Water Services for the Petrochemical Industry
Beijing Yanshan Petrochemical Complex
First Six Years of Operations
2006 – 2012

yansan VEOLIA

VEOLIA WATER

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About Veolia Water

Veolia Water specializes in managing water and wastewater services for public authorities and industrial clients throughout the world, delivering bespoke solutions that are adapted to the local context of every client served.

Standing at the heart of the water challenges facing the century, Veolia Water contributes to the responsible management of the whole water cycle by upholding the principles of **Service, Value and Responsibility**.

SVR
Service Value Responsibility

Service

Veolia Water strives for continuous improvement and optimization of its services by looking at every detail, pooling and transferring its worldwide expertise, modern tools and technologies into efficient operations management in the local context.

Sharing of experience and know-how among its global teams brings continuous innovation in Veolia Water's services. Such innovation in service excellence extends to all areas, for example, water treatment, water usage optimization, technological solutions, asset management, energy efficiency, health and safety and environmental risk management.

Value

Huge potential value exists in water and wastewater. Veolia Water leverages this value for the benefits of its clients and the future generations by combining its technological know-how and wide range of expertise and extracting the most out of valuable resources. For example, biogas is recovered for energy generation; wastewater is treated by stringent processes to become reusable and recover by-products; seawater is also treated to be used in industrial processes or to become drinkable water.

Responsibility

Veolia Water achieves one of its core missions to be a socially and environmentally responsible organization by embracing the needs of society and the environment in all its activities.

From reducing the carbon footprint in its operations to raising awareness through educational programs, or internally through emphasis on health and safety, strong human resources values or encouraging diversity through collaborating with the community, Veolia Water always strives to maintain its identity as a responsible corporate citizen.

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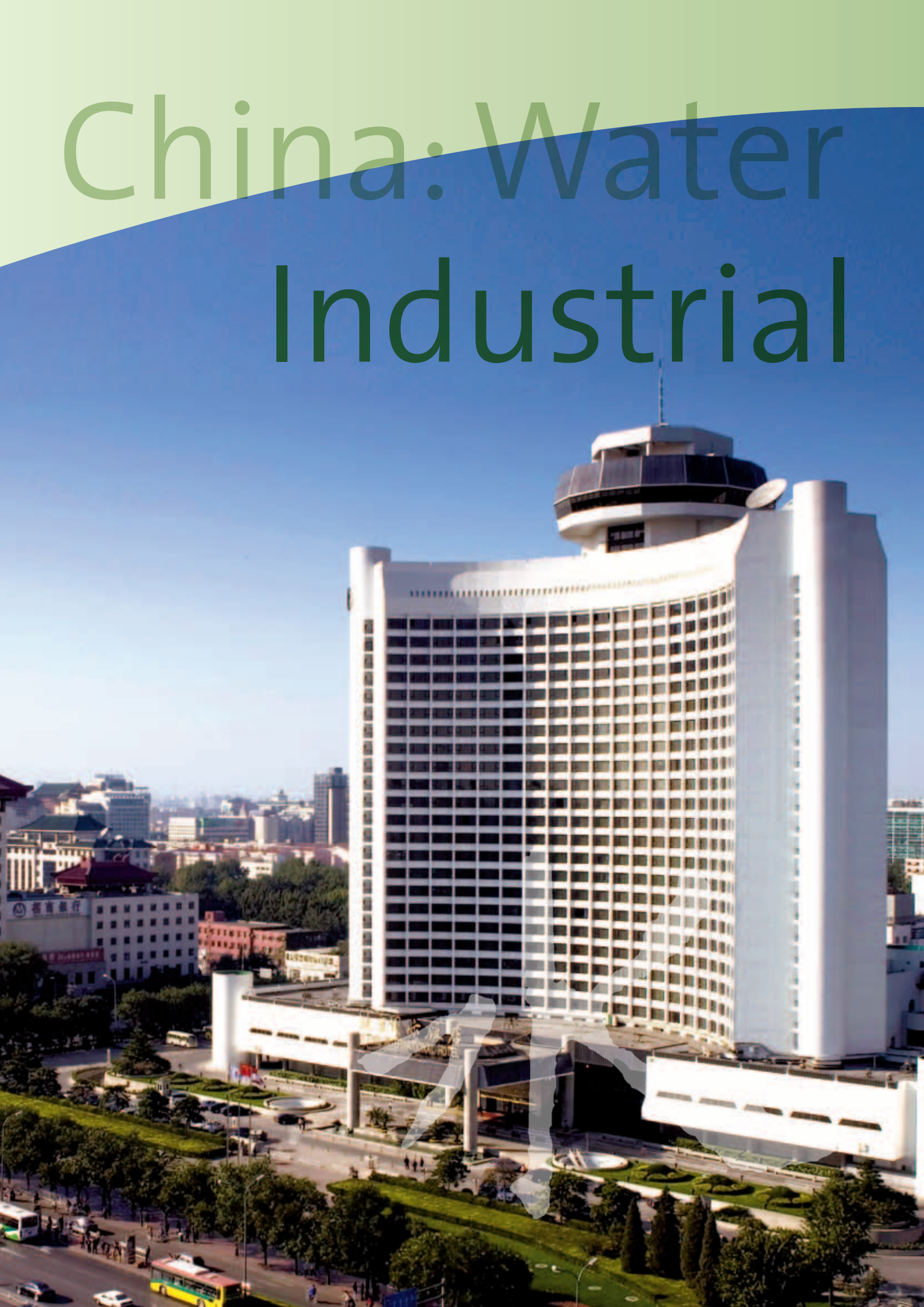
China: Water Industrial



for Growth

China's unprecedented economic growth in the past decades has spurred the country to become one of the world's major economic powers with the greatest potential today. Given its rapid urbanization, demand for higher living standards and strong requirements for consumer and luxury goods, not only has the pattern of domestic water use been altered, China's industrial use of water and wastewater management has also undergone significant changes. Prudent water and wastewater is important to sustain the industrial growth of the country. While pursuing economic development, China is committed to minimize the impact on water resources by implementing efficient water-management strategies and new technologies.

Changing China – responsible water management is essential for its industrial competitiveness

Just as water is vital for life, it is also essential for the development of China. It is needed to fuel the country's ongoing economic and social growth.

With its 1.3 billion-population, China is one of the world's most populous nations and needs to strategically tackle the pressing issues arising from the increasing demand for reliable water sources. To meet this need in the most sustainable manner, an efficient water management system is required and the private sector is playing an increasingly important role.

Sustaining agriculture and industrialization with water

Today, water is no longer only vital for China's huge agricultural sector, industrial usage of water is also very crucial to economic growth. The industries that are being developed in China, such as iron and steel, automobile, food processing, petroleum refining and production, rely a lot on water in their industrial processes.

According to US government data, from 1949 to 1998, China's agricultural water consumption fell from 97% to 69%, whereas industrial water consumption rose from 2% to 21%. Aggressive modernization and urbanization in every city in China, from now till the coming decade, is a huge challenge to secure a sustainable and reliable water source.

Water challenges

Despite China having significantly improved its water and wastewater infrastructure, availability of fresh water is still under scrutiny. According to the World Bank, China's per capita availability of water is 1/3 of the world's average. Given its high-speed industrialization and urbanization, China may face water shortage problems if the country's use of water is not properly managed.

Rapid industrialization requires higher water quality

While efforts have been made to reduce water consumption by different sectors, China's break-neck industrialization is also increasingly demanding higher quality water as industries have changed from resource-based to high-tech, knowledge-based. Requirements for process water treatment as well as specialist treatment processes are more stringent than ever for even the tiniest pollutants can cause damage to fragile and state-of-the-art equipment.

Continuing to be one of the world's major economic powers, China's growing industrialization will require ever-more sophisticated industrial water systems that produce purer water, and at the same time, enable water conservation.

Applying more sophisticated technologies to treat industrial wastewater

The composition and quantity of industrial wastewater have also changed under China's accelerating industrialization, requiring advanced wastewater treatment processes and solutions to achieve both sustainable economic growth and water resource protection. The change of industrial wastewater discharge standards made by many provincial governments in the past years to reduce the target COD level has demonstrated the commitment and leadership from government and state levels.

Industrial wastewater is often contaminated with various chemicals, metallic elements, ammonia, as well as gasification products, complex organic compounds, hydraulic oil, acids, and biodegradable waste. If properly treated, a significant portion of wastewater can be reused within the industrial plants, reducing the water consumption and achieving higher water efficiency.

To reach the goal of green industrialization, China will continue its industrial development full steam ahead while vigorously exploring better treatment technologies to obtain optimal water reuse and minimize raw water consumption.

New era of environmental consciousness

China has been taking up steps and measures to address environmental issues arising from its aggressive urbanization and industrialization. In the past decade, reforms of the water and wastewater sectors have been carried out to reduce pollution and enhance the environment.

Significant steps to reform wastewater management

China revised its Water Resource law in 2002, addressing its water and wastewater situations as well as environmental challenges. The legislation requires all cities in China to construct wastewater treatment facilities, which include wastewater collection systems, wastewater treatment plants and sludge disposal systems. Furthermore, the government also strongly encourages wastewater facilities at municipal level to open up to private sectors and foreign expertise.

Lending foreign water expertise to help industrial growth

Following China's open-door policy to allow public-private partnerships in the water sector since the late 1990s, there has also been a rise of Sino-foreign joint venture enterprises which recognize the benefit of having foreign expertise to manage their water and wastewater systems in order to optimize both water and operational efficiency at industrial plants and attain water sustainability.

Through partnership with foreign water specialists, these Sino-foreign joint ventures benefit from technical and operation know-how of the foreign private sector, raising necessary capital to build an effective infrastructure, saving resources for their own core business development and reducing operating costs through efficiency.

Carried out responsibly, this outsourcing business model provides a strong framework for water supply and wastewater management, being mutually beneficial for both local and joint venture enterprises, and allowing private companies to contribute their expertise to the water industry.

Establishment of Ministry of Environmental Protection increases the awareness of water quality

China has stepped up its commitment to the environment with the establishment of a new Ministry of Environmental Protection (MEP) in 2008. The new ministry joins the top-level decision-making body of the People's Republic of China, the State Council, to elevate the importance of environmental issues in the political and policymaking domain to the same level as agriculture and industry. It replaces the State Environmental Protection Administration (SEPA) in a strategic move to ensure the government's over 100 environmental policies are thoroughly enforced. The ministry may also take control of the green responsibilities of other ministries.

For China's entire water sector, the establishment of the MEP marks a major enhancement of China's water industry, where the water sector will now be regulated by five authorities rather than six, responsibilities will be re-designated, and the new ministry will have strengthened authority to deal with companies breaching wastewater management regulations or otherwise contaminating water supplies. With greater autonomy, the MEP will tighten water regulation in light of the seriousness of water conservation issues, as well as industrial and urban wastewater to boost China's environmental performance and better balance rapid development.

Enforcing environmental policies

With the establishment of the Ministry of Environmental Protection (MEP), environmental legislation is enforced via the means of discharge fees, surcharge fees, fines and administration sanction, and tightened regulations.

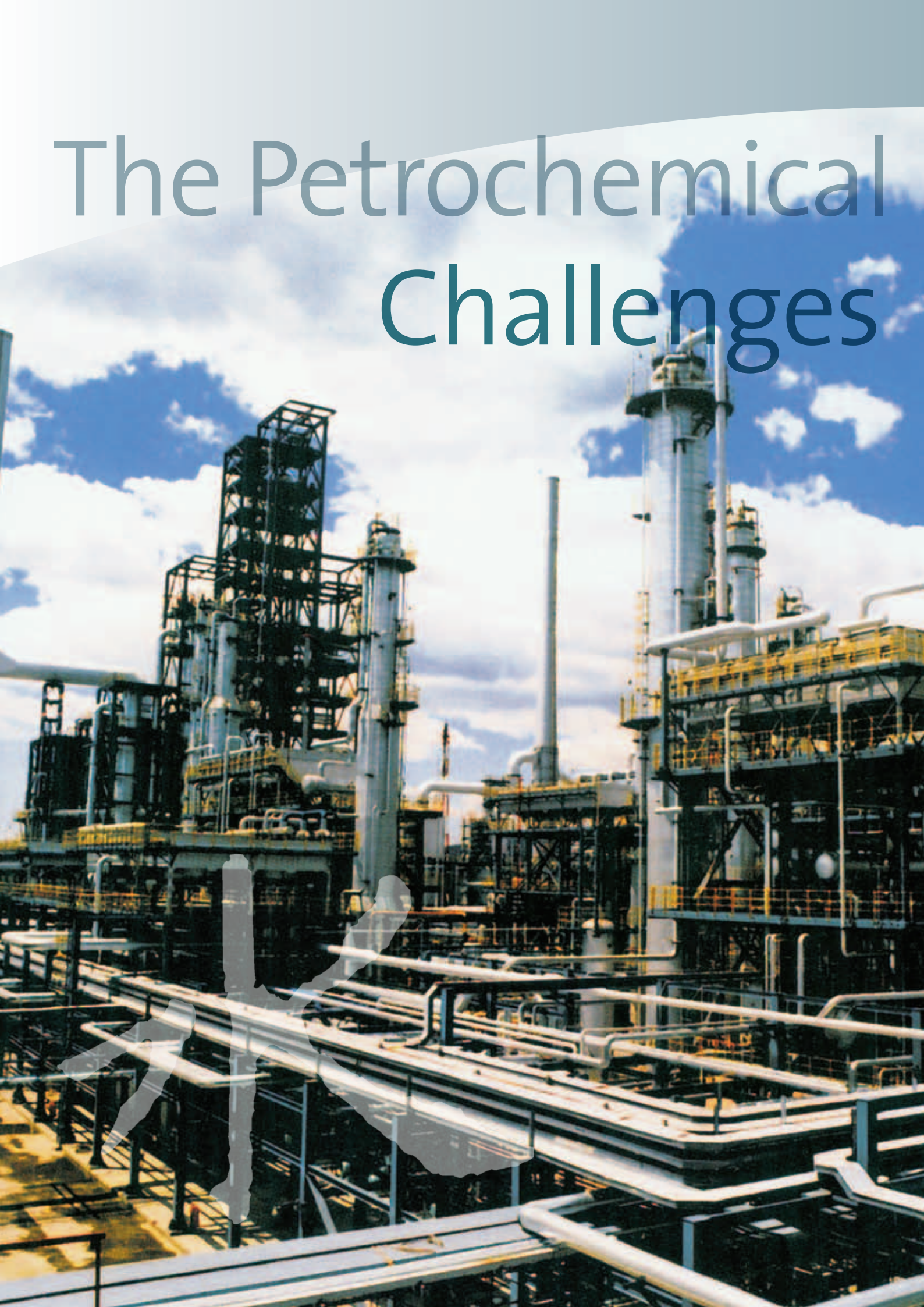
Stringent discharge standards are also established specifically for industrial wastewater, stipulating the parameters that industrial plant operators must abide by. Additionally, local regulations also limit the noise, smell and odors that an industrial plant can generate with the aim to minimize the adverse effects of industrialization.

Intermediate water – Environmentally-responsible and innovative water solutions

To relieve the pressure on water resources and ensure a stable water supply, many industrial operations in China have started to purchase intermediate water from the Municipal Government for their industrial use at sites.

The use of intermediate water recycled from wastewater is one of the major steps towards sustainable water management during China's industrial development. It can decrease the diversion of fresh or sea water from the sensitive ecosystems and reduce discharge to already-overloaded water bodies. It enhances overall water availability, conserving vital water sources.

The Petrochemical Challenges



Industry – for Water

China's petrochemical industry became one of the country's largest industries in the 1980s as Sinopec consolidated its hold on the domestic market and then looked abroad for expansion. Now ranked 5th on the Fortune 500 global companies list, the state-owned Sinopec is a major international player. With the dramatic change in China in the past decade, the country now has the biggest petrochemical market in the world, with ethylene being one of the major products in demand. While China is a mass importer of petrochemicals, its own production facilities are rapidly growing. As the industry continues to develop, so too does its need for water, a critical component in the production of petrochemicals. From the pure water needed to produce high-pressure steam in petrochemical power plants to the wastewater that is required to be treated to an environmentally-safe standard and be used as reclaim water for greater operational and water efficiency, the efficient reliable management of water underpins the industry.

Water is essential for petrochemical production

Petrochemical products are part of our daily lives. They are found in things we use every day such as towels, food containers, clothes, building materials and transportation vehicles. Ethylene is the most widely-produced petrochemical product globally and a benchmark for measuring industry competitiveness. Apart from ethylene, other basic petrochemical products include Propylene, Butadiene, Benzene, Toluene and Xylene. These products rely heavily on water for their production. Any halt in the supply process of water has the potential to disrupt the core petrochemicals production process, incurring significant business losses.

Water uses at a petrochemical complex

Cooling water: Operating cooling water recirculation systems with optimal quality

Cooling water is required in petrochemical complexes to remove waste heat to the atmosphere. This is often achieved through the operation of cooling towers which remove heat, from machinery or heated process material, absorbed in a plant's circulating cooling water systems. In many petrochemical complexes cooling water circulates from a cooling tower to a heat exchanger where heat is transferred continuously.

Without cooling towers to generate a recirculating system of cooling water, plants would require a significantly higher volume of cooling water, all of which would have to be continuously returned to natural waterways and continuously re-supplied to the plant – having a negative effect on the environment and operational efficiency.

Because cooling systems and petrochemical process units can be easily damaged by scale, corrosion, biofouling and suspended solids, cooling water must be specially treated to be free from certain impurities such as salt, which is highly corrosive, and calcium.

Demineralised water: Producing boiler and process water for petrochemicals production

Demineralized (demi) water is also critical to petrochemical complexes. It is water of chemically very pure composition, purified by passage through a bed of ion-exchange resin or membrane separation which removes mineral salts.

Demi water, used as boiler water, in the petrochemical industry is used to produce high-pressure steam to drive turbines which generate electricity in the power plants. Because of their energy-intensive requirements, petrochemical complexes have their own power generation plants, unlike other industries. Any impurities in the boiler water can damage the turbine, disrupting the entire petrochemical process. Hence demi water, which meets strict purity specifications, must be used.

Reclaim water: Using advanced technology to recycle water for sustainable reuse in operations

Reclaim water is increasingly important and widely used for petrochemical plants. Tightening effluent regulations and increasing need for reuse of treated water have generated interest in the treatment of wastewater with advanced technologies that allow water to be reused.

One of the most sophisticated and effective methods to produce pure reclaim water suitable for reuse, particularly for cooling and boilers, is through using a dual membrane approach of ultra filtration and reverse osmosis where dissolved inorganic solids (such as salt) are removed from the wastewater under high pressure through semipermeable membranes.

With environmental forecasters painting a bleak picture of water supplies for the near future, industry players are actively seeking alternatives to quench this possible thirst. Reclaim and reuse can bring a new life to used water. It can help reuse vital water resources while attaining a more stable and reliable provision of water. Its cost-effectiveness is highlighted by the consideration of operational savings generated by consumption and discharge reduction.

Wastewater: Treating wastewater before discharge to minimize environmental impacts

Wastewater discharged from petrochemical plants has dramatically increased in recent years as the industry has grown at a global level. Wastewater from petrochemical production processes typically contains soluble and non-soluble metal compounds, as well as oil and organic materials, which are contaminated and harmful to the environment. With the heightened awareness of environmental issues, many governments around the world are imposing increasingly stringent restrictions to encourage companies to treat and reuse wastewater.

Gradually becoming an industry trend and requirement, wastewater is now commonly being routed through the facility wastewater treatment system before being discharged. Techniques for treating industrial process wastewater are now not limited to streams segregation and specific pretreatment for reduction in ammonia and toxic organics, but also include more advanced treatments such as metals removal and recovery, removal of recalcitrant organics and the reduction in effluent toxicity.

These sophisticated treatment processes enable wastewater to be treated to an environmentally-affordable level and even to be used as recyclable water for manufacturing purposes.

Changing water management for a changing country

China has emerged as the biggest petrochemical market in the world. Petrochemical demand growth is closely associated with the economic growth of a country, and China is the fastest growing economy in the world. While most petrochemicals are imported, there is an ever growing domestic production trend.

Over the past few years, the Chinese petrochemical market has gradually been integrated into the global market and as a result it is now significantly affected by what happens in that global market. Ethylene and other downstream products manufactured in the Middle East will be increasingly sold in the Chinese market. The importation of petrochemicals from Japan and South Korea, which already account for more than 40% of China's petrochemical imports, will be accelerated in the coming years.

Only recently have Chinese petrochemical companies seen the advantages of entering into joint ventures to outsource their water process systems and the benefits it can bring. As China's domestic production of petrochemicals continues to grow there will be an increased need for strategic alliances which will allow petrochemical plants to focus on their core business while receiving stable, high quality water services which bring enhanced water quality, process optimization, innovation and global best practice.

Wastewater treatment and water reclamation is a top priority for industrial users in line with transforming process technologies, growing domestic demand, stricter water quality requirements and tightening environmental legislation. Industries such as the infrastructure and construction industry, packaging industry, textile industry, automotive industry and the consumer goods and electronics industry, which all depend on petrochemicals, are driving the Chinese economy.

To meet these increased government environmental parameters to improve water recycling and to improve processes, it is important that companies like Sinopec seek foreign expertise and enter into joint ventures so that they continue to improve their water process systems across the country as they rapidly modernize to meet the needs of the Chinese economy in the 21st century.

12th Five-Year-Plan

China's petrochemical industry is set to enter a key transition period during the 12th Five-Year plan period (2011-2015) as the petrochemical industry tries to solve problems like weak competitiveness, product shortages due to bad infrastructure planning and dealing with other issues like tightened environmental regulations. The petrochemical industry needs adjustments to its product structure, the importation of resources, a concentration on the refining sector and coping with an expanded ethylene production capacity.

As the Chinese government increases environmental regulations and further steps up the monitoring of treated wastewater that is released into the environment, the industry will have to improve its management of water resources by improving water treatment facilities and considering ways in which it can increase the recycling rate of wastewater for reuse in petrochemical plants. Failure to do so will lead to financial fines and the possible closure of plants.

21st century changes in the global petrochemical industry

A combination of a slowdown in US demand, the anticipated wave of new Middle Eastern capacity, and surging demand for petrochemical products is causing a shift in the global petrochemical industry. Traditionally centered in the US and Europe, the industry has in recent years experienced an eastward shift due to the Middle East's low-cost production capabilities of ethylene and a booming demand in East Asia with China in the lead.

New era for Asian petrochemicals

Asia will be a major player in shaping the future of the global petrochemical industry. While the Middle East has abundant supply at competitive prices and has attracted bountiful investments, strong demand fundamentals in Asia are heralding the age of Asian petrochemicals. Major investments are flowing across Asia in line with strong demand growth and the thriving Chinese economy.

Two complementary waves are driving the regional industry and providing a landscape of opportunity for multiple petrochemical hubs to develop. On the one hand, China and India are the two market-driven hubs which rely on the proximity of budding domestic markets to capture value. On the other, export-driven hubs such as Korea and Singapore are leveraging on their logistics connectivity to serve regional markets, adding value through integration and technology.

China: An import led petrochemical market

China is one of the largest consumers and importers of petrochemicals in the world. In 2012, China's demand for ethylene is expected to touch 35 million tons and the Chinese ethylene industry is poised to enter a "big ethylene" era. With vast improvement in China's ethylene production capacity, domestic production is able to meet 70% of local demand. However, domestic production is still a long way from attaining self-sufficiency.

Major petrochemical production facilities in China

Major facilities of Sinopec in China

The entire petroleum industry in China has state involvement at some level. The major subsidiary of China Petrochemical Corporation (Sinopec Group), Asia's largest oil refinery and petrochemical enterprise is China Petroleum and Chemical Corporation Limited (Sinopec Limited), the largest petrochemical company in China. PetroChina under China National Petroleum Corporation (CNPC) and China National Offshore Oil Corporation (CNOOC Group) are amongst the top competitors of oil producers, however Sinopec produces the most petrochemical products.

The facilities are distributed all across China, with the major ones located in Beijing, Shanghai and Guangzhou.

Sustainability enhances efficiency and competiveness

As massive amounts of water is consumed on a daily basis for cooling and cleaning purposes in the petrochemical industry, responsible water management is not only vital in sustaining operations, but also to acheive environmental performance. As demand for water surges and the need for conservation rises, sophisticated modern technologies are enabling greater reuse of industrial wastewater. This is particularly crucial for China, where the country faces limitations to its water supply and regularly experiences drought. Many petrochemical players including the market leader Sinopec are striving to make the most of wastewater through multiple stringent purification and treatment processes so that water initially discharged as wastewater can be recovered and fed back to the raw water supply to cooling systems for reuse.

Prudent management of wastewater and increasing the use of reclaim water are the future of the business. Companies are increasingly forward-thinking in developing solutions to meet – and to be ahead of – the unique water demands of their businesses and industries for reliable, efficient and environmentally-viable operations.

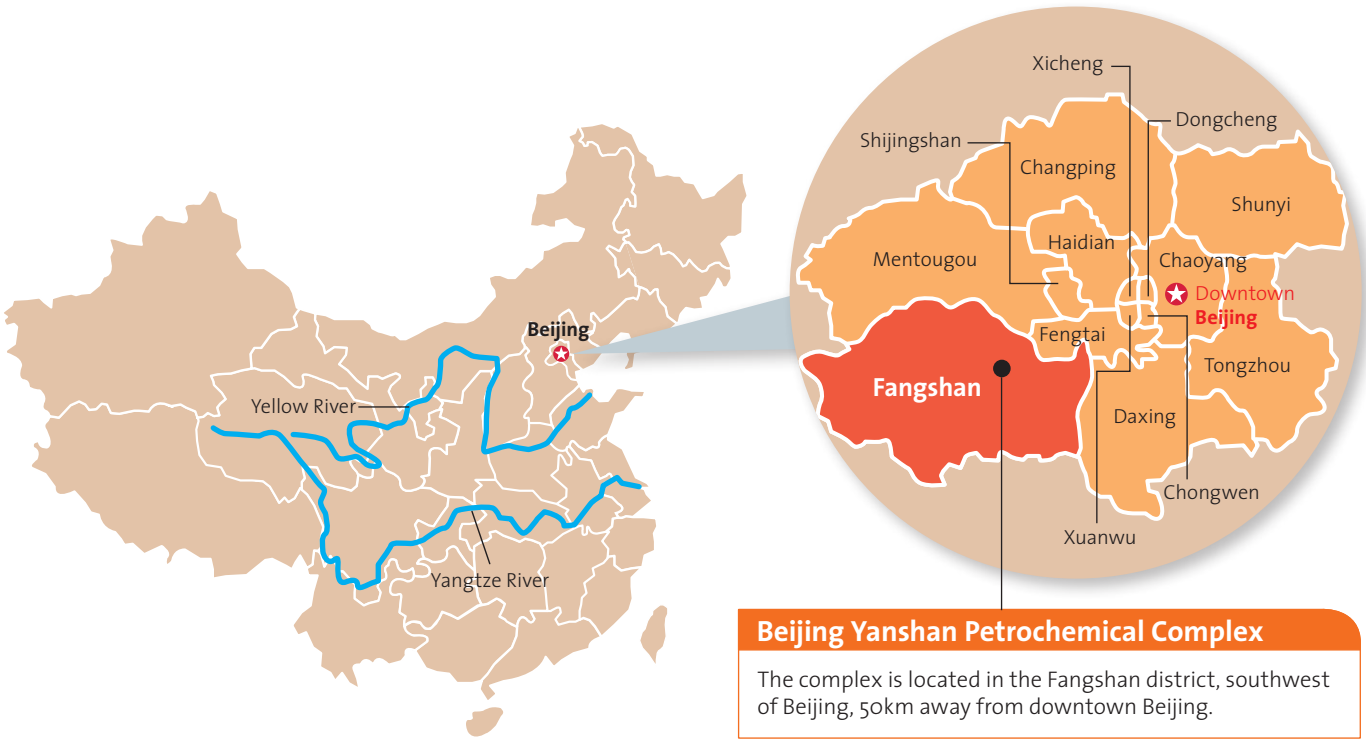
Partners with Yanshan

Beijing Petrochemical

Veolia Water took up operations, maintenance and development of the wastewater and reclaim water facilities in Yanshan in 2006 when it signed a 25-year contract with Beijing Yanshan Petrochemical to support its business objectives and water management needs, as well as environmental performance at its Yanshan operation.

Reflecting its principles of Service, Value and Responsibility, Veolia Water introduced bespoke and world-leading Veolia Water technology and an international management approach to stabilize the water performance and maximize water efficiency and self-sufficiency.

Being one of the largest and most significant contracts of its kind globally, the partnership between Veolia Water and Beijing Yanshan Petrochemical was soon recognized as a model of success and a benchmark for the petrochemical and water industries. Today, Veolia Water is also providing strategic counsel and creative solutions to address the new business priorities of Beijing Yanshan Petrochemical in order to achieve a secure water future for the operation and turn waste into resources through material recovery.



Beijing Yanshan Petrochemical Complex

The complex is located in the Fangshan district, southwest of Beijing, 50km away from downtown Beijing.

Beijing's water future not balanced

The partnership between Beijing Yanshan Petrochemical (BYPC), a subsidiary of China Petroleum and Chemical Corporation (Sinopec) and Veolia Water was a foresighted and proactive response to the burgeoning water and environmental challenges faced by both the petrochemical industry and the city of Beijing.

Beijing's water security has become increasingly vulnerable due to the ever-growing population, rapid industrial development and the lack of rainfall. With the Central Government's 5-year plan attaching greater importance to environmental excellence and the tightened discharge standards, BYPC, one of the largest water users in the city, aspired to seek opportunities and ways to optimize its water management and become a greener enterprise for more sustainable operations. BYPC has outlined its "zero liquid discharge" vision to embolden its commitment to minimizing its environmental footprint.

Outsourcing water management to specialists in order to focus on core business

As the business of the company has been fast and continuously expanding, BYPC sees the benefits of focusing on developing its core business while outsourcing non-core but essential services such as wastewater and reclaim water management. Effluents from BYPC come from several chemical plants, a power plant, a refinery, a rubber plant and residential areas. BYPC was therefore looking for a partner with experience in managing multiple sources of effluent to increase both operational and water efficiency.

Veolia Water – the ideal partner for BYPC

Forming a strategic alliance with Veolia Water, a water specialist with a strong presence in China and globally, was identified as an optimal solution to this unique business and water situation. The Yanshan project emerged from a negotiation process that started in 2004. Both Veolia Water and BYPC undertook a rigorous process of understanding each other's company structures and needs before committing to a partnership for the Yanshan complex. Veolia Water, with worldwide experience and demonstrated capabilities complying with and exceeding stringent water quality standards for many industries across the world, emerged as an ideal partner for BYPC.

Mr Xu Chuanhai
Deputy General Manager

"The joint venture is a showcase of cooperation between two industry leaders which share the same vision and passion for reducing discharge and their environmental footprint. The project makes use of Veolia Water's expertise and technology to strengthen the water performance and conserve water resources."

Synergy between two industry leaders

In 2006, Veolia Water was awarded a 25-year contract to acquire, operate and upgrade four wastewater treatment plants and two reclaim water facilities. With the signing of the deal, Veolia Water became the first water partner of Sinopec locally and regionally. It is a breakthrough partnership given Chinese enterprises' traditional approach to partner with local companies for water and utility management. Beijing Yanshan Veolia Water (BYVW), a joint venture between BYPC and Veolia Water was formed to manage the daily operation and provide strategic planning for future growth.

Multiple benefits of the partnership – for the partners and the environment

The outsourcing of the water operations to Veolia Water allows BYPC to focus on its strategic core competency and reinforce its competitive advantages. By releasing the value of non-core water assets to its partner, BYPC was able to generate capital for reinvestment in its core business. The guaranteed reliable water supply and shared operational and business risks safeguard the operations and ensure water compliance, as well as enhance the overall water availability through water reclamation.

The contract marked a milestone for Veolia Water's water services by extending the company's service to the petrochemical industry for the first time in China, and operating an integrated wastewater and reclaim water management facility for one of the largest oil and chemical operators in the world.

The environmental commitment of the joint venture provides better control of the water resource management. Through properly treating wastewater and reclaiming water, it reduces the discharge of pollutants into the environment and conserves vital water resources. Directly tackling the specific water needs of the industry and the city of Beijing, the partnership is a major step towards greater water self-sufficiency and BYPC's goal of "zero liquid discharge". It also provides a longer-term drought-proof and growth-enabling solution to fuel the development of the Yanshan complex.

The Partners

The wastewater and reclaim water management capability was significantly strengthened when **Beijing Yanshan Veolia Water** was formed in 2006, a joint venture between Veolia Water and Yanshan Petrochemical Co, Ltd. The formation of the joint venture came along with an Acquire-Operate-Transfer (AOT) project managing the wastewater and water reclamation facilities of the Yanshan complex. Yanshan Petrochemical supports the project with asset capital injection and Veolia Water financial investment. Each party holds a 50% share.

Veolia Water, the world's leading operator of water services for industrial and municipal clients, has been operating in the water market in China since the 1980s through its subsidiaries. Across the globe, Veolia Water's services include providing a range of process water, potable water, wastewater and reclaim water services including design, construction and operation and financing of new treatment facilities, as well as the operation and maintenance of existing treatment facilities. Today, Veolia Water is serving, in long-term partnerships, with a broad range of major industrial groups across the country, from tire manufacturing to petrochemical and nutritional companies.

Established in 1970 and based in Beijing, **Yanshan Petrochemical Co., Ltd**. is a super-scaled petrochemical venture and a subsidiary of China Petrochemical Corporation, manufacturing 120 kinds and 494 grades of petrochemical products. Its oil refinery capacity is 10.8 million tons per year and its ethylene production capacity is 750,000 tons per year. Of all the main products, the production capacities of synthetic resin, synthetic rubber, phenol and acetone are ranked as the top in China.

Its mother company, China Petroleum and Chemical Corporation (Sinopec) is one of the largest oil and gas companies in China, with capability and business in both energy and chemical spheres. Sinopec is now ranked as the second largest oil refiner in the world and the fifth largest company in the world for its installed ethylene capacity.

Mr Frédéric Puillet
General Manager

"The joint venture is a major step forward to address the water challenges of Beijing and BYPC. We work together with the client to provide an alternative, non-rainfall dependent water resource which can bring higher water self-sufficiency and maximize operational benefits."

Water services for Beijing Yanshan Petrochemical complex

Project timeline

January 2006:
Industrial outsourcing contract signed

June 2006:
Operation started

June 2011:
First five years completed

2012:
Construction of sodium bromide recovery plant completed

a Bromine Treatment Plant (LLX)
b Western Wastewater Treatment Plant
c Western Reclaim Water Treatment Plant
d Eastern Reclaim Water Treatment Plant
e Eastern Wastewater Treatment Plant
f Niukouyu Wastewater Treatment Plant
g Niukouyu Lake
h Xing Cheng Wastewater Treatment Plant

Key objectives of the contract

- Protect the environment by producing treated wastewater quality that complies with the city's regulation standards
- Increase the capacity and efficiency of the water reclamation units
- Optimize facilities and processes to save cost, enhance quality and promote efficiency
- Meet customer's quality standards for all supplies

Facilities capacity

In operation

Treated industrial wastewater:
96,000m³/day

Treated domestic wastewater:
6,000m³/day

Reclaim water:
28,000m³/day

Expanded capacity (2012-2013)

Sodium bromide recovery:
13.5m³/hour

Spent caustic pretreatment:
100m³/day

Additional reclaim water:
14,000m³/day

Progress Summary
Service, Value,

2006-2012 Responsibility

Veolia Water has implemented rapid improvements in a number of areas since the joint venture came into operation in 2006. From increases in the ratio of wastewater being used for industrial reuse, to increased water compliance rates, staff training to improve employee productivity and awareness of health and safety issues, the introduction of advanced management systems for improved operations and maintenance as well as the constant improvements in environmental policies and cost saving procedures. All these demonstrate the unique partnership that has been created at Beijing Yanshan Veolia Water. It also reflects Veolia Water's vision of Service, Value and Responsibility.

Veolia Water's principles of Service, Value and Responsibility can be emboldened in the Yanshan operation in multi-faceted ways:

SVR

Service Value Responsibility

Service

Guaranteeing the highest performance in every aspect, improving health and environmental safety while controlling costs for our customers, industry, local governments and end users through innovation, skill management and operating efficiency.

Value

Optimizing natural resource efficiency to make the most of water as a resource at every stage of the water cycle, ensuring that nothing is wasted.

Responsibility

Contributing to the wellness of everyone and the environment through carefully considered local initiatives.

It is this vision that inspires and guides every action taken by Veolia Water for its customers.

Achievements (2006-2012)

Service Value Responsibility

Service

Area of Expertise	Solutions	Applications
Operations and maintenance	New service-oriented organization	 **New organization and facilities** which are flexible and adaptable to BYPC's manufacturing evolution.
	Enhancement of operational management and communication	 **Implementation** of Integrated Management System (IMS).
		 **A customized, localized pre-treatment solution proposed and developed by Veolia Water** for better integration of a new wastewater stream containing bromine in the global reuse cycle of the BYPC's complex, with no impact on the performance and operation of the Western Wastewater Treatment Plant and Reuse Facilities.
		 **Optimize the operation of the wastewater treatment facilities** through prudent maintenance procedures and continuous monitoring of the water throughout the process.
		 **Implement Veolia's proprietary tools such as GAMA,** solution for assets preventive maintenance, and SAXO, a reporting decision-making tool for daily management of water treatment plants.
	Cost control improvement	 **Set up Purchasing Department** to guarantee best cost conditions.
		 **Define and implement productivity improvement plans** for more cost-effective operations.
		 **Cost reduction by enhancement** of operating procedures.

SVR
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Area of Expertise	Solutions	Applications
Water treatment	**Wastewater treatment**	 **Upgrade and modernize existing treatment facilities** and bring in expertise to improve the treated wastewater quality and upgrade the process.
Energy optimization	**Energy-saving measures**	 **Define and implement energy-saving measures** to decrease average electricity consumption by 35% in terms of kWh/m^3 for reclaim water and 42% for wastewater treatment.
Network instrumentation	**Central automation and information systems**	 **Set up Central Control Room and install SCADA** (supervisory control and data acquisition) in 2011 for real-time monitoring of operations and round-the-clock communication to ensure the flexible and smooth operation of water facilities and consistent reuse water quality.
Asset management	**Network and plant asset management**	 **Optimize, upgrade and finance** the two reclamation units through a focused maintenance and renewal plan.  **New pre-treatment unit located close** to BYPC's new rubber plant and its halogenation workshop.
Customer services	**Consistent high service levels**	 **Ensure stability and continuity** of the service through improved quality and reliability of operation management.
Risk management	**Risk management enhancement**	 **Improve assessment and management** of operational risks as part of a new operations management system.

Achievements (2006-2012)

Service Value Responsibility

Value

Area of Expertise	Solutions	Applications
Water recycling	Wastewater recycling	 ☑ **Management of water recycling onsite:** over 50% volume of industrial wastewater recycling (7.5 million m^3 recycled in 2011).
Material	By-product recovery	 ☑ **New pre-treatment solution extracts bromine (Br)** from the halogenation workshop's effluent at the rate of 13.5 m^3/hr of bromine effluent (> 8.5 g/L), with treated wastewater sent to Western Wastewater Treatment Plant.
		 ☑ **Development of a specific Liquid-Liquid Extraction (LLX)** treatment process enables Veolia Water to target high efficiency rates with an extraction yield above 95%.

Responsibility

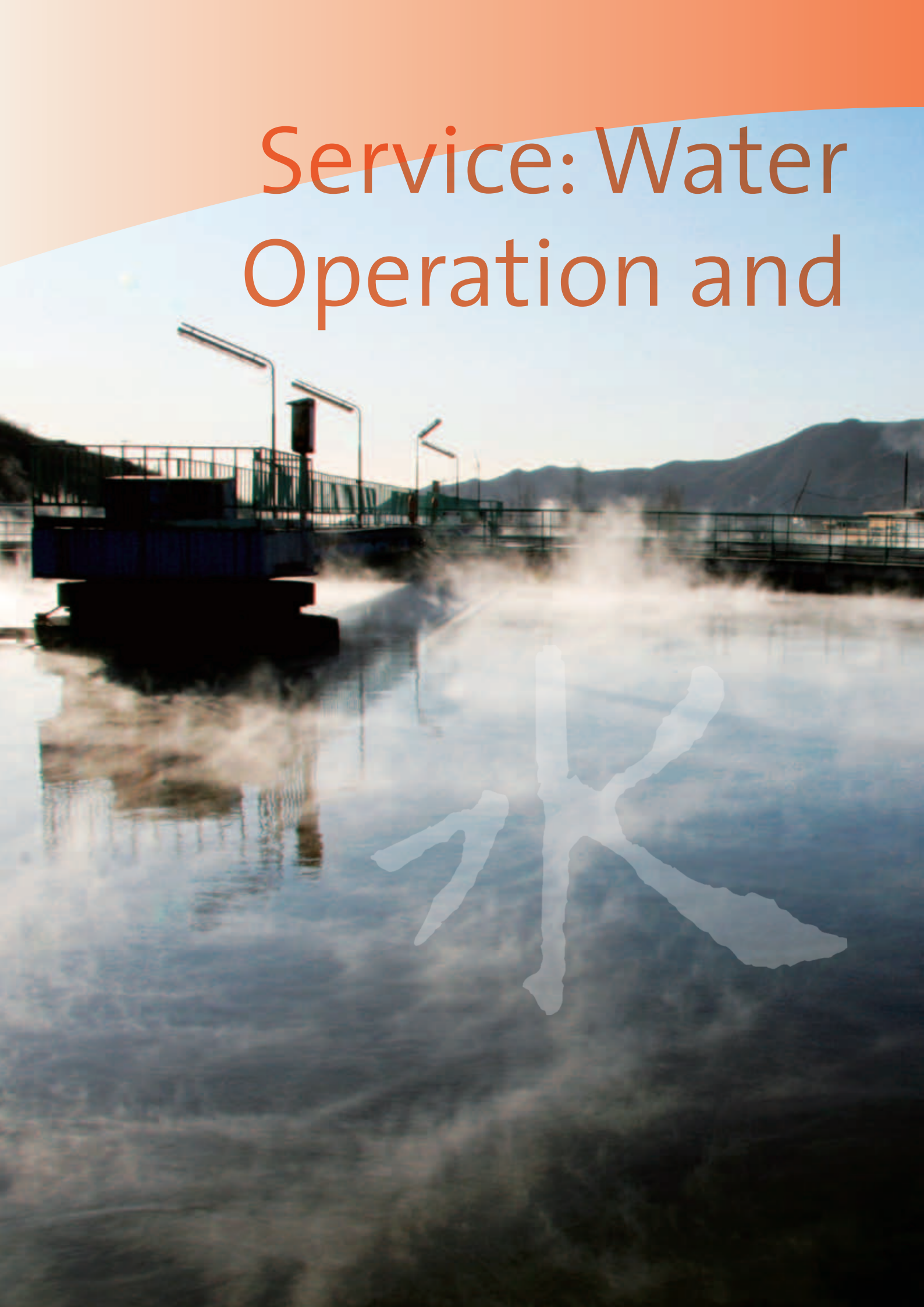
Area of Expertise	Solutions	Applications
Employment and human capital	Staff integration and communication	 ☑ **Successful transfer of** 412 BYPC employees
		 ☑ **Continuous, effective communications using formal and informal channels** to ensure a smooth integration of BYPC into the joint venture.
	Human capital management	 ☑ **Putting people first:** staff integration with a win-win strategy for employee transfer combining previous labor cost structure and Veolia HR policy, taking local concerns into full consideration.
		 ☑ **Enhanced communication and information sharing** between management and employees.

Service Value Responsibility

Responsibility

Area of Expertise	Solutions	Applications
Employment and human capital	Health and Safety	 ☑ **Safety First:** make Health and Safety the driver for operational and maintenance excellence, (e.g. improved safety equipment, safer procedures, regular drills).
		 ☑ **Promote continuous improvement in** operating procedures and ensure training of both the joint venture's employees and its subcontractors.
		 ☑ **Near-misses reporting introduced** to raise awareness and prevent risk.
	Training	 ☑ **Intensive training program** for the joint venture's employees to increase competency levels and promote professionalism.
		 ☑ **Benefit from experience sharing:** transferring existing employees from BYPC and bringing in some Veolia Water employees.
Sustainable resource management	Environmental recognition	 ☑ **Certification of the laboratory** for water quality control.
Management of environmental footprint	Water and biodiversity footprint	 ☑ **Protection of the water resource** by ensuring appropriate treatment of any new wastewater stream prior to discharge into the Niukouyu Lake ecosystem.
		 ☑ **Compliance with environmental discharge standards** (offer 99% of average outlet conformity).
Governance	Reporting	 ☑ **Implementation of** International SOX compliance.

Service: Water Operation and



Quality and Management

Service Value Responsibility

When the water facilities and operation of Beijing Yanshan was first transferred to the joint venture, Veolia Water and its partner set a high and immediate priority on improving water quality, promoting greater water efficiency and stabilizing the operations. These were achieved through process optimization, frequent and systematic monitoring and analyses and the deployment of industry-leading operation and management tools and approaches.

Six years after the joint venture was formed, Beijing Yanshan Veolia Water (BYVW) takes pride in providing smooth and high-performing operations and uninterrupted water services. Wastewater treated through a stringent recycling process has now emerged as an important alternative source of water for Yanshan's petrochemical production. Veolia Water's steadfast and long-term commitment to the Yanshan operation entails continuous improvement in services to upgrade the water infrastructure and install new facilities and procedures for more effective management. These initiatives have proven to be not only reliable in increasing water efficiency and self-sufficiency but also demonstrate visible and multi-faceted benefits of industrial outsourcing.

Mr Liu Chunjiang
Manager of Xing Cheng Wastewater Treatment Plant

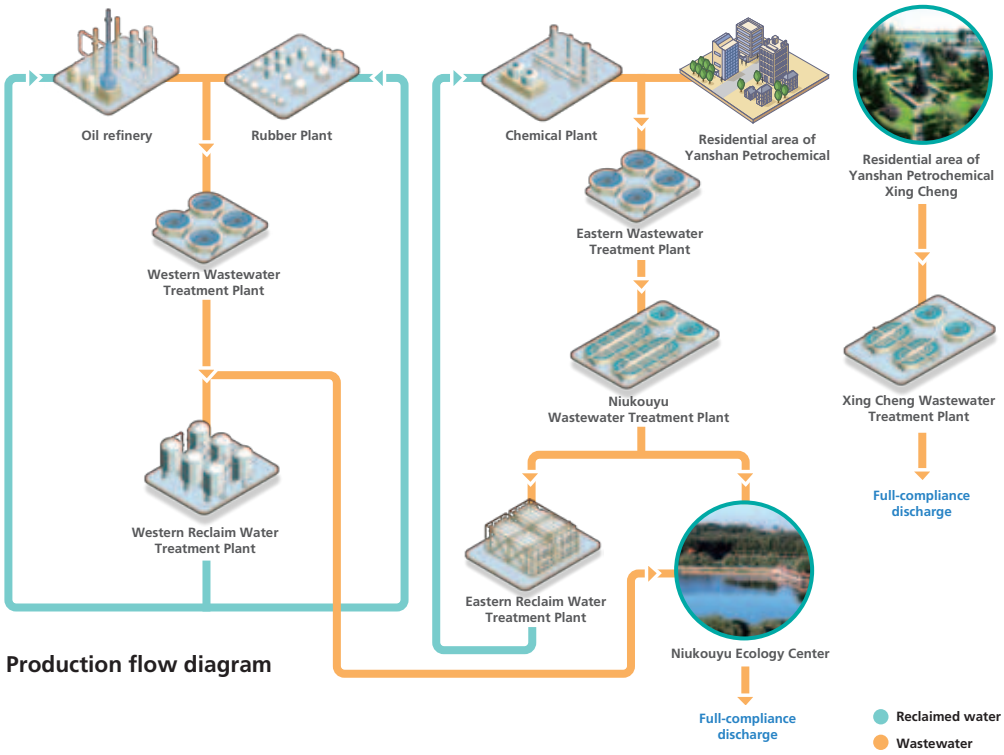
"Veolia Water has improved treatment and monitoring processes at the plant. It is an important part of the environmental policies that Veolia has brought to the joint venture."

Water Quality

Mr Wang Jianhui
Manager of the Western Wastewater Treatment Plant and Reclaim Water Treatment Plant

"The recycling rate and the use of reclaim water have been increasing since the joint venture started thanks to the commitment of the team. It reduces the use of raw water resources and is good for the environment."

Treated wastewater and reclaim water management process diagram



Production flow diagram

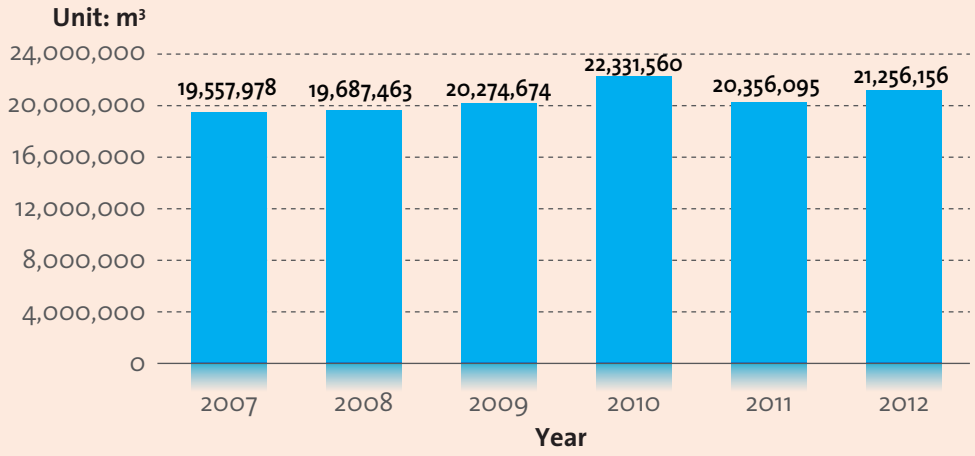
Wastewater treatment for industrial reuse and safe environmental discharge

BYVW is responsible for processing industrial wastewater and domestic sewage produced by Yanshan Petrochemical refineries and six chemical plants. As the production requirements and the effluents produced from each plant vary, Veolia Water adopts a customized treatment process to meet with the different treatment needs of each plant. In addition to traditional types of wastewater treatment processes such as aeration, flocculation, sedimentation, neutralization, clarification and sand filtration, some more advanced treatment processes have been brought in by Veolia Water. These include the use of ultra-filtration and reverse osmosis treatment to provide pure water to the chemical production facilities. Pretreatment has also been integrated into plant operations that have specific needs in order to guarantee the delivery of treatment results.

With strongly enforced internal standards, there has been a consistent increase in treated wastewater quality that meets both internal water and contractual requirements of the Beijing Yanshan Petrochemical Company (BYPC) for industrial reuse and the strict requirements of the Environmental Protection Agency (EPA) for release into the environment. The average compliance rate for treated wastewater reached 98.4% in 2011. The treatment potency to remove Chemical Oxygen Demand (COD), a key parameter to evaluate the treated wastewater quality, has increased since the joint venture. Veolia Water and its partner are committed to achieving strictly minimal figures on all key wastewater parameters.

The majority of treated wastewater will be fed back to the facility to produce reclaim water for petrochemical production. A small amount of water will be channelled and stored in reservoirs at the Niukouyu Valley for tourism and irrigation purposes. This is a sustainable impact which maximizes the use of the natural wastewater treatment process.

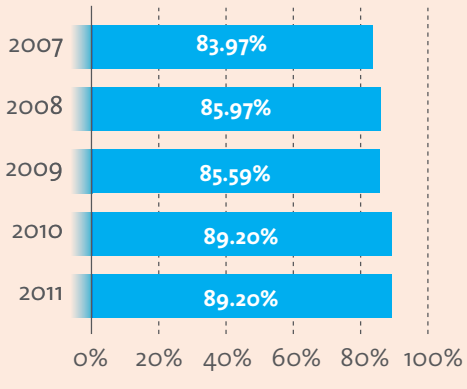
Total volume of treated wastewater by BYVW



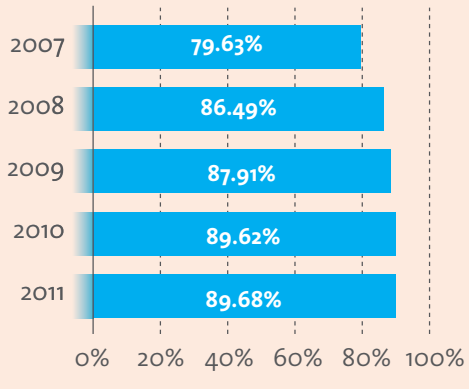
Ms Zhang Yanfen
Manager, Laboratory / Quality Centre

"The monitoring and testing results of the laboratory provide a good reference and directive to the operation team in maintaining and improving the water quality for a more stable operation. The work and contribution of the laboratory is indispensable to the joint venture."

Chemical Oxygen Demand (COD) removal rate of Niukouyu Wastewater Treatment Plant



Suspended solid (SS) removal rate of Niukouyu Wastewater Treatment Plant

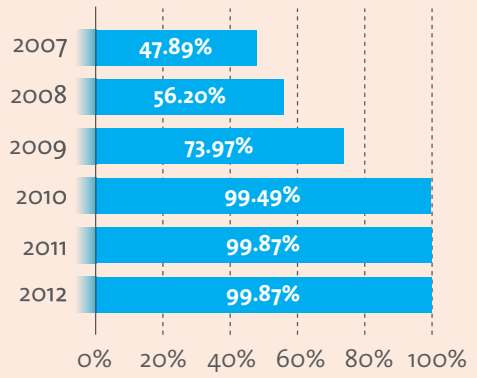


Increase in water efficiency through water reclamation

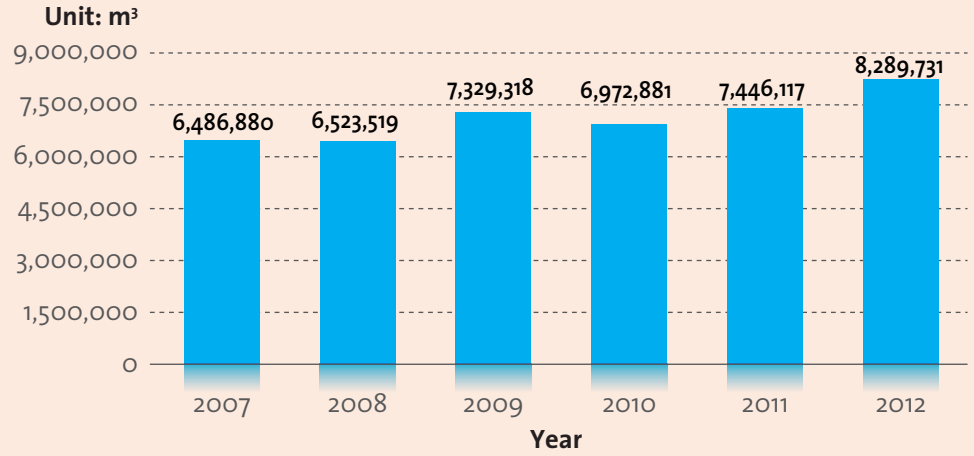
BYVW provides a value-add service, reclaim water, which is the recycling of treated wastewater so that water can be used for cooling and steam generation purposes in the petrochemical manufacturing process. The continuous improvement of the design and operation of water reclamation facilities at the Western and Eastern Reclaim Water Treatment Plants not only ensures optimal water standards, but also maximizes water, production and cost efficiency, serving as a benchmark for effective industrial outsourcing in water for petrochemical industries.

Since the joint venture took over operations in 2006, there has been a consistent increase in water quality and the compliance rate for reclaim water reaching the standards agreed in the contract with Beijing Yanshan. The ultimate aim is to reach a 100% recycling ratio of wastewater to industrial reclaim water for all wastewater that comes from the petrochemical plant. In 2012, the joint venture had reached a total water reclaim volume of 8,289,731 m^3, a substantial increase on the 2007 figure of 6,486, 800 m^3. Additionally the compliance rate of reclaim water has increased substantially, as an example the Eastern Reclaim Water Treatment Plant's reclaimed water compliance rate shot up from 47.89% in 2007 to 99.87% in 2012.

Compliance rate of the reclaim water produced by Eastern Reclaim Water Treatment Plant



Total volume of reclaim water by BYVW



Western Wastewater Treatment Plant:
Treating wastewater from the rubber and refinery plants

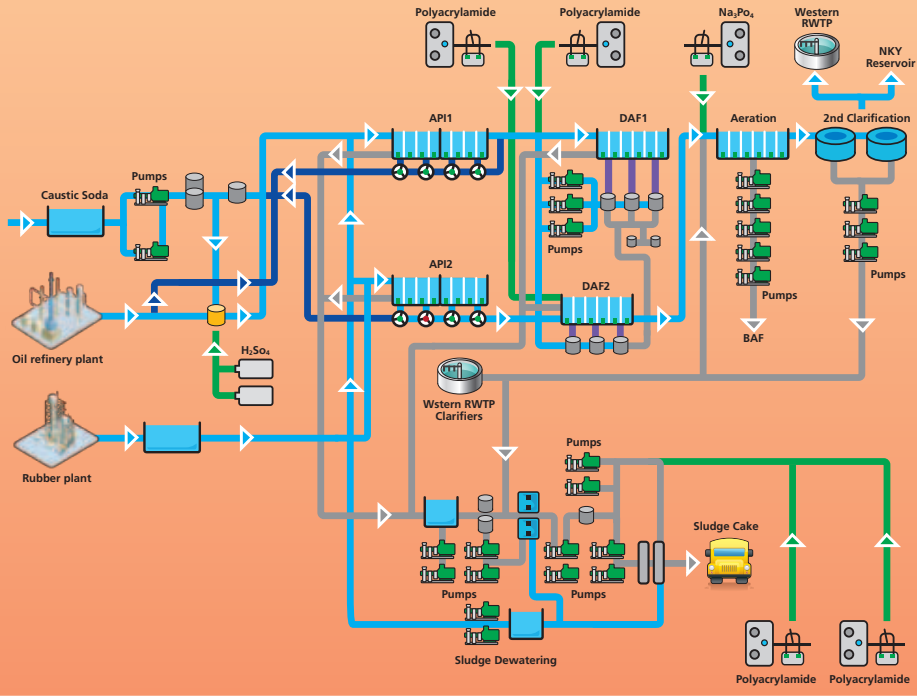
Facilities:
Industrial wastewater treatment plant

Main process for wastewater treatment:
API, Dissolved Air Filtration (DAF), Aeration Tank

Design capacity: 1500 m^3/h

The Western Wastewater Treatment Plant receives effluent from the rubber plant and the refinery plant, as well as the new Halogenation plant and puts the wastewater through a series of treatment processes that remove oil and organic materials from the water. Thanks to the optimized maintenance procedures and constant monitoring of the water process, operations in the Western Wastewater Treatment Plant have improved since the joint venture started which has helped to improve water quality. In addition, Veolia Water implemented modifications to the Western Wastewater Treatment Plant to improve its capacity and there were changes made to the chemical dosing system in the pretreatment process.

The process, sees the effluent first go through an API oil-water separator which separates the oil and suspended solids from the water, it is then sent for further treatment to a dissolved air flotation unit for further removal of any residual oil. After this it goes to an aeration tank which stimulates the growth of oxygen-using bacteria which consume most of the remaining organic materials. It then goes through a second clarification process where any remaining solids are allowed to settle. The impact of the process is the production of water that meets strict guidelines for release into the environment and minimizes the impact of BYPC. In addition to this the process of sludge treatment and removal in the Western Wastewater Treatment Plant has been optimized.



Western Reclaim Water Treatment Plant: Further treatment of water from Western Wastewater Treatment Plant

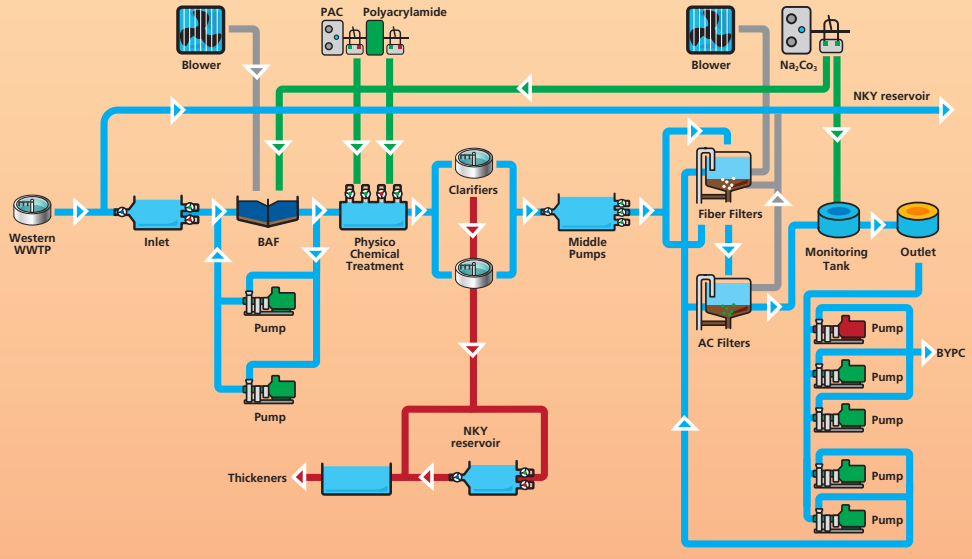
Facilities:
Wastewater reclamation

Main process for water reclamation:
Biological treatment, BAF clarification and fiber and activated carbon filtration

Design capacity: 450 m^3/h

60% of the treated water from the Western Wastewater Treatment Plant is sent to the Western Reclaim Water Treatment Plant for further treatment before being put to use in the refineries cooling system.

Biological treatment and filter and carbon filtration are employed to ensure treatment efficiency. 40% of the water is released into Niukouyu Lake where it meets Chinese EPA standards.



New Treatment Process

In 2010, a pretreatment process was integrated into the Western Wastewater Treatment Plant to extract sodium bromide. This new but essential step will help stabilize and safeguard the wastewater quality and avoid service disruption once the halogenation workshop of BYPC is in full operation in 2013. The concept and design itself is a one-of-a-kind in the industry. When it is implemented, it will soon become an industry breakthrough and be a benchmark in meeting the ever-changing industrial and environmental requirements.

Eastern Reclaim Water Treatment Plant:
Treating wastewater from chemical production and producing ultra pure water for boilers

Facilities:
Wastewater reclamation

Design Capacity: 800 m^3/h

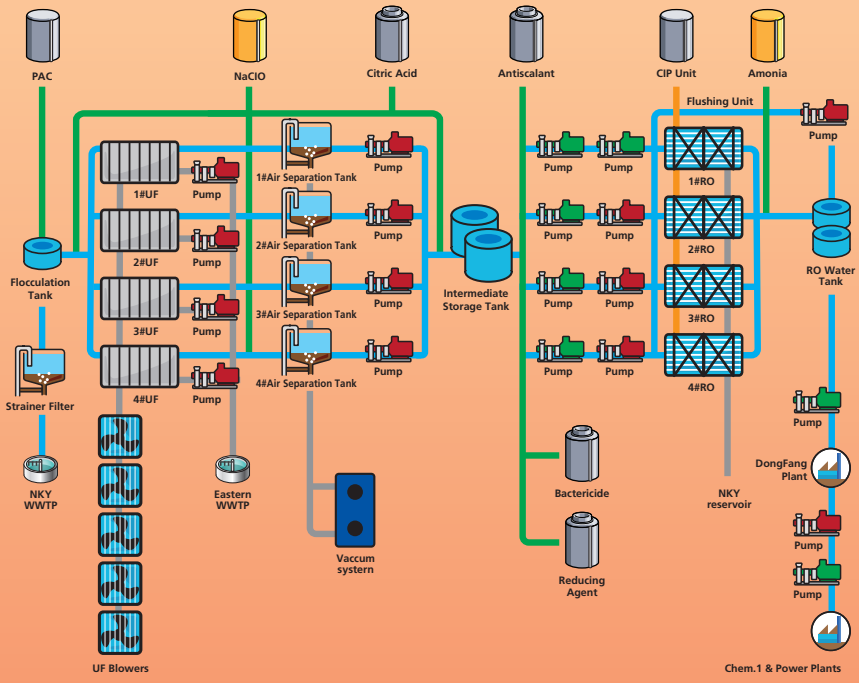
Main Process:
Ultra filtration and reverse osmosis

The Eastern Reclaim Water Treatment Plant receives treated wastewater from the Eastern Wastewater Treatment Plant and the Niukouyu Wastewater Treatment Plant. Wastewater collected is mainly from the Eastern area of the petrochemical complex and is used for chemical production.

Using a dual-membrane technique of ultra filtration and reverse osmosis, dissolved inorganic solids are removed from the wastewater under high pressure through a semi permeable membrane and turned into ultra pure water. Ultra filtration removes most of the larger particles left in the wastewater while reverse osmosis removes the remaining particles, including salt which means that the water is desalinated. This in-depth treatment process guarantees the production of high quality ultra pure water for use in boilers in the chemical plants.

The removal of the mineral deposits through ultra filtration and reverse osmosis are highly important because material deposits such as salt can build up inside boilers and impair operations.

To meet with the burgeoning business demand of the client, the joint venture is developing plans to upgrade and expand the Eastern water reclaim facilities, implementing a pretreatment of the feed water to the ultra filtration and reverse osmosis facility using Veolia Water's proprietary technology, Multiflo® Softening. Once the expansion is completed in 2014, the treatment capacity will be doubled.



Installation and refurbishment of Veolia Water laboratory

To reinforce water quality management, Veolia Water installed onsite laboratories at Yanshan. Veolia Water monitors water quality at every stage of the process. The water quality team examines the causes of any fluctuations or abnormalities in parameters in order to refine the process accordingly and ensure a supply of unwavering quality.

Veolia Water's water quality team also works in daily contact with operations colleagues to develop and implement a water quality procedure and schedule for each parameter. Such co-operation facilitates monitoring accuracy, response capability and overall management.

All water is monitored regularly according to stringent guidelines, particularly as raw water quality is often variable.

Two sets of online analyzers were installed in 2009 and subsequently adjusted to constantly report and measure several key parameters including volume, pH value, Chemical Oxygen Demand and so on. BYVW is the first company certified by the government for the use of such devices for industrial purpose. There are five laboratories on site but most activity takes place in the central laboratory. At the central lab, between 400 to 500 samples are analyzed on a daily basis. 50 staff work a shift pattern to make sure that the water quality is monitored around the clock on a 24-hour basis with the objective of giving the client the best possible service.

Apart from managing laboratory assignments locally, since 2007 the BYVW laboratory also participates in the Veolia Water international inter-laboratory calibration campaign twice a year, under which BYVW analyzes samples of industrial water sent by Paris and returns an analysis report. Results are scored and compared with Veolia Water laboratories around the world, which allows laboratories worldwide to better understand their performance. The exercise helps ensure the testing capabilities of the BYVW laboratory, providing a more accurate reference to the operation team on the water quality and performance.

Operations and Management

Mr Frédéric Alcaide
Operations Director

"The client is developing their plant very quickly, developing new streams of effluent. We need to stay on top of this and keep upgrading and developing the site to cope."

For the water-intensive petrochemical industry, any slight disruption in the water service would interrupt the entire petrochemical production process and lead to far-reaching business consequences. Hence, continuity of water service and supply is of utmost importance.

To enhance service continuity, operational efficiency and reliability as well as to improve the management of resources, Veolia Water and its partner have implemented a new management structure and advanced management systems as well as introduced the concept and approach of preventive maintenance.

The results have been salient and positive. BYVW excelled on this ultimate performance indicator by achieving 365 days of continuous operation, signifying its commitment and success in maintaining stable and smooth operations.

Exhaustive audit strengthens the planning process and system upgrade.

After the BYVW joint venture was officially launched in June 2006 the company became responsible for wastewater treatment from the petrochemical plants and the Yanshan complex. An extensive audit was executed by Veolia Water on the wastewater processes and facilities.

The review was instrumental in providing a comprehensive picture of the operability of equipment and identifying operation gaps. Based on the results and analyses of the audit, Veolia Water has developed a process optimization and investment plan.

The upgrading of facilities is an ongoing process and in the six years since 2006 the process has been intensified. As of May 2012, 295 renovation projects have been carried out. Targets to increase the recycling of wastewater for reuse in the petrochemical factory and for an increase in the quality of water being discharged into the environment to meet Chinese Environmental Protection Agency standards are steadily being met.

Bringing in expertise to improve treated wastewater quality and optimize the process

The creation of the joint venture in 2006 has allowed BYPC to concentrate on its core business as well as meet ever more stringent government targets on curbing industrial wastewater pollution.

At the inception of the joint venture, Veolia Water engaged its global experts specialized in water management for the petrochemical industry to visit the BYVW facilities and offer advice on the design improvement and process change for more effective management. Veolia Water's expertise, experience and advanced technology has not only helped to meet the government targets but it has also helped to optimize the wastewater treatment process to improve wastewater recycling levels, reduce energy consumption and ultimately save on costs.

Mr Liu Jie
Customer Service Center

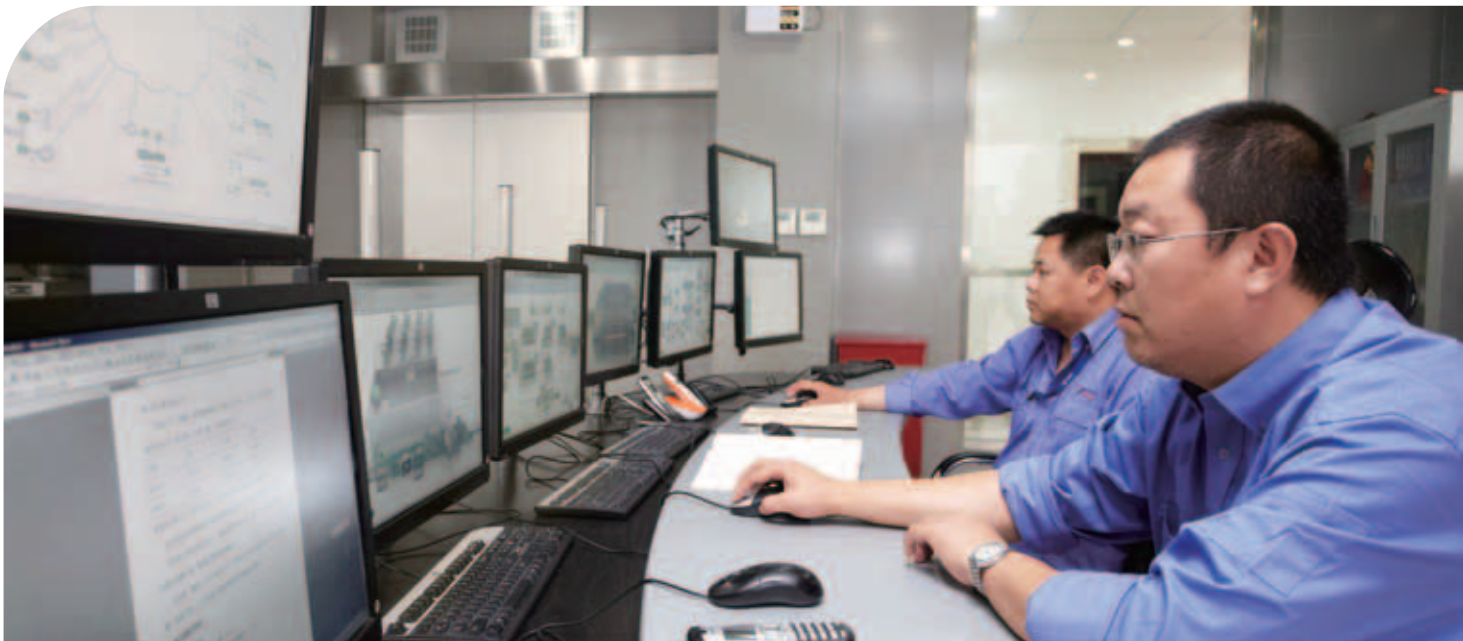
"In the control center, we can only find faults, not fix them. Having a SCADA control point in every workshop allows for action to be taken as soon as we identify a problem."

Customer Services and the creation of a Central Control Room

A Customer Services Department was implemented by BYVW. It coordinates daily exchanges back and forth between BYPC's operation centre and the joint venture's operation management to ensure a flexible and smooth operation of water facilities and consistent reuse water quality.

For real time monitoring of operations, in 2011, the department was equipped with a central control room which works continuously over a 24-hour period in five shift patterns which are each manned by two workers at a time.

The integration with the SCADA system has allowed the control room to check processes remotely and in real-time which can then be relayed to workshops around the site who can fix any problems at source.



Advanced management systems improve efficiency

The SAXO operation aids

The SAXO system is used in the water and sewage treatment plants and started operating in 2010. This customizable and efficient decision making tool provides daily data updates and reports which give information on a series of criteria such as flow pressure, power consumption, chemical consumption and water quality.

SCADA control system

Brought in by Veolia Water in 2011, the SCADA system operates around the clock 24 hours a day, monitoring the waste water industrial processes and giving real time performance parameters for each equipment process. SCADA enables operators and water managers to identify problems more easily and faster so as to provide swift, instant solutions to rectify any problem. With a computer control system in every workshop, a problem identified by the central control centre can be relayed and the problem can be fixed at source.

GAMA a comprehensive asset management and analysis system

High-quality and continuous water services are essential to the operations stability at the petrochemical plant. The Yanshan project has enhanced its preventative maintenance approach with the help of GAMA, an advanced proprietary, computerized maintenance management system used in industrial water and wastewater management facilities for enabling efficient maintenance activities. The merits of such a system are:

- Systematic feedback on installations
- Technical and specific documentation of the installations
- Systematic preventative maintenance
- Avoidance of unexpected defaults
- Optimization of operating costs
- Increased efficiency of maintenance and operations

Mr Chang Kai
Manager of Technology Department

“Since the implementation of SCADA all systems have been computerized. This allows us to monitor the systems in real-time, find problems and fix them quickly.”

Preventative maintenance approach promotes sustainable operation

The GAMA system allows early preventative maintenance to be carried out by spotting possible faults before they happen. This allows for any potential weak points in the system to be assessed, put into the maintenance planning process and then replaced before any breakdowns occur. This ensures operational stability and reliability as well as crucially helping prevent damage from happening which could cause major operations headaches and financial losses incurred to fix damaged equipment.

An energy-efficient operation

Water management consumes substantial amounts of energy, and the joint venture is fully aware of its impact in terms of operating costs and environmental sensitivity. Through its commitment and innovative energy saving ideas, BYVW has been working since the joint venture started to make energy conservation a permanent part of the culture.

Key initiatives to embrace energy saving and efficiency included installing new blowers in the biological treatment system in the Western Wastewater Treatment Plant and variable speed drives (VSD) on key equipment. The oxidization ditch and heating system have also been optimized, and valves and buttons have been installed to minimize power consumption. The use of energy has dropped by 15% on average since the joint venture started, demonstrating the effectiveness of the measures.

For example in the Niukouyu Wastewater Treatment Plant, unit energy consumption dropped from 2.685 KWh/Kg COD removed in 2007 to 1.150 KWh/Kg COD removed in 2012. Additionally in the Western Water system unit energy consumption fell from 1.402 KWh/m^3 in 2007 to 1.109 KWh/m^3 in 2012. This represents a fall of 57.17% and 20.89% respectively.

Miss Lou Yingli
Technician

"Since the joint venture was set up, Veolia Water has implemented several major improvements to the process to make the operation more reliable and sustainable. Biological treatment and sludge treatment have been adopted and improved in the Western Wastewater Treatment Plant. These refinements help tackle the unstable water challenges and optimize performance."

Working towards attaining an Integrated Management System (IMS)

BYVW is improving its process management systems by working towards obtaining an Integrated Management System with the intention being to have it completely in place by the end of 2012.

The IMS enables management to set priorities and strategies which can balance and benefit the three important aspects of production; quality and compliance, environmental sustainability and health and safety enhancement.

Value: Wastewater

Recycling and Product Recovery

Service Value Responsibility

Veolia Water has initiated an active calendar of process innovation and refinement projects to upgrade the operation and promote sustainability in order to secure a sustainable water future for the Yanshan complex and the wider Beijing area. The unceasing optimization of the water recycling service and capacity since the joint venture started and the pioneering materials recovery process have now become an industry benchmark and a vivid environmental success story. It will also be able to recover sodium bromide once the progress of the halogenation workshop is in full swing.

Through these initiatives, Veolia Water continues to strengthen its role as a key environmental stakeholder and solution-provider, as well as a trusted water advisor for the petrochemical industry to address a broad spectrum of sustainable development challenges and seize growing business opportunities together with it partners and clients.

Increase in water recycling: Pressing towards the goal of zero liquid discharge

The wastewater treatment and water reclamation facilities were already installed at the Yanshan water complex long before the joint venture, but Veolia Water and its partner have further unleashed their potential by maximizing the water recycling capacity through refining the treatment process and implementing sophisticated management tools to stabilize its performance and output.

Making the most out of used water

Achievement at-a-glance

- **Production of reclaim water by Beijing Yanshan Veolia Water (BYVW) has increased from 6,486,880m³ in 2007 to 8,289,731m³ in 2012.**
- **The water recycling rate of BYPC has increased from 50% at the outset of the joint venture to currently 60%, and can be further elevated to 85% once the expansion of the Eastern Reclaim Water Treatment facility is completed.**
- **Around 40% of the recycled water enters the Beijing Yanshan Petrochemical plant as ultra pure water, and for cooling purpose is reclaim water. This is an indication of water self-sufficiency to a significant extent and of Veolia Water's all-round, tailor-made services to tackle BYPC's specific water needs.**
- **It has significantly improved the Water Impact Index of the BYPC complex.**
- **It has also decreased the water volume discharged to the environment by 35% due to Yanshan industrial activity.**

Achieving water efficiency through cutting-edge technology and process change

To increase the amount of water recycling, Veolia Water has brought in expertise and some of the most sophisticated technology and environmental practices. This improves the quality of treated wastewater and reclaim water and optimizes the process by improving the efficiency of facilities. Major improvements include:

- Modifications to the Western Wastewater Treatment Plant to improve its capacity
- Modification of the chemical dosing system in the Western Wastewater Treatment Plant pretreatment
- Installing pressure vessels for reverse osmosis to increase capacity and to improve cleaning techniques to expand the membrane lifespan in the Eastern Reclaim Water Treatment Plant
- The integration of an automatic regulation cycle for higher efficiency

Optimizing the wastewater treatment facilities was also advanced by the installation of central automation and information systems such as GAMA for assets preventive maintenance and SAXO, a decision making tool for daily management of the water treatment facilities. A SCADA-enabled Central Control Room was also built to monitor the entire operation in real time. This is backed up by regular and accurate monitoring of water quality which is tested by the upgraded laboratory facilities onsite.

With more efficient processes, BYVW is increasingly able to produce more recycled wastewater for reuse in the petrochemical plants that is compliant with BYPC requirements, meeting contract commitments and being able to cope with the ever increasing needs of the BYPC facility as it grows.

Water recycling: A new trend to preserve vital water resources

Water recycling or reclaim water, is former wastewater that is treated to remove solids and certain impurities, and used as a renewed water source for industrial process, sustainable landscaping irrigation or recharging of groundwater aquifers. Water recycling provides tremendous environmental benefits, providing a dependable, locally-controlled water supply which promotes sustainability.

In a world of dwindling fresh water resources, many water-consuming industries increasingly rely on water recycling to secure a water supply. Water recycling can be tailored to meet the water quality requirements of a planned reuse. Leading water specialists have leveraged state-of-the-art technology such as dual membrane techniques of ultra filtration and reverse osmosis, biological treatment and other water softening skills to produce reclaim water.

Water recycling is seen as the future of the industry and has been widely adopted in many parts of the world.

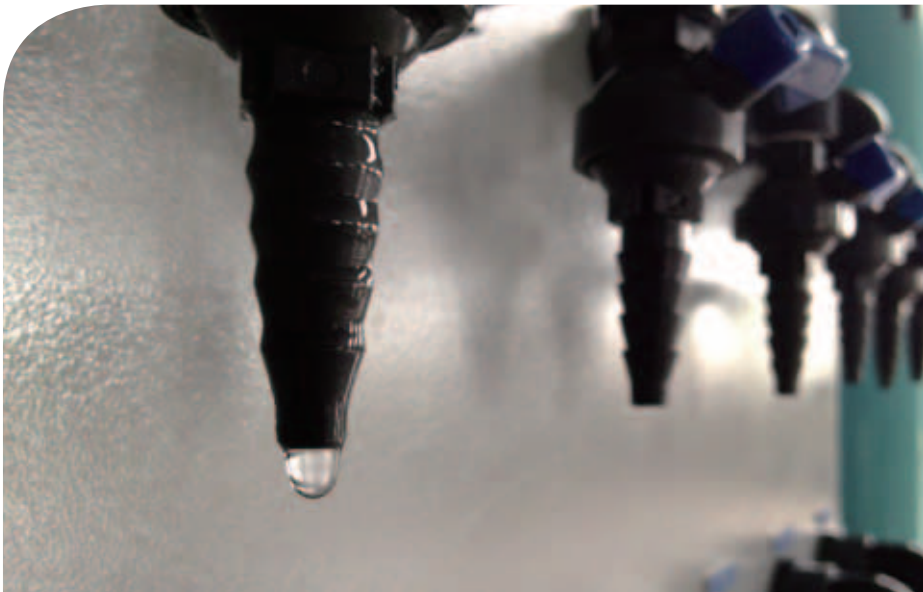
Water saving brings environmental and economic benefits

The increase of water recycling at Yanshan is a major step towards greater water self-sufficiency. Raw water consumption by BYPC has been significantly reduced since the implementation and augmentation of the reclaim and reuse programmes by Veolia Water and its partner. Through partial self-supply, BYPC has reduced its reliance on external water sources, and the overall water availability at the complex has soared. It is a showcase of the transformation from the "consume-and-dispose" to "use-and-recycle" approach.

Through recycling wastewater, BYPC has also lowered its discharge volume, reducing pollution and unnecessary loading to natural waterways and helping to relieve environmental tensions and build a greener society.

The enhanced operation of water reclaim facilities reduces the plant's environmental footprint, presenting a sound solution for water resource conservation. This is particularly important for petrochemical manufacturers since the refining processes require significant quantities of water.

From a resource management and business perspective, the increase in use of recycled wastewater can improve the business and cost structure. Its cost-effectiveness is highlighted by considerations of operating savings generated by raw water consumption and discharge reduction.



Building a self-reliant water future

The ultimate aim for wastewater treatment and water reclamation at BYVW is to recycle all wastewater for industrial reuse and to have zero liquid discharge into the environment and zero raw water consumption. This target continues to be at the forefront of solutions-based treatment and technology innovated by Veolia Water, looking to maximize every water opportunity.

Expansion of the Eastern Reclaim Water Treatment Facility: Raising capacity for greater water self-dependence

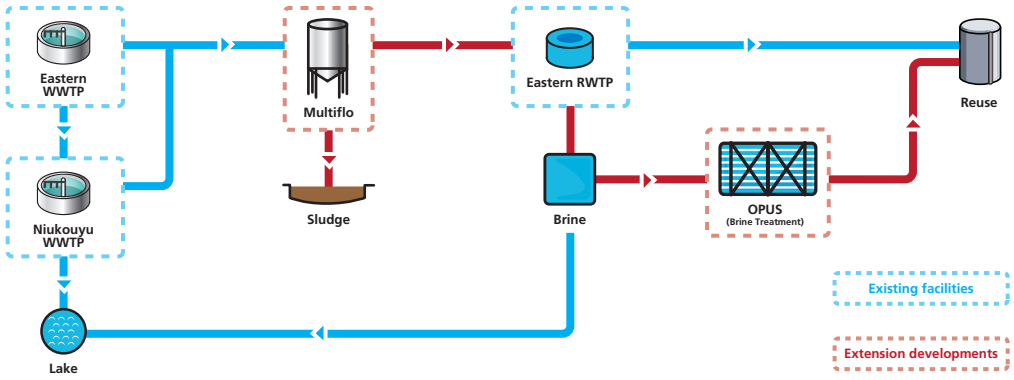
To cope with the increased facilities at BYPC and subsequent increased demand for denim water production capacity, BYVW is building the Eastern Reclaim Water Treatment extension project to produce more pure water for the plant. This new development at the Eastern Reclaim Water Treatment Facility represents the best of the joint venture's forward-looking approach to water requirements, technology and treatment.

Using OPUS® technology to employ a special reverse osmosis process operated at an elevated pH in combination with a proprietary high rate chemical softening process, known as Multiflo™, high quality water is generated with a low waste volume and a substantial extraction of salt from the water. This means that water which previously may have been discharged can be further treated and be reclaimed for reuse in the BYPC plant.

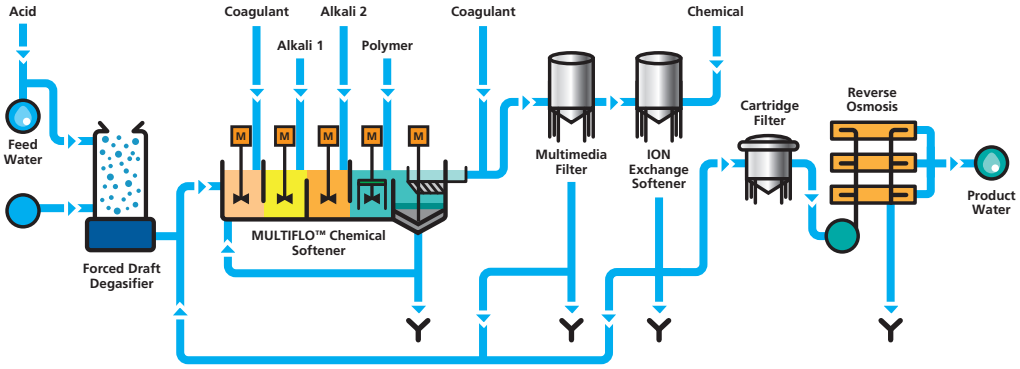
Not only will the water quality be largely improved for more sophisticated petrochemical production processes, the extension and upgrade will also double the treatment capacity from the existing 800m^3/h to 1,500 m^3/h. When the extension is fully in use, it can boost the wastewater global reuse rate of Sinopec to 85%.

The project is currently in a pilot testing stage using low scale facilities to treat real effluent through pretreatment and ultra filtration as well as reverse osmosis. The new extension will be ready for operation by 2014.

Eastern Reclaim Water Treatment Facility extension



OPUS Treatment process



Materials recovery: Turning waste into resource

Halogenation and the recovery of sodium bromide

Not merely a water operator, Veolia Water also plays an important role as a water solution provider to its partners across the globe, offering water strategies and service solutions that are flexible and adaptable to the business developments of clients.

Groundbreaking project: Innovative, environmental and business-lucrative
The world's first bromine extraction facility for petrochemical sites

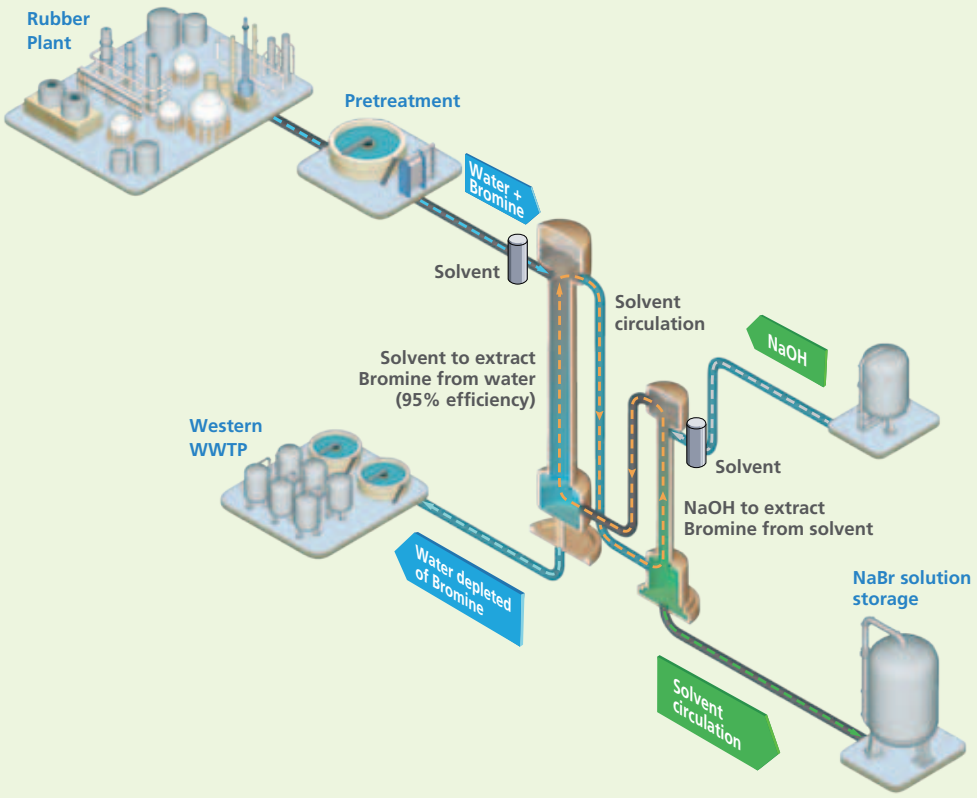
Challenge

The challenge: After BYPC built a new halogenation workshop in its butyl rubber plant it required effluents generated during the process to be treated by existing facilities. The effluents have high concentration levels which create a burden on the existing treatment process. It can take a toll on service reliability and water quality if the effluents are not carefully and precisely managed.

Solution

The solution: In response Veolia Water designed a tailor-made solution based on wastewater segregation and point-source pretreatment solution to extract bromine (Br) from the halogenation workshop's effluent with an extraction yield above 95%. While halogenation workshops are common in the petrochemical industry, the design and construction of the bromine extraction unit is one-of-a-kind, an innovation pioneered by Veolia Water and specifically-crafted for the unique context of the Yanshan operation. The development of a specific Liquid-Liquid Extraction (LLX) process with the support of a worldwide technical and research network, enables Veolia Water to target high efficiency rates. After design, the construction of the facility started in 2010 and was completed in less than a year. Today this unique facility is under process adjustment and will be fully in operation in late 2013.

The LLX process, also known as solvent extraction and partitioning, allows separation of compounds according to their solubilities into water and an organic solvent.



Mr Ma Xiaoxuan
Manager of Halogenation Workshop

"The halogenation workshop will be the greatest highlight of the joint venture once it is fully-operated. It can recover useful materials for medical use and be used as a disinfectant. Not only can it bring economic benefits, it will also maximize the water treatment results for smoother operations."

Impact

The impact: The level of water and resource management has literally moved to new heights with the launch of the bromine extraction process. With the integration of this pretreatment process, effluents from the halogenation workshop can be effectively pretreated and purified before being sent to the Western Wastewater Treatment Plant. This can reduce the load put on the central wastewater management process, safeguard the treated wastewater quality to ensure compliance and maintain a stable operation. More importantly, this pioneering approach enables the recovery of Sodium Bromide that can be reused by BYPC or as a reusable, saleable product to other companies as a raw material to produce cleaning agents, fire spray or even high-performing tires. It opens a brand new revenue source for the joint venture which can improve its long-term profitability. It also demonstrates the values and belief of Veolia Water in prudent and sustainable resource management, turning waste into valuable, recyclable materials and maximizing the utilization of resources.

The world's first bromine extraction facility, LLX columns

Specifications of the halogenation workshop bromine extraction unit

- **13.5 m^3/h of bromine effluent (>8.5 g/L)**
- **A pretreatment prior to sending to Western Wastewater Treatment Plant**
- **Bromine extraction rate can reach 95%**
- **The location of the facility is close to BYPC's new rubber plant and its halogenation workshop**

Recovering materials for greater use

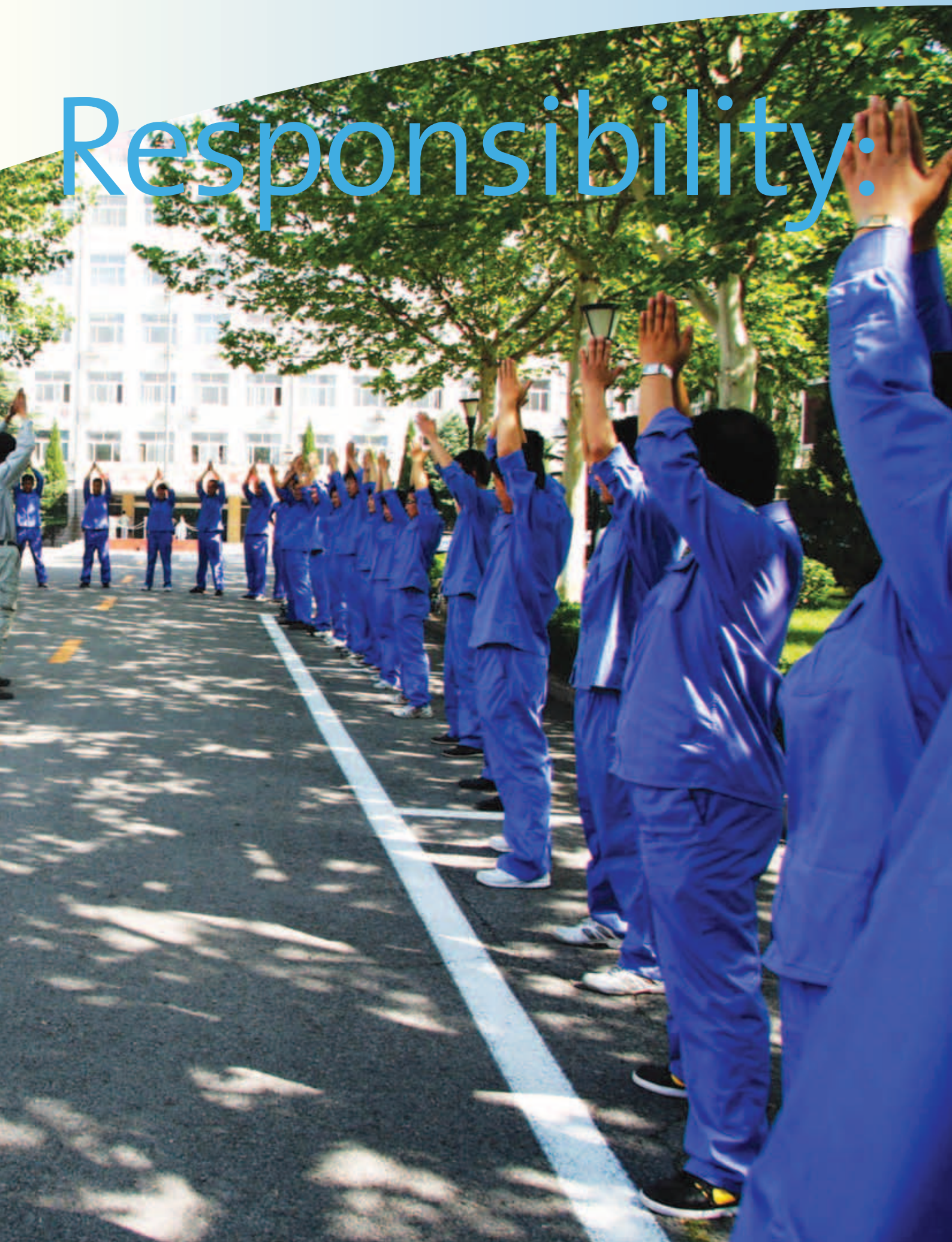
Process water and solutions from the petrochemical production process contain valuable metals and chemicals that can be recovered and reused if wastewater streams are segregated and treated specifically. Organic matter can be transformed into fertilizer, sludge into bioplastics and waste can be recycled as useful manufacturing ingredients.

As such, many water operators in different water-consuming industries are spearheading a wide array of treatment strategies to maximize reuse at a product finishing plant. Advanced technology such as wastewater segregation and point-source pretreatment have been developed and widely used in different industrial contexts. It can lead to a significant reduction in disposal volumes and therefore in cost and in the concentration of contaminants. The concentrate can also be recycled back into the production process as useful materials. Environmental and economic benefits are both salient.

Optimizing the sludge treatment and extending its use in industry

Since BYVW came into existence, the process of sludge treatment and disposal has been optimized. Mainly comprised of organic matter, the removed sludge from wastewater treatment can be used for a number of purposes, including in agriculture where it can be used in place of fertilizer to help grow crops and as an aggregate in the manufacturing of concrete.

Responsibility:



Employees

Service Value Responsibility

Veolia Water's principle of people-oriented management has been visibly embodied and reflected in its actions. At Yanshan, Veolia Water and its partner have adopted different systems and platforms to unleash the potential of the Beijing Yanshan Veolia Water (BYVW) staff and have built a strong team for high-performance service.

Mr Li Xuewei
Human Resources Director

"It was obvious that we needed to bring in advanced technology to improve our wastewater management. There have been significant human resources improvements, particularly on health and safety and all staff fears have been allayed and they are now all in full support of the joint venture."

Integration – Formation of a strong team

Outsourcing of water management into a joint venture is a new business model in China for the petrochemical industry. To gain and maintain higher service quality and reliability the process must be managed carefully to ensure smooth employee integration. At Yanshan, this was successfully achieved through effective communication between existing employees, Veolia Water and Beijing Yanshan.

At the inception of the joint venture, 412 employees who originally worked in the water division of the Beijing Yanshan Petrochemical Company (BYPC) were fully transferred to BYVW. A full-team structure was inherited from BYPC and the joint venture has taken a step forward to optimize the structure and establish a safety department, a purchasing department and a customer service department, which created an additional 33 positions. Additionally operations staff were employed in the new halogenation plant when it was set up in 2010.

To integrate local best practices with Veolia Water management and culture, orientation was organized immediately to explain the objective and spirit of the joint venture. Existing staff were enlightened, empowered and motivated through a series of induction programmes and ongoing initiatives, from training, and employment conditions improvement, to health and safety enhancement, and welfare and social benefits. Support was won over through the integration activities and all staff were soon fully integrated and have been inspired and motivated by the same passion which Veolia Water has for outstanding water standards and services.

Training to upgrade skills and boost confidence

Veolia Water is committed to the training and development of its staff to develop the best skills for both the company and its employees. Staff profit from new learning and skills and the company reinforces competitiveness and sustainability with a group of workers who are motivated, competent, and abreast of industry trends and cutting-edge technology. A comprehensive training programme to nurture the best talents is therefore considered a major investment by Veolia Water.

Employees at Yanshan are experienced, skilled industry veterans, so their basic job competency is satisfactory. Veolia Water helps reinforce their capabilities by identifying and closing skill gaps through Competency Based Training (CBT), an advanced training model from Veolia Water which is based on identifying training needs through competencies required for each position and evaluating the actual and required capability. The system offers a variety of training projects, in order to ensure that employees can work more efficiently and to a higher skill level. With reference to CBT assessments, training programmes are customized and implemented with suitable training materials and providers, both internal and external.

Mr Li Lan
Manager of Human Resources Department

"Continuous dialogue with staff was carried out to answer their questions about the formation of the joint venture. Now that we are through that transition period, the staff have fully embraced the change."

Veolia Water service skills training model

The Veolia Water service skills model, uses a set of performance indicators to assess employees. There are three areas that get targeted.

1. **Skills-based technology training:** Used to improve the drinking water and industrial water treatment process, quality assurance, water chemistry and laboratory analysis capabilities.
2. **Management skills training:** Used to improve communication skills and customer service relations.
3. **Project skills training:** Used to improve language and computer technology skills.

The total yearly participation rate for all BYVW staff in CBT training is 20,000 hours a year.

Fair pay and benefits boost morale

Talent recruitment, fostering and retention are important to the water industry as staff are an asset to the company and indispensable to maintaining a highly efficient and stable operation. As such, Veolia Water attaches great importance to employee benefits and treatments in order to promote a sense of commitment, belonging and loyalty in the team. To ensure market competitiveness, Veolia Water designed and implemented a compensation strategy to acquire and retain the best talent, boost morale and ultimately reinforce overall service quality.

In order to maintain fairness, all staff in the joint venture receive remuneration packages similar to their colleagues in the main Beijing Yanshan Petrochemical plant. This is important for staff morale and keeps employees happy.

Mr Wang Song
Manager of Labor Union

"The labor union provides an important bridge between management and employees. And at the moment there is a very good and smooth relationship between the joint venture and the labor union."

Priority on safety benefits all

To ensure high Health and Safety standards across all stages of the operation and business, Veolia Water has reinforced Health and Safety infrastructure, policies, planning and management training and awareness. Health and Safety is viewed as an important performance indicator. Thanks to a concerted team effort, a culture of Health and Safety first has been established, visible in both management principles and actual daily operations. Employees now understand that Health and Safety is a responsibility towards themselves as well as their colleagues.

Improvement in safety standards since joint venture came into operation

Health and Safety standards have gone through the roof since the start of the joint venture. A series of initiatives such as the purchase of essential personal protection devices, training on self-protection to enhance employee's self-awareness of safety and the establishment of safety first management have all played their part. Contractors also participated in specific safety training activities.

There are now regular gas and fire prevention drills for the site as well as more specific training in the laboratory to deal with any chemical related problems that may arise.

Health and Safety audit, policies and operational procedures

A thorough Health and Safety audit is conducted on an annual basis at all Veolia Water sites to reveal the current and desired state-of-play of Health and Safety practices. However there are also more regular checks by safety staff to ensure all equipment in the individual workshops meet the required standards.

The "near-miss" concept has been introduced at Yanshan, encouraging frontline workers to report on the potential risks associated with certain job positions or tasks in order to raise preventive awareness.

The safety audit is instrumental to effective operations and a good working environment at Yanshan. It has helped identify and eliminate safety hazards and create a positive cycle of safety improvement. Management awareness has improved, and the morale and productivity of employees likewise as they feel confident and comfortable to work in a healthy and safe environment. Staff can also draw on practices outlined in the Veolia Water Health and Safety handbook and the separate joint venture Health and Safety handbook.

A series of practical measures to improve Health and Safety have been carried out. These include the upgrading of safety warning signs, safety improvements to ladders and rails and a serious of preventative work to minimize accidents from wind, ice (during cold weather) and high-altitude. New working clothes have also been designed to meet the new Health and Safety requirements. The quality of the risk assessment procedures at BYVW was recognized when the facility won a Veolia Water Asia-Pacific Health and Safety Contest Gold medal.

Mr Zhang Dongsheng
Manager of Health and Safety Department

"Since the joint venture came into being, staff have developed a lot more self-awareness about the dangers around them. They are now more concerned for their personal safety and that of others."

Health and Safety training statistics of 2011

Total number of training hours: 25,712

Number of employees being trained: 404

Number of training hours of employees: 64

Number of contractors being trained: 937

Number of training hours of contractors: 1405

Internal communications to enhance transparency and cohesion

For employees in BYVW, work is more than just about doing a good job; it is also about being part of a family and being involved in a positive and happy company culture. This is maintained through good internal communications and social events.

Formal channels of communication that are used to engage employees and keep them informed and updated include the use of a monthly bilingual internal newsletter and an intranet. The newsletter provides updates on the achievements of the project, staff training and the work of the Labor Union. Staff can contribute to editorial content which strengthens their sense of belonging to BYVW and stimulates their interest in the newsletters.

Intranet

Newsletter

Mr Wei Yongqi
Manager of Administration Department

"The company has undergone major changes since the formation of the joint venture. The team works more closely with collaboration through seamless integration and consensus building, which has laid a good foundation for our future development."

The Labor Union

The Labor Union plays a very important communications role at BYVW. It acts on behalf of all employees on contract negotiations with management and also relays employee concerns to them. At the same time, the Labor Union conveys any major messages from management to employees. These include production results and other big decisions. It was the Labor Union that collectively bargained on the employees behalf for their current contract and benefits package as well as who signed the Collective Agreement with BYVW.

Working with the Labor Union, Yanshan Veolia nurtures the development of a positive company culture through a series of social events that provide a mixture of passive and sporting involvement to suit all types of employee. The events enhance health awareness amongst employees, give them a sense of responsibility and also help to develop career goals. Types of events held in recent years include:

- The organization of a winter marathon
- Involvement in a football tournament organized by Pudong Veolia Water
- A female fitness hiking group
- An acrobatic performance
- Tug of war competitions
- Staff art exhibition
- Annual Chinese New Year celebrations
- A dance performance to welcome the 2008 Beijing Olympics
- Community service activities

Ms Lu Jingmei
Management Personnel of CPE Office

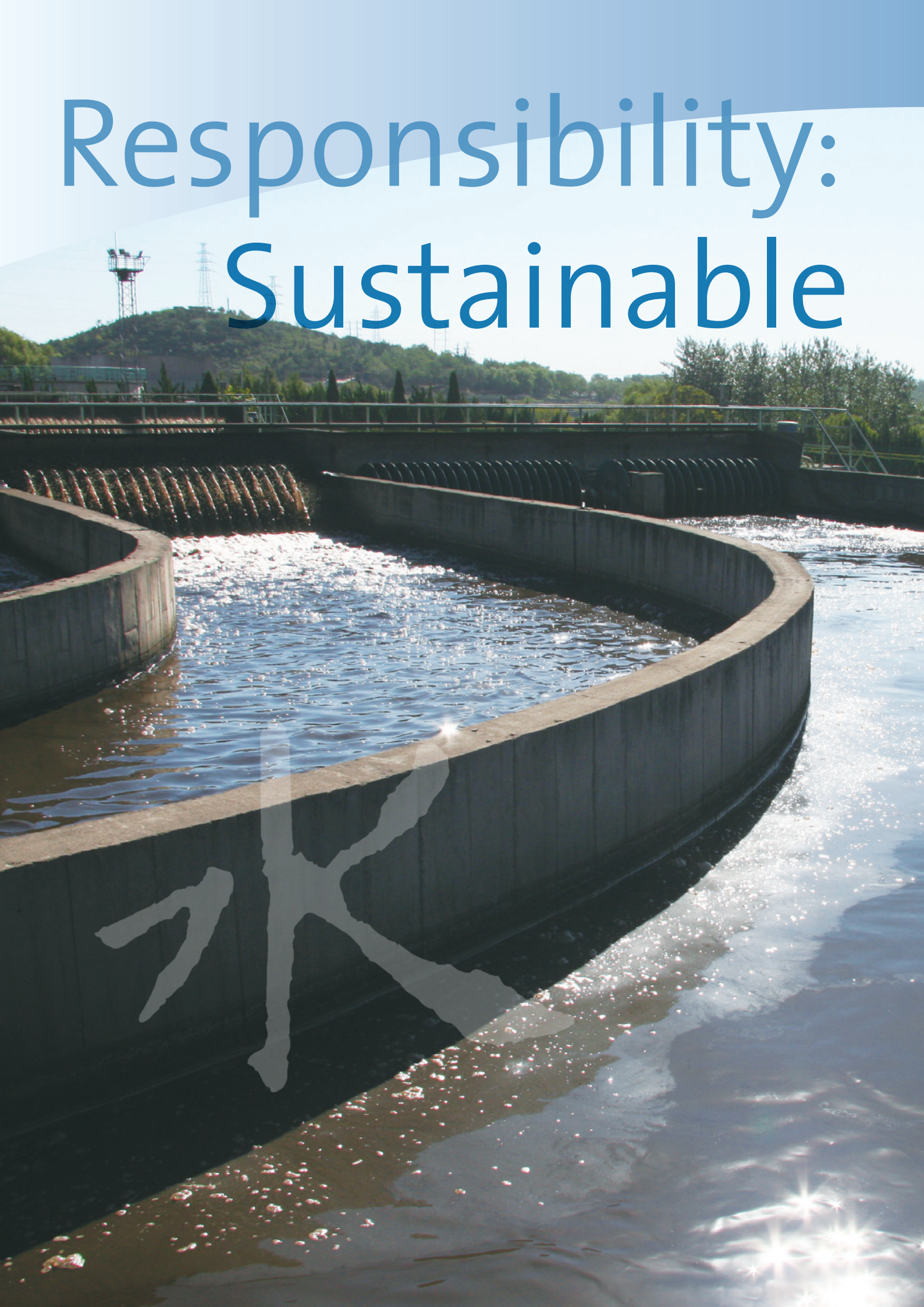
"Veolia Water brings new management methods to the joint venture which helps revitalize the team. The training it has provided has been well-embraced by the employees. With the upgrade of skills and personal development, employees participate more, and are more engaging and energetic in their work."

Management improvements to motivate

Accountability is a key driver for business and operational success. The joint venture has thus developed a number of Key Performance Indicators (KPIs) for management, and the KPIs are made transparent to all staff. Trying to reach set targets and take the suggested pathways to achieve them have motivated and encouraged managers and subsequently energized and encouraged teams to improve their performance. This has helped to rapidly improve the quality of management in the joint venture as well as the staff under their guidance.

Management are also assessed on a monthly and yearly basis to monitor their performance and ensure that they continue to meet the high expectations set and raise the bar.

Responsibility: Sustainable



Development

Service Value Responsibility

Assuming and fulfilling its environmental responsibility is an unwavering commitment by Veolia Water to its operations across the globe. Veolia Water takes carefully considered initiatives with regard to sustainable development on the operation of state-of-the-art wastewater facilities as well as with measures that reduce environmental impacts such as improvements in wastewater recycling and initiating more energy efficient processes. Financial sustainability constitutes another pillar of sustainable development and Veolia Water is constantly looking at ways to improve these processes.

Mr Zhang Xueue
Manager of Eastern Wastewater Treatment Plant and Reclaim Water Treatment Plant

"Wastewater management is important because it can contribute to sustainable development. We have a vision of achieving zero liquid discharge, and the team is working towards that goal by leveraging Veolia Water's technology."

Optimizing the operation for greater sustainability

The water operation of Beijing Yanshan Veolia Water (BYVW) was designed for greater environmental benefits, and Veolia Water and its partner have elevated the effort through process refinements since the joint venture started.

Overall the joint venture shares Beijing Yanshan Petrochemical Company's (BYPC) target of zero liquid discharge into the environment for all its wastewater treatment plants. It is also committed to BYPC's target of zero resource consumption by recycling more water as well as another aim of recovering more material for reuse.

In the long-term, the aim is that the operation at the Yanshan complex will no longer utilize any fresh water from local water sources and will instead only use recycled wastewater.

Treated wastewater compliant with Chinese EPA standards

Through process innovation and optimization, treated wastewater that is released into the environment now consistently meets the number 8 protocol standards set by the Environmental Protection Agency. Spearheading the various water monitoring and analysis initiatives through regular sampling, online analysis, laboratory testing and a water collection and monitoring station near the Niukouyu Valley owned by the Chinese government, Veolia Water and its partner continuously monitor water around the clock, checking pH levels and other parameters.

Recovery of materials turns waste into resources

Segregation of recyclable waste at source was made possible at Yanshan's operation when Veolia Water stepped up efforts to turn waste into resources with its first-class materials recovery technology.

The pretreatment solution introduced by Veolia Water for the halogenation workshop in the butyl rubber plant enables wastewater segregation. The treatment process helps extract bromine (Br) from the halogenation workshop's effluent, which optimizes wastewater treatment for chemical removal and allows the recovery of materials and clean permeates. This customized, localized process not only stabilized the water performance and the operation, but more importantly, the recovery of sodium bromide (NaBr) solution which can be reused by Beijing Yanshan Petrochemical Company (BYPC) and can be served as a saleable product, maximizing both the utilization of resources and the value to shareholders.

Mr Yin Jiran

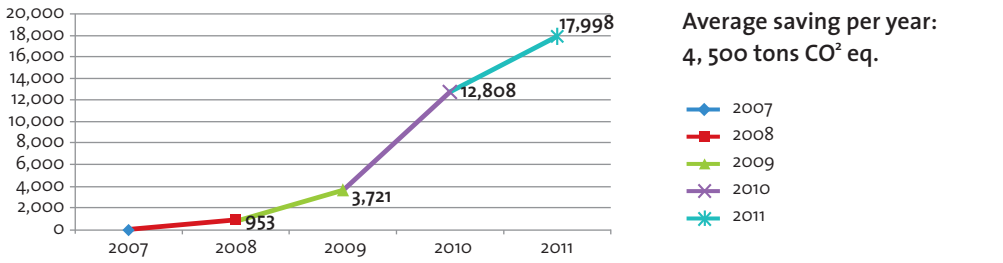
Deputy Manager of Niukouyu Wastewater Treatment Plant

"As an education institute, the Niukouyu Ecology Centre is a showcase of the environmental commitment and excellence of Sinopec and Veolia Water to the community. It receives lots of visitors annually and allows people to understand more about water management and sustainable development."

Reduction in carbon released into the atmosphere

In order to minimize its affect on air quality in Beijing and to reduce its general environmental impact, the joint venture has made huge strides towards reducing its carbon footprint.

Accumulated reduction in carbon emissions at BYVW (in tons of CO^2)



Implemented energy saving processes

Since the joint venture came into operation, Veolia Water has increased the energy efficiency of equipment involved in the waste water management systems. The installation of a new blower in the biological treatment system in the Western Wastewater Treatment Plant, which produces the same amount of air as the old equipment but with a 50% saving in energy consumption, is one such measure.

Variable speed drives (VSD) have also been installed on key equipment to reduce energy consumption. The VSD installed in the Beizhuang Pumping Station has achieved a 40% decrease in power consumption.

Another example of energy saving has been the optimization of the oxidization ditch to save power consumption in the Niukouyu Wastewater Treatment Plant.

In addition to optimizing the treatment process for a more sustainable operation, BYVW also improved the heating system of the plants and offices to maximize energy efficiency. The heating system of the centrifuge, furnace and stations of security guards has changed from gas heating to water heating. Valves and buttons have been added to enhance power control, and major tanks and pipes have been covered to reduce the loss of heat. These initiatives have led to a significant reduction in energy consumption.

Reduction of odor released from wastewater treatment

To minimize the nuisance to the surrounding environment and the community, Veolia Water and its partner spearheaded several notable initiatives to control odor and mitigate its environmental footprint. The installation of covers, fans, funnels and the diversion of odor to a designated chimney have helped to decrease the amount of odor that comes out of the Western Wastewater Treatment Plant and helps to emit the odor in a controlled manner so that it can be diluted.

Optimizes sludge management

Sludge is a by-product of the wastewater treatment process and thus needs to be managed properly to diminish its environmental impact. BYVW adjusted the amount of sludge backflows to the system and controlled the sludge concentration in the sedimentation tanks to optimize the treatment process and reduce the amount of sludge being produced. Not only did it bring better treatment efficiency and lower the consumption of coagulant, a chemical used for treating sludge, there has also has been a major reduction in the sludge disposal cost including for its transportation.

Showcasing sustainable development achievements: Niukouyu Ecology Centre

The Yanshan complex is no longer a mere industrial area due to the presence of the Niukouyu Ecology Centre, an environmental initiative pioneered by BYVW to showcase its water performance and to help create an environmentally enlightened community.

Centering around Niukouyu Lake and now a landmark of the Yanshan complex, the Niukouyu Ecology Centre is an integrated educational and recreational destination for many visitors from the local area, Beijing and other provinces in China. The Centre encompasses a tranquil, and one of the biggest, lakes in the Yanshan district, a wetland, a park, a display board illustrating the water management process of BYVW and its water cycle as well as some water sports facilities such as water bicycles and pedal boats.

Veolia Water and its partner have contributed to the preservation of the wetland and the lake in the Centre by treating wastewater to a high quality standard for discharge. With the compliant, safeguarded treated wastewater, the picturesque and relaxing Niukouyu Lake has restored its aquatic balance and become a habitat of many water based species including swans, ducks and fish. The wetland also promotes biodiversity and a lusher, greener Yanshan complex. An excursion to the Lake and the Ecology Centre not only offers visitors an incredibly scenic break, it also showcases a unique and inspiring water and environmental journey to those who aspire to build a sustainable future.

Promoting financial transparency and accountability

Acquire-Operate-Transfer (AOT) projects require extra attention and caution to transparency and accountability, as well as long-term visionary financial planning, as financial data is essential in evaluating assets and anticipating future returns. In light of this, the joint venture has adopted stringent financial measures since its formation. Key areas for the enhancement included tightening internal control, reporting and the set up of a Purchasing Department for better asset management and cost control.

Ms Liu Chunju
Chief Accountant

"The financial procedure and status has become more transparent since the joint venture, thanks to the increased effort in improving the reporting and auditing system here."

BYVW's financial management objectives:

- Enhance financial transparency, accountability and sustainability
- Cost optimization
- Revenue generation for project reinvestment

Attaining Sarbanes-Oxley Act (SOX) compliance

As the regulatory framework tightens in China and international regulatory authorities become increasingly influential, BYVW has started to prepare for compliance with the Sarbanes-Oxley Act (SOX) since November 2011. As a strategy for improved risk management and internal control, SOX compliance will standardize and improve internal management of company procedures for fixed assets, investments, the treasury, inventory and its dealings with suppliers which reduce errors in financial operations.

Strengthening reporting requirements

BYVW employs first-class financial management tools and adopts the most up-to-update standards to achieve a more accurate, transparent financial reporting and performance.

Since June 2008 the joint venture has used UFIDA as its financial and accounting software. It has strengthened its reporting capability through the incorporation of the procurement procedure including order placement and billing into the accounting software. This enhances data transfer ability and increases efficiency while greatly reducing the manual work required for accounting and procurement.

Improved auditing systems for better asset management

More stringent requirements were imposed on both internal and external auditing when the joint venture was introduced. Internally, the Finance Department regularly checks and audits the assets and finances of the company. BYVW also commissions external consultants to perform auditing exercises to ensure transparent disclosure of the asset status and bring a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control and governance processes. This independent, objective assurance adds value to the company's integrity.

Ms Yang Dongping
Manager,
Purchasing Department

"Inventory used to be managed by different maintenance departments but it is now centralized by the Purchasing Department since the joint venture. Resources can now be shared across the teams which can save cost. Transparency and accountability have been enhanced."

Empowering procurement

As a heightened commitment to optimize cost and regulate financial processes, a Purchasing Department was set up in September 2007 to oversee and manage all procurement initiatives and inventory management.

As an industry which requires frequent replacement of parts, tools and other consumables, the expense on procurement can be as high as one-fifth of the operating cost. As such, a prudent management of the function has become a priority for cost management since the joint venture started.

The newly-established Purchasing Department has integrated the strengths of the joint venture partners, Veolia Water's global procurement experience and connection and Sinopec's negotiation power from bulk purchasing. A framework agreement has been signed between the joint venture and its suppliers. Leveraging the resourceful purchasing networks of the joint venture partners, the procurement process has become streamlined, simplified and more effective and the payment structure optimized. BYVW can easily source tools and equipment from trustworthy suppliers at competitive prices.

The Department also centralizes the inventory management to enhance inventory transparency across the entire operation and optimize stock and inventory allocation for each plant and department. It avoids unnecessary hoarding of stocks which may lead to unhealthy cash flow. From a resource management perspective, it helps grow visibility into the short-term and long-term planning for upcoming purchases to meet current and future operational requirements.

Plans for

the Future

Main goals:

- Uphold and reflect the principle of Service, Value, Responsibility
- Sustain uninterrupted operations
- Achieve high client satisfaction and grow with the client
- Protect the environment through complying and surpassing the discharge limits
- Maximize water self-sufficiency

The joint venture celebrated its first five years in 2011 and took pride in its smooth transition and stable, optimized operation in those important foundation years. The benefits of industrial outsourcing have been demonstrated through cost optimization, process management and water quality. Veolia Water and its partner look forward to the next five years and beyond and target to set new benchmarks and fulfill its commitment of promoting Service, Value and Responsibility.

Service upgrade and expansion to boost performance

The design and construction of the bromide extraction process for the halogenation workshop was completed in 2011 and is currently in a trial stage. When it is in full operation, the process can help extract sodium bromide solution, a valuable material, which is useful and resalable for industrial purposes. The project will bring a value-added business model to the existing operation, diversifying the source of revenue while easing the load on the treatment facilities.

Several water and environmental initiatives are also in planning including the upgrade of the Eastern Reclaim Water Treatment Facility using Veolia Water's proprietary technology of Multiflo® Softening and the segregation and point-source pre-treatment process for spent caustic from refinery and ethylene plants. The system upgrade will elevate the joint venture's treatment efficiency, ensure service stability and raise its environmental performance.

Strengthening the management capability remains a priority. The attaining of SOX compliance and an Integrated Management System will become another milestone for the company, helping it to keep raising the bar amongst the industry players.

Value of water efficiency and economic benefits

The system upgrade and process optimization will embolden Veolia Water's value in maximizing water efficiency and promoting environmental excellence. It can be achieved through the elimination of the discharge level and increasing the water recycling ratio. When the upgrade of the Eastern Reclaim Water Treatment Facility is completed, the water reclaim rate can be significantly lifted from 50% to 85%. The recovery of materials from the bromide extraction process helps turn waste into resources, a new and widely-agreed environmental concept that is supported and spearheaded by Veolia Water across its global operations.

With customized solutions to suit the client's needs and for better resource and cost control, Veolia Water will continue to maximize efficiency to attain lower operating costs but higher returns for the client's business.

Showcase environmental responsibility

The partnership has demonstrated the importance and benefits of balancing economic interests and environmental sustainability. It is a showcase of future water technology and management for responsible and sustainable development. The ultimate objective of the joint venture is to improve the Water Impact Index of the Yanshan complex and preserve the valuable water resources in Beijing. The total water solution offered by Veolia Water and its partner is innovative, practical and successful to address the water challenges of the industry and China.

It also helps realize the vision of Sinopec to achieve zero liquid discharge and zero fresh consumption in a gradual and reliable way.

With the good examples set by the Yanshan operation, Veolia Water welcomes any opportunity to extend its services for environmental conservation and water management to more petrochemical complexes and industrial sites so that good practices can be transferred to different parts of China and Asia to help create a healthier, greener and more sustainable environment.

Future plans being targeted:

Service Value Responsibility

Service

Area of Expertise	Solutions		Target
Water treatment	**Treatment services**		**Spent caustic from refinery and ethylene plant:** segregation and source point pre-treatment.
			**Upgrade of Eastern Reclaim Water Treatment Facility:** implement pretreatment of the feed water to Ultra Filtration or Reverse Osmosis facility, applying Veolia's proprietary Multiflo™ Softening technology.
			**Pretreatment of halogenation wastewater stream:** Bromine extraction plant.
			**Double Eastern Reclaim capacity:** expand the existing reverse osmosis capacity by implementing a Veolia proprietary technology, OPUS™, to further treat brine.
Asset management	**Network and plant asset management**		**Continuous enhancement** of the performance of the existing wastewater treatment plants and strengthen the performance of the reuse cycle.

Service Value Responsibility

Value

Area of Expertise	Solutions		Target
Water recycling	**Wastewater recycling**		**Recover a larger volume** of water for reuse by using OPUS™.
			**Increase wastewater global reuse yield** of BYPC's complex from 50% to 85% after extension works are put into full operation.
Material recovery	**By-product recovery**		**Recovery of Sodium Bromide solution** for reuse by BYPC.

Responsibility

Area of Expertise	Solutions		Target
Sustainable resource management	**Water resource conservation**		**Consolidate BYPC manufacturing capacities** in an area facing water shortages.
Management of environmental footprint	**Water footprint**		**Preserve the water resource** and improve the Water Impact Index of the BYPC complex.
			**Improve effluent quality.**


VEOLIA
WATER