Middle East|
2| 21| 1| Total| 465| 682| 797 ! | Source: Hyflux Ltd. Annual Report 2005 and 2006.

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Thus far, attracting the right people had not been a problem at Hyflux. Despite the punishing pace, staff turnover was reported as only three to four percent. 60 From 135 full-time employees in Singapore and China in 2000, Hyflux's workforce grew to 1, 228 at the end of 2007 and increased almost 50 percent a year later, to 1, 899 employees in 2008. FINANCIAL MANAGEMENT In early 2001, Hyflux raised S\$6.

8 million from its IPO on Sesdaq, the second board of the Singapore stock Exchange. This was followed by three rounds of share placements which raised almost S\$30 million between 2001 and 2002.

In January 2003, through a private share placement, Temasek Holdings, a Singapore government-owned investment company, bought 11. 8 million new Hyflux shares at S\$1 per share. This was after the Hyflux- led consortium was awarded PUB's desalination plant project. Hyflux announced that the proceeds would be used to fund acquisition of new technologies.

61 However, in January 2004, Temasek pared its stake in Hyflux from five percent to three percent. 62 In 2002, Hyflux made it to Forbes Global magazine's list of the world's 200 best small companies and the company moved to the main board of the Singapore Exchange in April 2003. 3 With its entry into the municipal market, Hyflux wanted to balance its revenue from the project-based EPC business with revenue from operations and maintenance (O; M) business which offered regular income streams through the management of plant operations. In 2005, Hyflux adopted an asset-light strategy with the divestment of 50 percent of the SingSpring Desalination Plant at Tuas, the sale and leaseback of Hyflux Building, and the formation of a joint venture, SinoSpring, to invest in Build-O